US Monetary Policy and Corporate Bond Issuance in Emerging Markets

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Abstract: This paper analyzes the impact of unconventional monetary policy in the US on bond issuance by non-financial firms in emerging markets. It distinguishes between the effect on foreign currency and local currency bond issuance. Whereas foreign currency bond issuance is heavily impacted by shocks to the US term spread and global risk aversion, local currency bonds react only modestly. Hence, US monetary policy influences the currency choice of debt issuance by non-financial corporates in emerging markets. This hypothesis is further supported by firm-level evidence showing that emerging market firms are more likely to issue a bond in foreign currency in times when US interest rates are low and risk aversion is muted.

Key words: Corporate bonds; Monetary Policy Spill-overs; Foreign Currency Denominated Debt; Emerging Markets
JEL Codes: E44, F31, F42, G15

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1 Introduction

A striking phenomenon in recent years has been the strong growth in corporate bond issuance by non-financial firms in emerging markets (EM). The amount of non-financial corporate bonds outstanding more than tripled since 2009 and reached USD 1.7 tr at the end of 2014. Bond financing is increasingly replacing bank financing as the source of funding for non-financial firms in many emerging countries. While the majority of new corporate bonds is denominated in local currency (LC), a second trend is that the share of bonds outstanding in foreign currency (FC), mainly US dollar, has increased sharply over the last five years. It increased from 13% in 2009 to 20% in 2014, and if one excludes China, which is predominantely issuing in local currency, the share of international bonds outstanding even increased from 22% to 35% (see Figure 7 in the Appendix). Shin (2013) labeled these developments the *Second Phase of Global Liquidity*. In contrast to the *First Phase of Global Liquidity*, which had global banks at the heart of transmission of financial shocks, in this second phase the bond market takes the center stage. The transmission of financial conditions across borders now takes the form of *reaching for yield*, the decline in risk premia for debt securities and the explosion in issuance of EM debt securities to satisfy this demand. While the shift to bond markets in general provides economic benefits in the form of enhanced access to financing for EM firms, even in times when banks are unwilling or unable to extend credit, it exposes firms to more volatile funding conditions. As pointed out in the IMF's *Global Financial Stability Report* (2015), especially in an environment of rising US interest rates, slower growth, falling commoditiy prices and EM currency depreciations, the high debt burden may become increasingly difficult to service and roll-over for some non-financial borrowers in emerging markets. The debt stock of the corporate sector in developing countries is thus a potential source for global financial distress and deeper knowledge about its determinants is of utmost policy importance.

Using a large dataset on bond issuance by non-financial firms in 20 emerging markets this paper contributes to understanding the driving forces behind the rise and the currency composition of corporate bond issuance. The hypothesis is that global factors, i.e. the stance of monetary policy in the US as well as global risk aversion, affect bond issuance in EMs. By reducing long-term US yields the Fed's expansive monetary policy pushes global investors towards alternative assets via a *portfolio rebalancing channel* (Bernanke, 2013; D'Amico and King, 2013). Among those assets are EM corporate bonds and the rising demand reduces their yields. This makes it more attractive for borrowers in EMs to issue bonds, so that they can profit from favourable borrowing conditions, and thus corporate bond issuances increase. The second hypothesis is that this transmission channel is more pronounced for foreign currency bond issuances than for local currency bond issuances. Global investors avoid the currency risk stemming from buying local currency

debt and domestic issuers prefer the lower nominal interest rates on international debt. This conjecture is supported by the data presented in Figure 1. It can be seen that whereas foreign currency bond issuance is clearly negatively related to higher US term spreads and a higher VIX, there seems to be no relation between those variables and local currency bond issuance.

Figure 1: Scatter Plot

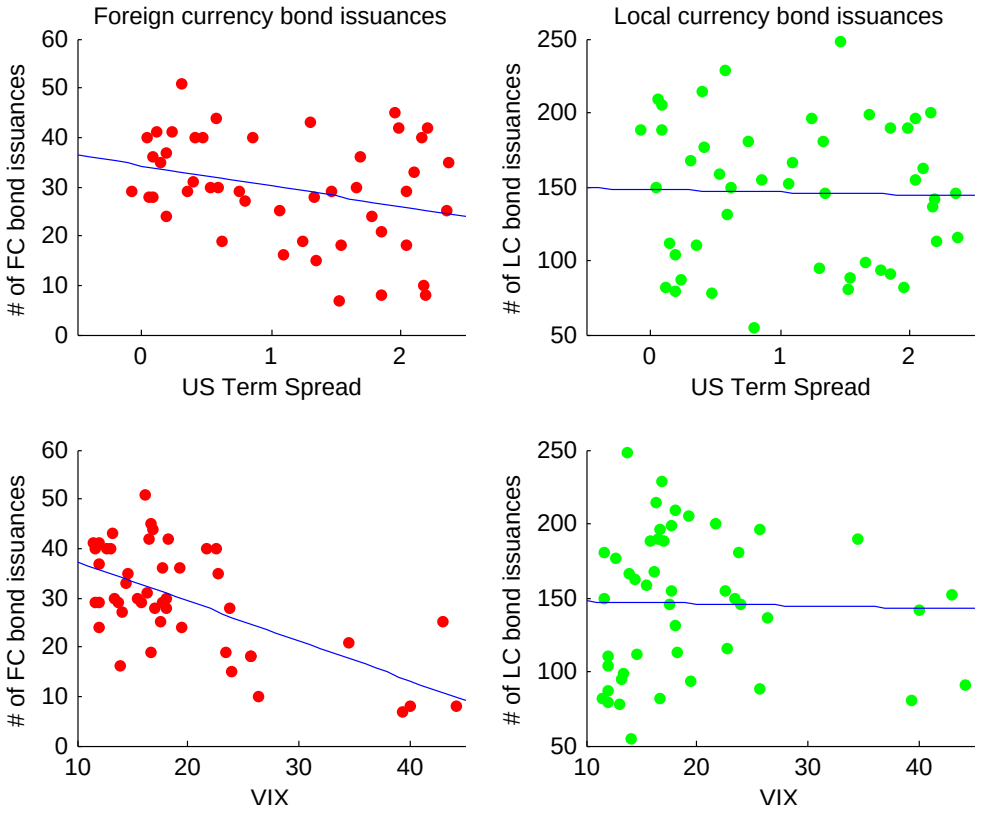


Figure 1 shows the relation between the number of bond issuance in a given quarter and the US term spread (upper two charts) and the VIX (lower two charts). The charts on the left side display in red the number of foreign currency bond issuance by non-financial borrowers in EMs per quarter in relation to these two global variables. The charts on the right side display in green the number of local currency bond issuance in EMs per quarter in relation to the two global variables. The blue line displays the linear relation between the variable on the x-axis and the variable on the y-axis.

The empirical analysis is carried out in two steps. In a first step, using a panel VAR framework, I study how shocks to the US term spread and the VIX affect bond issuance by non-financial corporates in emerging markets. The results show significant differences in the response of foreign and local currency bond issuance. Whereas foreign currency bond issuance increases sharply following an expansive shock to US monetary policy or lower risk aversion, local currency bonds react only modestly. After a period of two years 17% of the variation in foreign currency issuance is explained by global factors, whereas US monetary policy and global risk aversion can explain only 6% of the variation in local currency bond issuance. By raising foreign currency bond issuance, but not significantly impacting local currency bond issuance, expansive monetary policy and reduced risk aver-

sion thus change the currency composition of bond issuance. The paper finds that the share of foreign to local currency bond issuance rises significantly and lastingly following an expansionary shock to the US term spread and a decline in global risk aversion.
In a second step, I make use of the full depth of my dataset and look at specific bond issuance by around 6,000 individual non-financial firms incorporated in 20 emerging markets. I model explicitly each firm's choice between foreign currency denominated and local currency denominated bond isssuance as a function of the US term spread and global risk aversion. Using a logit framework I show that firms are more likely to issue a bond in foreign currency than in local currency in times when interest rates in the US are low and global risk aversion is muted. A one percentage point decrease in the US term spread increases the conditional probability of a foreign currency bond issuance by between 1.5pp and 2.6pp. This increase is large given that the unconditional probability of a foreign currency bond issuance stands at only 12%.

Let me briefly discuss how the paper fits into the existing literature. The paper primarily relates to the literature on the international transmission of global monetary policy shocks. This literature has traditionally focused on the banking sector as a shock transmitter (Cetorelli and Goldberg, 2012; Borio, McCauley and McGuire, 2011). Bruno and Shin (2014), for example, argue that adjustments in bank leverage act as the linchpin of global monetary policy transmission that works through fluctuations in risk taking. The authors show that an expansionary shock to US monetary policy leads to an increase in cross-border banking capital flows through an increase in the leverage of international banks. As global banks apply more lenient conditions on local banks, the more lenient credit conditions are transmitted to the recipient economy. In this way, more permissive liquidity conditions in the sense of greater availability of credit are transmitted through the interactions of global and local banks.
In recent years, however, the research focus has shifted increasingly towards the bond market as the main conduit for the transmission of monetary shocks. Most famously, Shin (2013) coined the term of the *Second Phase of Global Liquidity*. In contrast to the *First Phase of Global Liquidity*, which was dominated by the traditional banking sector transmission channel, in this second phase, starting around 2010, the main stage is the bond market. As for the main players, Shin argues, that global banks have been increasingly replaced by asset managers and other "buy side" investors. The cross-border transmission of monetary and financial conditions has taken the form of *searching for yield*, the decline of risk premia for debt securities and explosion of issuance in emerging market corporate debt securities to satisfy this demand. This theory is consistent with the *portfolio rebalancing channel* outlined by Bernanke (2010) and D'Amico and King (2012). Unconventional monetary policy in the US, i.e. the purchase of US Treasuries, affects the supply of these assets available to private investors, which in turn impacts the

price and leads to some degree of rebalancing towards other assets, to the extent that the purchased assets are imperfect substitutes. As some of these alternative assets are fixed income securities issued by borrowers in emerging markets, the portfolio rebalancing channel increases global investors' demand for EM bonds, which increases their price and reduces the yield. This damping effect of expansive unconventional monetary policy on country spreads in emerging markets is documented by Akinci (2013), Neely (2010) and Chen, Filardo, He and Zhu (2012). According to the so-called *market timing hypothesis* (Baker et al., 2012), the lower interest rates induce managers in EMs to stronger issuance in order to "time the market" and profit from low fixed interest payments. In this respect, as long as US monetary policy reduces global interest rates, bond issuances should increase.

The first ones studying explicitly this relation between unconventional US monetary policy and bond issuance abroad were LoDuca, Nicoletto and Martinez (2014). The authors find that the Fed's Quantitative Easing (QE) had a large effect on corporate bond issuance outside the US and that flow effects (i.e. portfolio rebalancing) were the main transmission channel. A counterfactual analysis shows that bond issuance since 2009 would have been half without QE. My paper builds on the work of LoDuca et al. (2014). A main difference is that whereas LoDuca et al. (2014) consider the effect of unconventional monetary policy in a static setting, I also allow for dynamic responses. Most importantly, however, in contrast to LoDuca et al. (2014) as well as other previous studies, I distinguish between the effects of global monetary policy on foreign and local currency bond issuances.

The impact of global monetary policy on the currency choice of corporate bond issuance has not received much attention in the literature yet. Traditionally the literature offers three non-exclusive explanations for the issuance of foreign currency denominated corporate debt. The first explanation for the decision to issue in foreign currency is the *natural hedge* motive. A borrower would ideally want to match the currency of its interest and principal payments to that of net cash inflows it expects to receive from operations over the life of the bond (Cohen, 2005). Empirical studies (Allayanis and Ofek, 2001; Kedia and Mozumdar, 2003) find indeed a positive relation between a firm's propensity to issue in foreign currency and proxies of foreign exchange exposure such as the share foreign sales or foreign currency earnings. Other studies (e.g. IMF, 2015) show at a sectoral level that sectors, which have a higher share of international business, such as the oil and gas industry, issue relatively more bonds in foreign currency.

The second reason why borrowers may decide to tap international markets is due to the fact that many domestic debt markets in emerging and developing countries are still small and illiquid (Habib and Joy, 2008). Emerging market firms, thus, issue foreign currency debt in international markets to access a broader investor base and, especially for large-size and longer-maturity bonds, to exploit fewer credit constraints and lower transaction

costs in more liquid foreign bond markets.

A third - and for the purpose of this paper most relevant - explanation is that firms determine the currency of debt issuance strategically, in order to exploit savings in debt servicing costs over time. Firms might try to reduce borrowing costs by issuing bonds in whichever currency offers the lowest effective cost of capital (Habib and Joy, 2008). Borrowing in foreign currency is benefitial if there are deviations from *interest rate parity*.[2] This means if the lower nominal borrowing costs associated with borrowing in a foreign currency are not counteracted by a depreciation of the domestic currency over the life of the bond, borrowers save by issuing in foreign currency. Thus, there are two blocks that determine a firm's strategic decision: the yield differential between domestic and foreign currency debt, as well as the expected path of the exchange rate. If global monetary policy affects the firm's currency choice of debt issuance, it has to work through these variables. Recent studies (e.g. Mohanty, 2014) have shown that although unconventional monetary policy in the US affects both, long-term interest rates on local currency as well as on foreign currency debt, the effect is significantly larger on foreign currency interest rates. For example, Mohanty shows that whereas EM local currency bond yields declined by 236 basis points between mid-2009 and mid-2013, yields on EM foreign currency bonds declined much more, by 341 basis points, during that period. The sharper decline in foreign currency yields compared to local currency yields is thus one potential channel through which global monetary policy affects the currency choice of debt issuance. A second channel might work through the exchange rate. QE led to an initial appreciation of many EM currencies against the US dollar. If firms anticipate the appreciation to continue, they face strong incentives to issue foreign currency debt and benefit from a reduced local currency repayment burden. From an investor side, the depreciation of the US dollar meant that securities denominated in EM currencies were expensive. Additionally, as the magnitude and timing of future exchange rate moves are uncertain, investing in EM local currency bonds would expose asset managers to significant uncertainty over the US dollar value of their investment. By buying US dollar debt on the other hand, international investors can avoid the currency risk associated with taking a long position in an EM currency.

[2] In the absence of exchange rate hedging, an issuer of foreign currency bonds can realize savings on its borrowing costs if it issues in a low interest rate currency that does not appreciate enough to offset the savings accrued from the favourable interest rate differential. Such savings are only possible is uncovered interest parity does not hold:

$$r_{t,t+k} = r^*_{t,t+k} + (e^e_{t,t+k} - e_t)$$

where $(e^e_{t,t+k} - e_t)$ is the expected rate of depreciation of the domestic currency against the issuance currency (depreciation: $e^e_{t,t+k} > e_t$). If the empirical evidence is right and the foreign currency tends to depreciate rather than appreciate when foreign interest rates are lower than domestic rates, then an issuer, by issuing in a low interest rate currency can realize expected borrowing cost savings equal to

$$\epsilon = r_{t,t+k} - r^*_{t,t+k} - (e^e_{t,t+k} - e_t)$$

For more details see Habib and Joy (2008).

Hence, global investor interest was probably more lavish for US dollar denominated debt securities, which in turn can explain why interest rates on these securities decreased more.

The paper contributes to the existing literature in three ways. First, it analyzes the effects of US monetary policy on non-financial corporate bond issuance in a dynamic setting. This has the advantage of enabling a flexible analysis of the lead-lag structure of the effects and allows for endogeneity between the variables. The second contribution is that this is, to the best of my knowlege, the first paper that explicitely distinguishes between the effect of unconventional monetary policy on local and foreign currency denominated bond issuance. Third, the empirical approach used in combination with a large and detailed dataset allows to model the firm-level currency choice of bond issuance as a function of global monetary and financial variables. The granularity of the dataset allows for a robust estimation of the effect by enabling to control for different country and bond charateristics, as well as several fixed effects.

The reminder of the paper is structured as follows. Section 2 introduces the dataset used for the analysis and discusses cross-country and cross-sector differences in the foreign currency share of bond issuance. In Section 3 the panel VAR model is estimated and the different responses of local and foreign currency bond issuance to global shocks are displayed. Section 4 contains the firm-level logit model of the currency choice of bond issuance. Finally, Section 5 concludes.

2 Data

The sample covers the period from 2003:Q1 until 2014:Q4. Data on individual corporate bond issuance are obtained from Thompson Reuters. I only consider non-financial firms (excluding SIC codes 6000-6999) domiciled in the 20 largest emerging markets (Argentina, Brazil, Chile, China, Colombia, Czech Republic, Hong Kong, India, Indonesia, Israel, Mexico, Peru, Philippines, Russia, Singapore, South Africa, Taiwan, Thailand, Turkey, Vietnam). The data set contains bonds issued with a maturity of more than one year. Shorter term notes are excluded because data reliability for those instruments is limited. For each bond issuance I extract the following information: borrower's name, borrower's domicile, borrower's sector, date of issuance, currency and market of issuance, volume of issuance and maturity of issuance. As firms issue debt only occassionally, the dataset is structured as an unbalanced panel of new bond issuance (firm-quarter observations). The final sample contains 12,775 bonds issued by 5,799 individual firms. On average a firm in the sample issues 2.2 bonds throughout the sample. 3,137 firms issue only once, 565 firms issue in more than five quarters and 96 firms in more than ten quarters. The average size of a bond issuance is USD 206mn, the median USD 200mn and

95% of the bonds issued are smaller than USD 481mn. The average maturity is 5 years. The geographical distribution of the number of issuance and firms is in line with the countries' relative economic size. Chinese bond issuance accounts for the largest share in the sample, contributing roughly 30% of total observations, followed by Brazil and India with roughly 13% each. Vietnam, Czech Republic and Columbia account for the lowest number of issuance. Firms in the sample are classified in 42 sectors. The *Service* sector has the largest number of observations with roughly 10% of total issuance, followed by the *Metals and Mining* sector and the *Utility* sector with each around 8% of the data.
Throughout the analysis I distinguish corporate bond issuance by the currency of their principal. More precisely, I distinguish whether the bond is issued in local currency, i.e. the currency that is the legal tender in the country in which the borrower is domiciled, or in a foreign currency. The overall share of foreign currency bond issuance stands at 12%. The vast majority of foreign currency bonds is issued in US dollar (86%) followed by euro (5%). Foreign currency and local currency bonds differ in their maturity and size. On average foreign currency bonds have a longer tenure (6.6 years versus 5.3 years) and are larger (USD 230mn versus USD 202mn). Additionally, there are substantial cross-country differences in the prevalence of foreign currency bond issuance. The share of foreign currency to total bond issuance is highest in Hong Kong (70%), Czech Republic (55%), Argentina (52%) and Mexico (45%). In contrast, the share stands at only 3% in China and Thailand and at 4% in Russia. The foreign currency share of corporate bond issuance also varies significantly across sectors. In the *Oilfield Machinery*, the *Gas Utility* as well as the *Gaming* sector the share of foreign currency bond issuance exceeds 30%. On the other hand, in sectors such as *Transport* or *Health Care* the share stands at only 6%. This might not appear suprising, as according to the *natural hedge* theory discussed in Section 1 sectors, such as *Oil and Gas*, that have a high share of foreign sales and revenues should be more likely to issue bonds in foreign currency than sectors focusing mainly on domestic consumers. However, for sectors such as *Telecommunication* or *Cable/Media* their high share of foreign currency bond issuance of 25% and 22%, respectively, is less obvious.

For the empirical analysis in the subsequent sections I use the data in two ways. First, for the panel VAR in Section 3 I aggregate the individual bond issuance data for each country and quarter. To bring the quarterly volume of bond issuance in relation to the size of the respective economy and account for valuation effects stemming from exchange rate fluctuations I divide the total quarterly volume of bond issuance in a given country by the country's nominal GDP. The variable thus represents the country-specific total volume of *gross*[3] non-financial corporate bond issuance as a share of GDP. In the second

[3]Focusing on *gross* issuance is a novelty of this paper as most existing studies use the aggregate *net* issuance data reported by the BIS. However, *net* issuance is influenced by variations in redemptions (see BIS *Handbook of Securities Statistics (2015)* p. 38). Hence, using *net* issuance data might bias the analysis of bond issuance.

part of the analysis, I make direct use of the depth of the data set. The data are no longer aggregated per country, but instead the individual firm-quarter issuances are used.

3 Panel VAR

In order to determine the dynamic response of bond issuance by non-financial corporations in emerging markets to shocks in US monetary policy and global risk aversion I estimate the following panel VAR (PVAR). The empirical specification follows closely the model specification in Akinci (2013) as well as in Uribe and Yue (2006):

$$Ay_{it} = \eta_i + \sum_{k=1}^{p} B_k y_{i,t-k} + \epsilon_{it} \tag{1}$$

where i denotes countries and t quarters, η_i is a country specific intercept and

$$y_{it} = [\hat{R_t}^{US}, V\hat{I}X_t, BondFlow_t, \hat{R_{it}}^{EM}, \hat{e_{it}}, BondIssuance_{it}]$$
$$\epsilon_{it} = [\epsilon_{it}^{R^{US}}, \epsilon_{it}^{VIX}, \epsilon_{it}^{BondFlow}, \epsilon_{it}^{R^{EM}}, \epsilon_{it}^{e}, \epsilon_{it}^{BondIssuance}].$$

The variable R^{US} denotes the US term spread, i.e. the difference between the 10-year US Treasury bond yield and the 3-month US Treasury bill rate. The US term spread is frequently used in the literature as a proxy for the stance of the Federal Reserve's monetary policy (Chen et al., 2011; Turner, 2014; Mohanty, 2014; McCauley et al., 2014). It is particulary useful when the zero lower bound on nominal interest rates is reached and the Fed resorts to unconventional monetary policy such as asset purchases whose objective it is to reduce long-term bond yields. But also in normal times the US term spread is a useful indicator for the stance of monetary policy, as central banks often act to shape public expectations about a specific policy path well into the future.
The second variable included in the PVAR is the Chicago Board of Options Exchange Market Volatility Index, or simply VIX. The VIX measures the implied volatility of the S&P 500 index options and is a widely used proxy for global risk aversion (Baekert et al., 2010). The variable $BondFlow$ captures the net flows into mutual funds dedicated to emerging market bonds. The emerging markets' country-specific borrowing rate in international markets, R^{EM}, is measured as the sum of J.P. Morgan's EMBI Global Yield Spread[4] and the 3-month US Treasury-bill rate. The variable e denotes the exchange rate of country i versus the US dollar. It is expressed such that a lower value of e indicates an appreciation of the domestic currency against the US dollar. Finally, the variable $BondIssuance$ measures for each country i the sum of total non-financial corporate bond issuance in a given quarter t in percentage of nominal quarterly GDP. Within the subse-

[4]The EMBI Global Yield Spread is a composite index of different US dollar denominated bonds. The spreads are calculated as an arithmetic, market-capitalization-weighted average over US bonds.

quent analysis I use either all bond issuances, only bond issuances denominated in foreign currency (FC) or only bond issuances denominated in local currency (LC). The hat on the variables denotes log first differences. The variables R^{US}, VIX, and $BondFlow$ are common across all countries.

3.1 Identification

In order to obtain structural identification of the empirical model I use a Cholesky decomposition and impose the restriction that the matrix A is a lower triangular matrix. In addition I make the following two assumptions for the identification of structural shocks. First, I assume that the US term spread and global risk aversion are independent of bond flows, interest rates, exchange rates and bond issuance in emerging markets. This means I assume that R^{US} and VIX follow a two-variable VAR process and are not affected by the other variables in the model. In particular, I impose the restriction that $B_{k,1,j} = B_{k,2,j} = 0$ for $j > 2$ and $k = 1, 2...p$ (further explanations are in the appendix). Second, I assume that within the international block, the US term spread is ordered before the VIX. This means that contemporaneous innovations in the US term spread affect risk aversion, but not vice versa. Shocks to risk aversion affect the US term spread only after one period. This assumption is fairly standard in the empirical literature on monetary policy spillovers (see, for example, Bruno and Shin, 2014).
Regarding the country-specific variables I assume the following ordering: $BondFlow$, R^{EM}, e, $BondIssuance$. This country-specfic block is ordered after the independent international block. The reasoning for this ordering is the following: An expansive monetary policy shock in the US leads to a compression of the term spread and reduces global risk aversion. The lower interest rates in the US mean that global investors turn towards alternative assets in a *search for yield*. Among those assets are emerging market bonds. Hence, more funds flow into mutual funds dedicated to EM bonds. The rising demand for EM bonds increases their price, and hence reduces their yield. At the same time the capital inflow in domestic markets leads to an appreciation of the domestic exchange rate against the US dollar.[5] Lower yields and an appreciated exchange rate make it more attractive for non-financial corporates in emerging markets to issue bonds, so that they can profit from the favourable borrowing conditions. In a robustness check in Section 3.4 I try a series of different orderings, but the main message remains unchanged.

[5]This portfolio inflow channels is explained for example in Chen et al., 2014.

3.2 Estimation

The panel VAR is estimated by pooling data for the 13 countries for which data for all variables are available.[6] The model contains 46 quarterly observations, capturing the period 2003:Q2 until 2014:Q3. The panel VAR is estimated using a least-square dummy variable estimator (LSDV) also known as fixed effects estimator. The LSDV is the usual approach for estimating panel vector auto-regressive models from macroeconomic data (Akinci, 2013; Uribe and Yue, 2006). The LSDV contains a country specific intercept, which corresponds to the fixed effect η_i in Equation (1). As a robustness check I try as an alternative specification, the mean group estimator, which gives similar results (see section 3.4).

Two lags are included in the panel VAR, as suggested by formal lag-length selection procedures (Akaike Information Criteria (AIC) and the Bayesian Information Criteria (BIC)).[7] For a stable VAR all eigenvalues are required to be less than one and the formal test confirms that all the eigenvalues lie inside the unit circle.[8] I display bootstrapped confidence intervals based on 2,000 replications.

3.3 Results

In this section I report the impulse response functions of the panel VAR specification. In a first step I show the reaction of foreign currency bond issuance (as a percentage of GDP) to shocks in the US term spread and in risk aversion. Then I compare this reaction to the reaction of local currency denominated bonds. I discuss the economic significance of the results with a forecast error variance decomposition. Finally, I analyse whether global monetary or financial shocks affect the ratio between foreign and local currency bond issuance of non-financial corporates in emerging markets.

3.3.1 Response of FC bond issuances to US Term Spread and VIX

Figure (2) displays the impulse response functions in response to a shock to the US term spread. The shock takes the size of minus one standard deviations, i.e. the US term spread decreases by one standard deviation. The reason for taking a negative standard deviation shock is that I want to illustrate the consequences of an *expansionary* US monetary policy

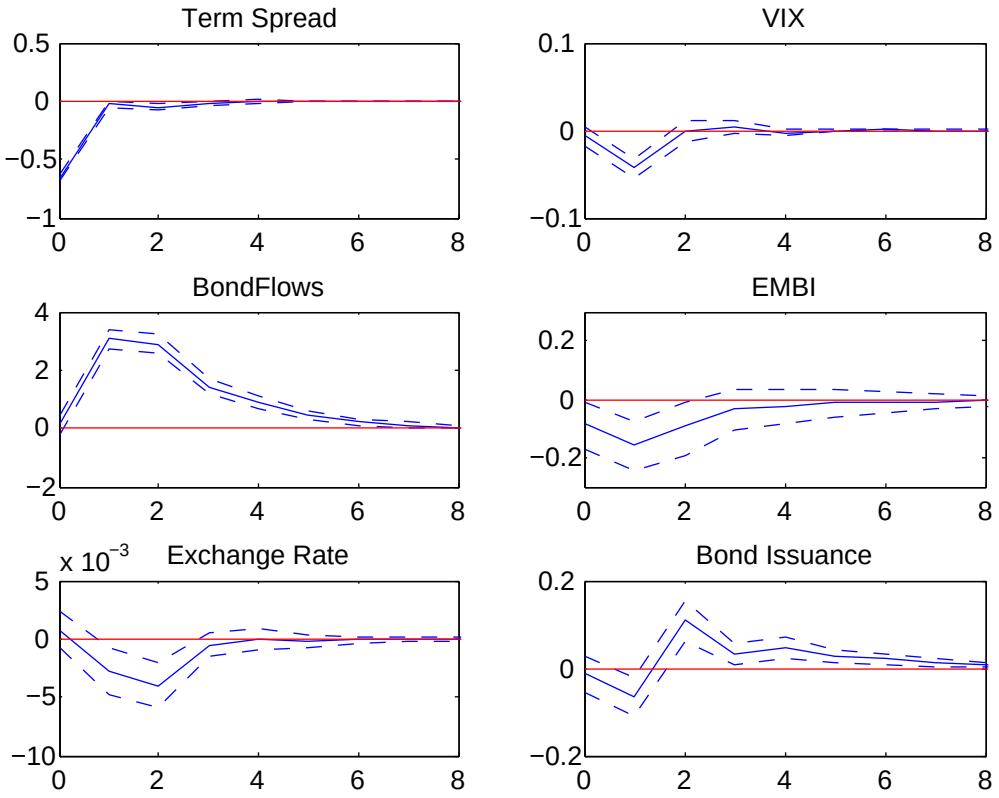
[6] The lower number of countries included compared to section 4 is the result of limited data availability of the EMBI spread. The countries included in the estimation are: Argentina, Brazil, China, Chile, Columbia, Indonesia, Malaysia, Mexico, Peru, Phillipines, Russia, South Africa and Turkey.

[7] The Akaike Information Criteria (AIC) is -56.05 for the PVAR(1) specification, -59.16 for the PVAR(2) specification, -58.98 for the PVAR(3) specification and -58.35 for the PVAR(4) specification. The Bayesian Information Criteria (BIC) also suggests two lags. I also estimate a PVAR(4) specification as VARs with quarterly data usually include four lags. The results are qualititively similar to the prefered two-lag specification.

[8] The unit circle chart is displayed in the Appendix

shock. As the model is symmetric the effects of a positive shock are the same, just with opposite signs.

Figure 2: IRF shock to Term Spread

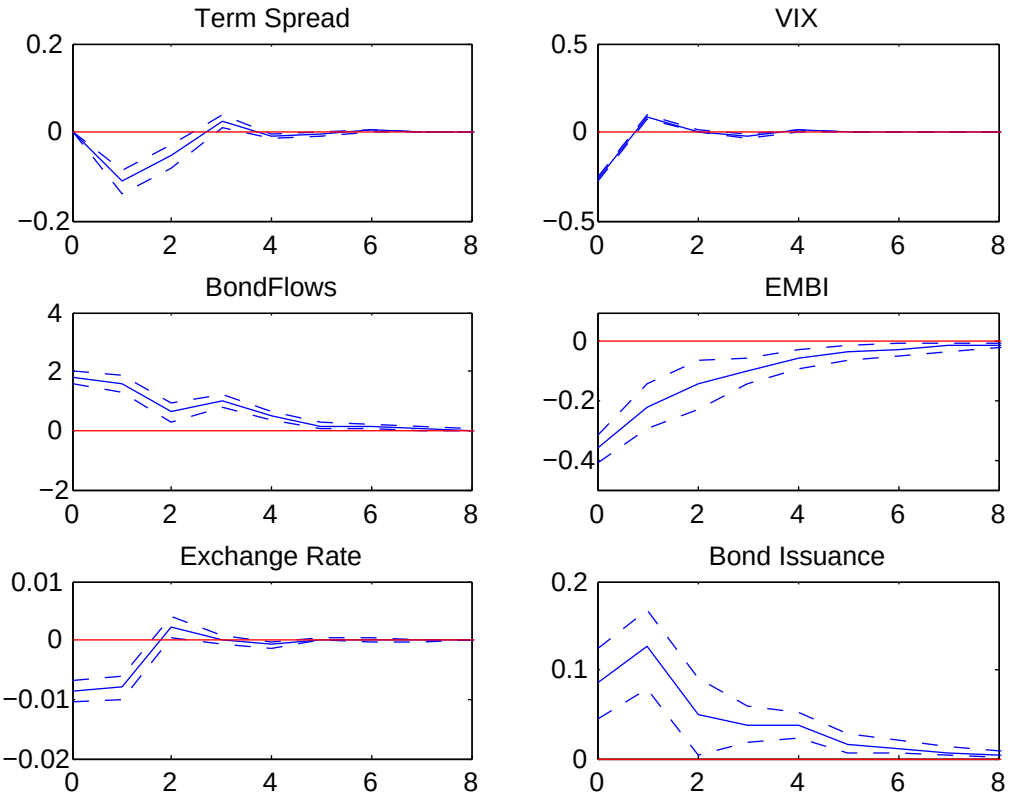


The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repetitions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

The expansionary monetary shock in the US significantly dampens risk aversion in the next quarter. Following that quarter risk aversion returns back to its initial level. The low persistence of the effect is due to the fact that log first differences are used in the specification and not levels. Expansive monetary policy in the US results further in a strong and persistent net flow into mutual funds dedicated to emerging market debt. The effect reaches its peak within the first two quarters after the shock to the US term spread, but declines only very slowly and remains significant for nearly two years. The increased demand from international investors, who have to search for yield in alternative assets given the depressed return on Treasuries lowers the EMBI yield immediately. EMBI yields remain negative for two quarters after the initial shock, before returning to their initial levels. As portfolio inflows increase, the domestic currency appreciates against the US dollar after one quarter, with the effect reaching its peak in quarter two. Finally, the last segment of Figure (2) shows that foreign currency bond issuance increases in the long-run following the expansive US monetary policy shock. In fact, bond issuance declines slightly

in the first quarter after the shock but soon turns positive. The effect of the negative US term spread shock on foreign currency bond issuance remains positive and significant until almost two years after the initial shock.

Figure 3: IRF shock to the VIX



The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repetitions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

Figure (3) displays the impulse response functions to a minus one standard deviation shock to the VIX. The negative shock can be interpreted as a decline in global risk aversion. As it can be seen from the chart, the reduced risk averion leads to an immediate increase in flows into mutual funds dedicated to EM debt. The effect is fairly persistent and dies out only slowly. The EMBI spread decreases initially. The impact is markedly stronger than the impact of a shock to the US term spread indicating that the market perception of risk plays a strong role in the pricing of EM debt. As in the previous case, the exchange rate appreciates instantly, but reverses to its original level relatively quickly. Foreign currency bond issuance increases immediately and issuance levels remain significantly elevated for almost two years.

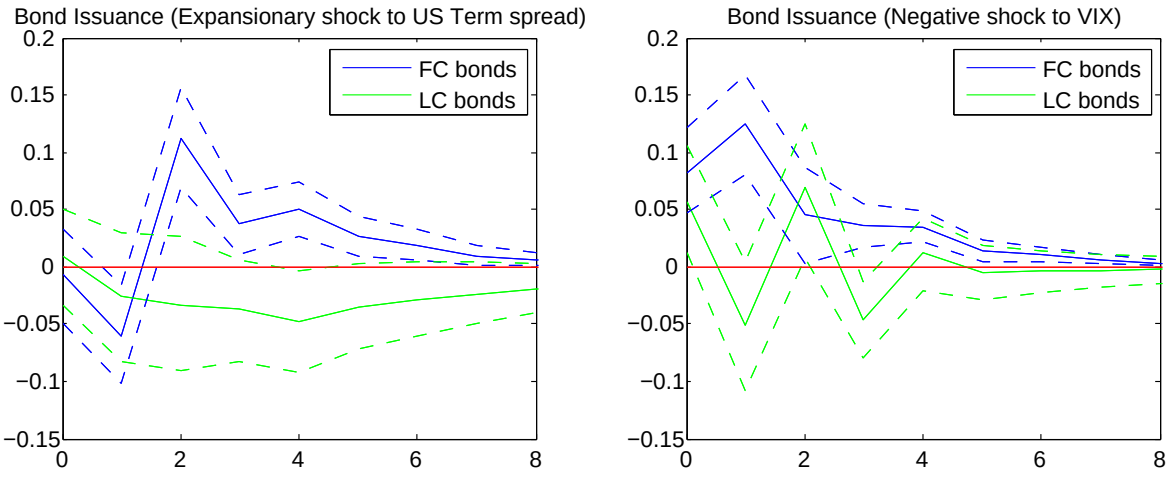
The results of Figure (2) and Figure (3) confirm the hypothesis that global monetary and financial developments influence bond issuance by non-financial corporates in emerging

markets. Both, an expansive US monetary policy as well as reduced global risk aversion, lead to increasing foreign currency bond issuance for the next two years. These result are in line with previous studies on the relation between US monetary policy and bond issuance abroad (Lo Duca et al., 2014; McCauley et al., 2015).

3.3.2 Different responses of FC and LC bond issuance

I repeat the analysis of the previous section, but instead of looking only at the behaviour of bond issuance denominated in foreign currency I also simulate how local currency bond issuance responds to shocks in US monetary policy and global risk aversion. The results are reported in Figure (4).

Figure 4: Different responses of FC and LC bonds



The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repetitions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

The blue line displays again the impulse response function of foreign currency denominated bond issuances as a percentage of GDP and the green line shows the response of local currency denominated bond issuance as a percentage of GDP. The left panel of Figure (4) shows the impulse response functions of these two variables in response to a minus one standard deviation shock to the US term spread and the right panel shows the impulse response functions to a minus one standard deviation shock to the VIX. It can be clearly seen that bond issuance denominated in local currency reacts differently than international bond issuance. Whereas non-financial firms in emerging markets significantly increase foreign currency bond issuance in response to expansionary US monetary policy and lower global risk aversion, local currency bond issuance does not react in a significant way. The impulse response function of local currency bond issuance in response to a shock to the US term spread is even negative (although insignificant), suggesting that fewer bonds

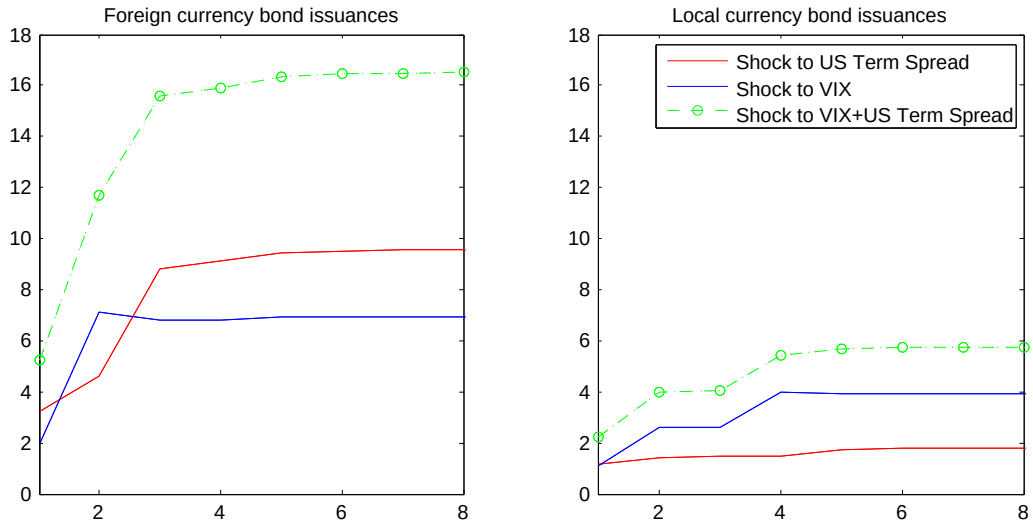
are issued after a reduction in the US term spread. This effect might be explained by a substitution of local currency bond issuance with foreign currency bond issuance. When global interest rates are depressed due to expansive US monetary policy, it may be more favourable for firms in emerging marekts to issue US dollar denominated debt.[9]

3.3.3 Variance Decomposition

To gauge the economic significance of the previous results I turn to a forecast error variance decomposition and, in particular, to the question of how much of the variation in bond issuance is accounted for by shocks to the US term spread and the VIX. The left hand panel of Figure 5 displays the results of the forecast error variance decomposition for foreign currency denominated bond issuance and the right hand panel for local currency denominated bond issuance.

We see that after four quarters around 10% of the variance of foreign currency bond issuance is explained by shocks to the US term spread and around 7% by shocks to the VIX. Hence, combined these two shocks manage to explain a sizeable 17% of the variation in foreign currency denominated bond issuance at horizons longer than one year.

Figure 5: Forecast Error Variance Decomposition



The figure displays the forecast error variance decomposition for foreign currency bond issuances (left panel) and local currency bond issuances (right panel). In both panels the red line depicts the fraction of the k-quarter ahead forecasting error explained by a shock to the US term spread, the blue line depicts the forecasting error explained by a shock to the VIX and the dashed green line the fraction of the total forecast error that is explained by both, shocks to the US term spread and shocks to the VIX.

The right hand panel reveals that the fraction of the variance of local currency bond issuance explained by global monetary and financial shocks is significantly smaller. Inno-

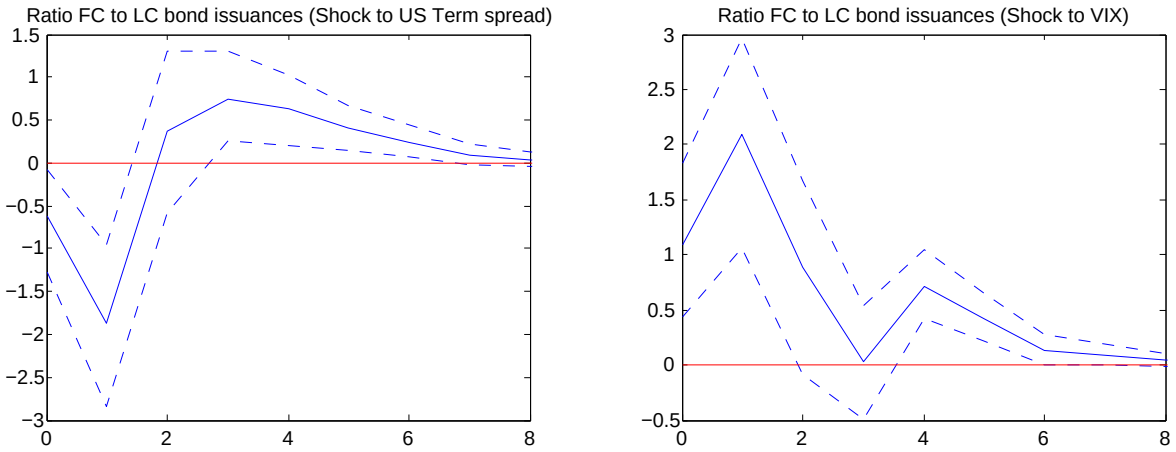
[9]In order to control for a potential interaction of local and foreign currency bond issuances I include both, foreign and local currency bond issuances in the regression and thus estimate a seven variable VAR. In terms of ordering I try both, ordering FC bonds before LC bonds and vice versa. The IRFs, however, remain basically unchanged. The full set of IRFs is displayed in the appendix.

vations in the US term spread and the VIX only explain a combined 6% of the variation in local currency bond issuance at horizons longer than four quarters.
The forecast error variance decomposition thus reinforces the results from the impulse response functions in section 3.3.2. Shocks to US monetary policy and global risk aversion do have a strong and economically significant impact on foreign currency bond issuance but not on local currency bond issuance.

3.3.4 Responses of the ratio between FC and LC bond issuance

To shine more light into the potential switch from local currency to foreign currency bond issuance in response to expansive global monetary and financial shocks I slightly change the model specification. Specifically, instead of using foreign or local currency bond issuance as a percentage of GDP, I now include the ratio of foreign currency to local currency bond issuance. This ratio is simply obtained by dividing for each country the volume of all foreign currency denominated bonds issued in a given quarter by the volume of all local currency bond issuances in that quarter.

Figure 6: IRF of FC and LC issuance ratio



The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repetitions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 9 countries. The specification includes fewer countries than the previous section because I drop countries where the ratio cannot be computed for more than five quarters due to no issuance of LC bonds.

The impulse response functions of this new specification to shocks in the US term spread and in the VIX are displayed in Figure (6). In the left panel it can be seen that in response to an expansionary US monetary policy shock the ratio of foreign currency to local currency bond issuance decreases for one quarter. Following this initial drop, however, the ratio increases quickly and turns positive. It remains significantly positive until quarter seven. The response to a reduction in global risk aversion, displayed in the

right panel, is even less ambiguous. The ratio of foreign currency to local currency bond issuance increases immediately after the shock to risk aversion and remains positive for two years. The effect is statistically significant, with the exception of a one-off drop of the significance level in quarter three.

Table 1: Variance decomposition for the ratio between FC and LC bond issuances

Horizon	US term spread	VIX	Combined
2 quarters	7.48	9.70	17.18
4 quarters	8.45	9.61	18.06
6 quarters	8.55	9.70	18.25
8 quarters	8.56	9.71	18.27

Regarding the economic significance of the result I turn again to a forecast error variance decomposition. Table 1 displays the fraction of the total variance of the ratio between foreign currency and local currency bond issuance that can be explained by innovations in US term spreads and global risk aversion. We can see that after a horizon of more than four quarters over 18% of the movement in the ratio between foreign and local currency bond issuance can be explained by either shocks to the US term spread or shocks to global risk aversion. This leads to the conclusion that global monetary and financial developments have a statistically and economically significant impact on the currency choice of bond issuances by non-financial companies in emerging markets.

3.4 Robustness Checks

In this section I analyse whether the previous results are robust to changes in the model specification. In particular I test whether the results still hold under (i) different identification assumptions, (ii) an alternative proxy for the stance of US monetary policy, and (iii) a different panel VAR estimation method.

Different ordering

The first robustness check regards the identification assumptions of the panel VAR specification as the sensitivity of structural VARs to alternative orderings of the variables is a constant concern in VAR analyses. To obtain structural identification of the shocks the following ordering of variables was assumed in section 3.1: The US term spread was ordered first, followed by the VIX. After these variables, which are assumed to be independent of the other variables, I ordered the variable bond flow, EMBI, exchange rate and bond issuances. A potential point of critique is that the variable bond flow is ordered before the EMBI yield. This assumption means that shocks to bond flows affect yields in emerging markets instantly, but that changes in yields affect bond flows only with a

one quarter lag. The idea behind this assumption is that higher bond flows mean higher demand for EM bonds and that this higher demand immediately increases bond price and hence reduces bond yields. Basically, it assumes that prices react instantly to changes in demand, but demand reacts only with a lag to price changes. It makes sense to assume that it takes some time until bond investors react to changes in EM yields and reallocate their portfolios accordingly. However, one could still argue that the yield level in emerging markets acts primarily as a pull factor for bond flows, i.e. it is the high yield level that causes bond flows in the first place and, hence, bond flows should react instantaneously to changes in yields. To make sure that the main results of the PVAR are not affected by this assumption, I repeat the analysis of section 3.3 using an alternative ordering in which the EMBI yield is ordered before the variable bond flow. The results are displayed in Figure (9) in the appendix and it can be seen that the IRFs do not change due to this alternative ordering. Especially, we still see that an expansionary shock to US monetary policy results in a persistent increase in international bond issuances.
A second potentially controversial identification assumption taken in section 3.2 is that the variable EMBI yield is ordered before the exchange rate. One might well argue that both price variables, i.e. yields and exchange rates, react at the same time. To show that the relative ordering of the price variables does not affect the key results, I change it so that the exchange rate is ordered before the EMBI yield. The results of this alternative ordering are displayed in Figure (10) in the appendix and, again, the main results remain robust to the change in the identification assumption.

Alternative proxy for monetary policy

In a second robustness check I analyse whether the results also hold under a different proxy for the stance of the US monetary policy. The proxy used for the Fed's monetary policy in the main specification is the US term spread, i.e. the slope of the US yield curve. The term spread is used because it is an exceptionally useful proxy for monetary policy when the zero lower bound is reached. However, one might argue that it is not the slope of the yield curve that affects the issuance decision of non-financial corporates in emerging markets, but the actual level of US yields. Hence, I replace the US term spread with the 10-year US Treasury bond yield level. The results are shown in Figure (11) in the appendix. It can be seen that a drop in the 10-year bond level has similar implications to a compression in term spreads. It leads to a drop in risk aversion, a rise in inflows into EM mutual funds dedicated to EM debt, a drop in the EMBI yield, an appreciation of the domestic exchange rate against the US dollar, and finally a significant increase in international bond issuance between quarter two and quarter seven.

Different estimation technique (Mean Group Estimator)

The Least-Square Dummy Variable (LSDV) estimator used for estimating the panel VAR in section 3.3 contains country fixed effects as well as parameters common to each country used in the sample. According to Akinci (2014), a potential concern with the LSDV estimation is that the estimator might be biased due to the combination of fixed effects and lagged dependent variables. However, this bias is known to decrease in T (Nickel, 1981). To make sure that the previous results are not biased due to the choice of estimation technique, I repeat the analysis using instead of the LSDV the Mean-Group Estimator (MGE) proposed by Pesaran, Smith and Im (1996). This technique involves estimating the VAR country-by-country and then taking simple averages of the IRFs across countries. The results are shown in Figure (12) in the appendix. It can be seen that qualitatively the results are little changed. Most importantly, we still observe that following an expansive US monetary policy shock, international corporate bond issuances in emerging markets increase.

4 Firm-level evidence on the currency choice

To shine more light on the currency choice of bond issuance of non-financial corporates in emerging markets in response to US monetary policy and global risk aversion I now turn to a micro-level analysis. I make use of the full depth of my dataset by no longer aggregating bond issuance across countries and quarters, but by instead looking at specific issuance of individual firms. This allows to explicitly model firms' choice between foreign currency denominated and local currency denominated bond issuance as a function of the US term spread and global risk aversion.

4.1 Model

The model specification is similar to the one outlined by Becker and Ivashina (2014), as well as by Antoun de Almeida and Masetti (2015). The dependent variable - the currency choice of debt - is modeled as a dummy instead of the issuance amount because amounts are more affected by firms' investment opportunities and subject to valuation effects stemming from exchange rate movements (Habib and Joy, 2008). By conditioning the analysis only on firms that have issued a bond this setting allows to control for demand effects. All firms in the sample have demand for bonds, otherwise they would not issue at all. The main question is once firms issue bonds, in which currency do they issue? Do they decide to issue a bond denominated in foreign currency or a bond denominated in domestic currency? To answer this question I estimate the following baseline equation:

$$d_{icst} = \alpha + \beta R_t^{US} + \gamma VIX_t + \boldsymbol{\eta Z_i} + \boldsymbol{\omega X_{ct}} + \psi_c + \theta_s + \phi_{ts} + \epsilon_{icst} \tag{2}$$

where $d_{icst} = 1$ if firm i, incorporated in country c and active in sector s issues in quarter t a bond denominated in foreign currency and $d_{icst} = 0$ if the firm issues a bond in domestic currency; α is a constant, R^{US} is the US term spread; the VIX is again used as a proxy for global risk aversion. The vector $\boldsymbol{Z_i}$ contains bond specific control variables that might affect the currency choice of the issuance, such as the volume and maturity of the specific issuance. The vector $\boldsymbol{X_{ct}}$ contains time-varying country-specific control variables. I include proxies for the currency risk stemming from issuing in foreign currency, namely the real effective exchange rate (REER) as an indicator for whether a currency tends to be overvalued/undervalued in real terms and is hence likely to adjust in the future, as well as the historical volatility of the domestic currency, measured as the standardized four-quarter rolling window standard deviation of the nominal exchange rate. Additionally, I include domestic bond market capitalization as a percentage of GDP to measure the depth of domestic debt markets and hence the ease for firms to issue domestically.[10] The domestic policy rate is included in the regression to control for the interest rate level in a given country-quarter and should indicate the lower bound for the cost of issuing a bond domestically. Finally, to proxy the ability to issue in international markets and the attached risk premium I include the sovereign credit rating. To control for unobservable factors I include additionally several fixed effects. The variable ψ_c represents country fixed effects; the variable θ_s indicates sector fixed effects[11], and finally ϕ_{ts} indicates quarter-sector fixed effects. Since I only consider quarters in which a firm has issued new debt and that only happens occasionaly, I have an unbalanced panel including data for 48 quarters from 2003:Q1 to 2014:Q4 for 5,799 firms. The model is estimated with logit and error terms are clustered by quarter.

The interpretation of the mean of our dependent variable is the probability of a firm issuing a foreign currency denominated bond, conditional on a firm issuing a new bond. The unconditional mean in the sample is 0.12, meaning that 12% of the issuance is in foreign currency. The coefficient of interest is β, the coefficient on the stance of US monetary policy. My hypothesis is that β is significant and negative, meaning that when US monetary policy is expansive, i.e. interest rates in the US are low, firms in emerging markets are more likely to issue foreign currency denominated debt.

4.2 Results

The regression results are displayed in Table 2. I use a general-to-specific approach. In the first column I only include the US term spread, the VIX and fixed effects. In the subsequent columns the bond characteristics size and maturity, the proxies for currency

[10] To avoid endogeniety concerns the variable bond market capitalization is taken for the period previous to the issuance.

[11] The currency choice of bonds varies strongly across sectors. Sectors that generate proceeds in foreign currency, such as the oil and gas sector, are more likely to issue in foreign currency to avoid a currency mismatch on their balance sheet

risk and the proxies for the relative ease to issue internationally are stepwise included. Finally, in Column (5) the full model is estimated.

Throughout the different specifications the main result holds. The US term spread has a negative and highly significant coefficient. This means that in times when US monetary policy is expansive and, hence, US interest rates are low, non-financial corporations in emerging markets are more likely to issue foreign currency denominated debt once they issue. This micro-level result confirms the previous finding from the aggregate PVAR model used in Section 3. For interpreting the magnitude of the effect I calculate the marginal effect of a change in the US term spread on the probability that the new bond is issued in foreign currency. The average marginal effect of the US term spread ranges from -0.015 to -0.026 in the different specifications. This means that a decrease in the US term spread by one percentage point, say from 2% to 1%, increases the conditional probability that the new bond is issued in foreign currency by between 1.5pp and 2.6pp.[12] This effect is large given that the unconditional probability of a foreign currency bond issuance is only 12%.

The coefficient on the VIX is also significant and negative in all specification. As argued in the previous section, when risk aversion is elevated, firms are less likely to issue international debt. The marginal effect of the VIX ranges from -0.0019 to -0.0027, meaning that a one point decrease in the VIX raises the probability of foreign currency bond issuance by between 0.19pp and 0.027pp.[13]

Regarding bond characteristics the volume of the bond issuance has a positive and significant coefficient. The higher the issuance amount, the higher is the probability that the bond is denominated in foreign currency. The reason for this is probably the still limited depth of many emerging markets' debt markets, which makes it difficult to issue large volumes. The coefficient on maturity is insignificant.

Currency risk turns out to have a strong impact on the currency choice of bond issuance. The coefficient on the real effective exchange rate (REER) is negative and highly significant. A higher value of the REER in general means that the domestic exchange rate is appreciated in real terms against a trade-weighted basket of currencies. An appreciated currency has negative effects on external competitiveness and hence puts depreciation pressure on the nominal exchange rate. Thus, the higher the REER, the higher is the probability that the nominal exchange rate depreciates (or in the case of fixed exchange rate regimes the pressure to devalue the currency). A devaluation of the domestic currency would increase the costs of servicing foreign currency debt and hence we see that a high REER reduces the incentive to issue foreign currency denominated debt. A similar reasoning explains the negative coefficient on exchange rate volatility. In contrast to the

[12]The standard deviation of the US term spread is 0.79. Between early 2010 and early 2012 the US term spread decreased by 1.8pp.

[13]The standard deviation of the VIX is 8.4.

Table 2: Firm-level evidence: Baseline Results

Dummy dependent varible: 1 if the issue is a FC bond, 0 if the issue is LC bond					
	(1)	(2)	(3)	(4)	(5)
US Term Spread	-0.3031***	-0.2205**	-0.2815***	-0.3200***	-0.2519***
	(0.0864)	(0.1031)	(0.0970)	(0.0970)	(0.1014)
VIX	-0.0282***	-0.0294***	-0.0249**	-0.0345***	-0.0352***
	(0.0101)	(0.0112)	(0.0108)	(0.0126)	(0.0139)
Amount Issued		1.0801***			1.1145***
		(0.0539)			(0.0576)
Maturity		-0.0359			-0.0971
		(0.1006)			(0.1123)
REER			-0.0254***		-0.0268***
			(0.0053)		(0.0068)
ExchVol			-0.0794***		-0.0445**
			(0.0191)		(0.0227)
BondCap				-0.0062***	-0.0086***
				(0.0018)	(0.0019)
Sov. Rating				0.0843	0.1706**
				(0.070)	(0.0809)
PolicyRate				-0.0053	-0.0778*
				(0.044)	(0.0454)
Country-fixed effects	Yes	Yes	Yes	Yes	Yes
Sector-fixed effects	Yes	Yes	Yes	Yes	Yes
Sector*quarter-fixed effects	Yes	Yes	Yes	Yes	Yes
# observations	11,059	10,142	10,712	9,441	8,646
R-squared	0.31	0.46	0.32	0.29	0.46
Marginal effects					
US Term Spread	-0.0245	-0.0146	-0.0228	-0.0257	-0.0161
VIX	-0.0022	-0.0019	-0.0020	-0.0027	-0.0022

The dependent variable is a dummy variable that takes the value 1 if a firms has issued a bond in foreign currency and the value of 0 if a firm has issued a bond in local currency. The sample spans from 2003:Q1 to 2014:Q4. Each firm-quarter observation corresponds to a new debt issuance (foreign or local currency bond). If in a given quarter a firm has not issued new debt, the observation will not be included in the sample. The regression is estimated via logit with error terms clustered by quarter. All regressions include a constant which is not reported. ***,**,* indicate statistical significance at the 1%, 5% and 10% level, respectively. The two bottom rows display the average marginal effects (AME) based on the regression results for the five different specifications.

REER, it is a backward looking indicator, that describes past volatility of the nominal exchange rate. A highly volatile exchange rate increases the uncertainty around the future domestic currency value of foreign currency debt repayments and this uncertainty seems to discourage international bond issuances. Similar results are reported in previous studies on the currency choice of corporate bond issuance (see for example Siegfried, Simeonova and Vespro, 2007).

The domestic bond market capitalization has a negative impact on the probability to issue international bonds. A larger and more liquid domestic market means that firms can more easily obtain funding domestically and that transaction costs are lower. This reduces the need to issue abroad. The sovereign rating has a positive coefficient. A higher, i.e. better, sovereign rating increases the probability that a foreign currency denominated bond is issued. This is likely due to the established practice of *country ceiling*. In most cases no corporate issuer can be rated higher than the sovereign. Thus, a low sovereign rating results in low corporate ratings and means that it is more difficult for those corporates to tap international markets. If they manage to issue, the low rating implies a higher risk premium and hence higher yields, which makes international issuances less attractive. The domestic policy rate has a negative but hardly significant effect on the currency choice of debt issuance.

Overall, the model has a very high explanatory power. The R-squared ranges from 0.29 to 0.46 in the full specification. It is materially higher in those specifications that include bond charcteristics.

4.3 Robustness Checks

Changes in the sample

As robustness checks I re-estimate Equation (2) using five alternative samples: (i) excluding Chinese firms, (ii) including only large bond issuance ($\geq$ USD 10m), (iii) including only firms which have issued bonds both in domestic and in foreign currency, (iv) using a propensity-matched subsample and (v) excluding the financial crisis period. The results are reported in Table (3).

The motivation for excluding China is that Chinese firms account for more than one third of all firms in the sample and around 30% of total issuance. The dominance of China means that the overall result could be driven by country-specific trends in China. However, estimating the model with a subsample that excludes Chinese firms yields very similar results compared to the baseline specification. The coefficient on the US term spread even increases indicating that the effect of US monetary policy on international corporate bond issuances is stronger outside China.

The second alternative sample excludes all issuances that have a volume of less than USD 10m. The reason is that foreign currency denominated bonds tend to be larger

and one might argue that they are no substitutes for domestic bonds with a small face value. Repeating the analysis with a subsample that includes only bond issuances with a volume of $\geq$ USD 10m yields results very similar to the baseline specification. Again the coefficient on the US term spread is slightly higher meaning that the effect of US monetary policy is more pronounced for larger bond issuances.

As a third robustness check I re-estimate Equation (2) using only firms in the sample that have issued both, bonds denominated in local currency and bonds denominated in foreign currency. The motivation is that we can be absolutely sure that these firms have access to international debt markets and, hence, are able to adapt their currency choice of bond issuances to international developments. The results in Column (3) show that the coefficients are hardly affected by this change in the sample.

In Column (4) I repeat the analysis for a propensity-matched subsample. To obtain a propensity-matched sample I first estimate the predicted probability of a bond being denominated in foreign currency instead of local currency based solely on its characteristics and not on global factors. Then I exclude all bonds that have a probability of being in foreign currency that is below 10% and above 90%, losing about one-third of my sample. The goal is to make foreign and domestic bond issuance more comparable. In a last step I estimate the baseline equation for this reduced subsample. Again, the coefficients of interest barely change and the main results remain valid.

Finally, I estimate the model for a subsample that excludes the period of the financial crisis, i.e. all observations between 2008:Q1 and 2009:Q4 are dropped. This robustness check is done to make sure that the results are not only driven by the exceptional circumstances during the peak of the financial crisis when international bond issuance came almost to a complete standstill. As it can be seen from Column (5) this is not the case. We still see a significantly negative relation between the US term spread and foreign currency denominated bond issuance by non-financial corporations in emerging markets.

Substitution of foreign currency bank loans

In addition to unconventional monetary policy in the US, a second major trend following the financial crisis has been the deleveraging of global banks and a slowdown in cross-border bank lending (Milesi-Ferretti and Tille, 2011; Shin, 2013). This development might influence a firm's decision on the currency choice of bond issuance, if the firm is issuing foreign currency bonds in order to substitute scarcer foreign currency bank loans. To control for this alternative/complementary explanation I include the growth of cross-border international bank claims vis-a-vis the country where the issuing firm is domiciled in Equation (2) as an additional control variable. A negative number means that foreign banks reduce lending to that country and, hence, the availability of foreign currency bank loans declines. As it can be seen from Column (6) the inclusion of the corss-border lending variable does not change the sign or significance of the coefficients on the US term spread

Table 3: Firm-level evidence: Robustness Checks

Dummy dependent varible: 1 if the issue is a FC bond, 0 if the issue is LC bond						
	(1) excl. China	(2) bonds ≥USD 10m	(3) firms issuing both	(4) prop.-matched sample	(5) excl. FinCrisis	(6) incl. cross-border banking
US Term Spread	-0.3381***	-0.3209***	-0.2839*	-0.2763***	-0.2896***	-0.2714***
	(0.0824)	(0.0962)	(0.1601)	(0.1040)	(0.0917)	(0.0961)
VIX	-0.0367***	-0.0270**	-0.0474***	-0.0260**	-0.0219	-0.0313***
	(0.0109)	(0.0118)	(0.0143)	(0.0126)	(0.0146)	(0.0218)
Cross-border banking						0.0257
						(0.0174)
Country-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector*quarter-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
# observations	7,621	9,294	1,497	6,901	9,589	10,198
R-squared	0.31	0.33	0.19	0.34	0.32	0.33

The dependent variable is a dummy variable that takes the value 1 if a firms has issued a bond in foreign currency and the value of 0 if a firm has issued a bond in local currency. The sample spans from 2003:Q1 to 2014:Q4. Each firm-quarter observation corresponds to a new debt issuance (foreign or local currency bond). If in a given quarter a firm has not issued new debt, the observation will not be included in the sample. The regression is estimated via logit with error terms clustered by quarter. All regressions include a constant which is not reported. ***,**,* indicate statistical significance at the 1%, 5% and 10% significance level, respectively.

and global risk aversion. The coefficient on cross-border lending itself is insignificant.

Additional control variables

A potential critique is that in the baseline specification of Equation (2) the US term spread and the VIX are the only global and time-varying variables included. It is thus possible that the two variables do not only proxy the stance of US monetary policy and global risk aversion respectively, but also pick up the influence of other unobserved time-varying global developments. To make sure that this is not the case I include additional control variables, namely global growth and the growth rate of world trade, in the regression. Including these two variables does not change the main results (not reported but available on request). The US term spread and the VIX continue to exert a significant negative influence on the probability of foreign currency bond issuance.

Alternative estimation method

Estimating Equation (2) with logit might give raise to an *incidental parameter*[14] problem due to the presence of fixed effects (Neyman and Schott, 1948). This could eventually

[14]The *incidental parameter* problem refers to a situation where maximum likelihood estimators are inconsistent if the number of incidental parameters grows at the same rate as the number of observations.

lead to biased results. However, the potential bias decreases as T grows (Beck, 2011). Katz (2001) and Coupe (2005) show using Monte Carlo simulations that when T is above 16 or 20 the bias becomes negligible, suggesting that "... the researcher can savely use the [unconditional logit] estimator under such conditions" (Katz, 2001, p1). As in my sample T is with 48 far above this threshold, the bias arising from the incidental parameter problem should be small.[15] Nevertheless, to make sure that the main results are consistent and unbiased I re-estimate Equation (2) using an OLS estimator instead of a maximum-likelihood logit estimator. The results are presented in Table 8 in the Appendix. It can be seen that the different estimation method does not change the results. The US term spread remains significant and positive throughout all specifications and also the sign and significance of the control variables remains unaltered. Also regarding the magnitude of the effect the results are comparable. Decreasing the US term spread by one percentage point increases the conditional probability of a foreign currency bond issuance by between 2.6pp and 3.9pp in the OLS setting. This is in line with the marginal effects of a one percentage point increase in the US term spread in the baseline logit framework. The similarity of the OLS results to the logit results further suggest that the incidental parameter problem does not significantly bias the logit results.

5 Conclusion

This paper studies the influence of monetary policy in the United States on corporate bond issuance by non-financial firms in 20 emerging market economies. A panel VAR analysis reveals that the effects differ significantly for foreign and local currency bond issuance. Whereas foreign currency bond issuance increases sharply following an expansive shock to US monetary policy, local currency bonds react only modestly. By raising foreign currency bond issuance, but not significantly impacting local currency bond issuance, US monetary policy thus affects the currency composition of bond issuance in emerging markets. The paper finds that the share of foreign currency bond issuance rises significantly and lastingly following an expansionary shock to the US term spread and a decline in global risk aversion. These results are confirmed by a micro level analysis in the second part of the paper. Firms are more likely to issue foreign currency bonds than local currency bonds in times when interest rates in the US are low.

The impact of US monetary policy on the currency choice of corporate bond issuance in emerging markets identified in this paper presents a new and widely unexplored channel of cross-border spillovers of (unconventional) monetary policy. Further research to understand its implications for global financial stability is needed especially given the prospects of rising interest rates in the US and a strenghtening US dollar.

[15] This conjecture is also supported by the fact that only around 10% of the observations are dropped, due to fixed effects perfectly predicting success or failure.

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6 Appendix

Figure 7: Non-financial corporate bonds in emerging markets

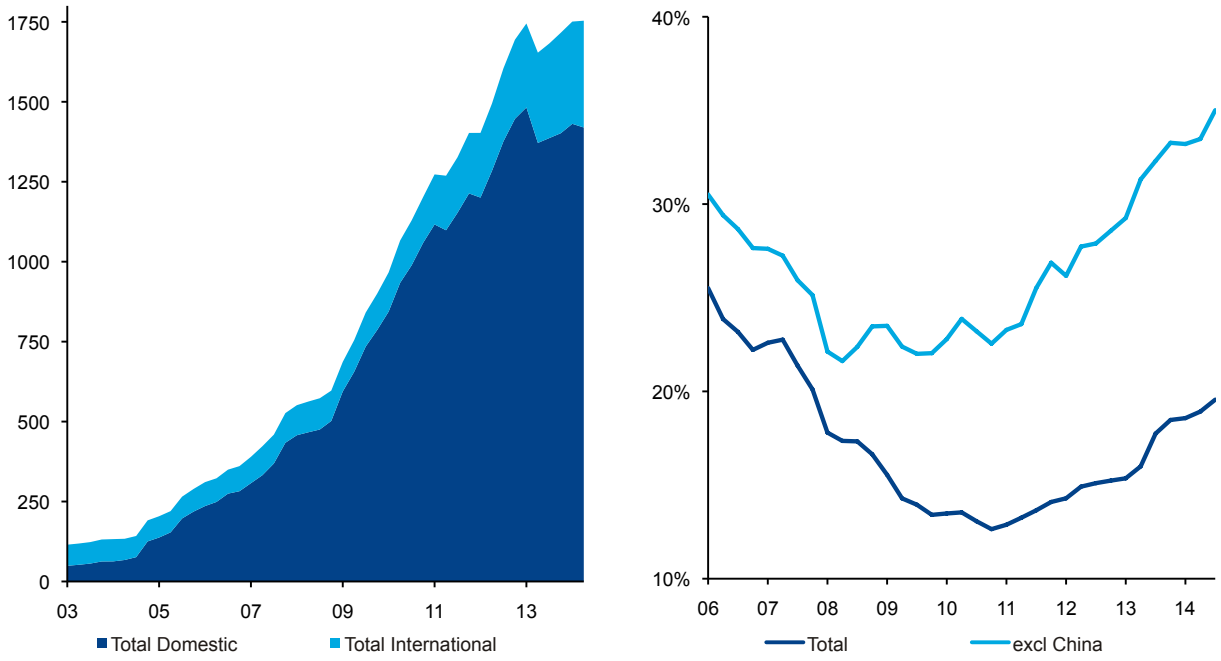


Figure 1 shows the development of the corporate bond market in emerging markets. The left-hand panel shows outstanding amounts of bonds issued by non-financial corporations in USD bn. Data are taken from the BIS *Debt securities statistics*. Domestic bonds are taken from Table 16B and international bonds from Table 12D. International bonds are taken by nationality of issuer. The right-hand panel shows the ratio of international to dometic bonds outstanding.

Summary Statistics

Table 4: Bond characteristics

	Maturity (# of issuances)					Volume
	< 5	5-10	10-20	> 20	Average	Average
LC Bonds	4,496	6,247	407	95	5.33	202.8
FC Bonds	261	1,172	70	27	6.61	230.2

Average maturity is expressed in years, and the avarege volume is expressed in USD million.

Table 5: Bond issuances by country

	# of new debt issuances				# of firms
	FC Bonds	LC Bonds	Total	FC/Total	Total
Argentina	104	97	201	0.52	91
Brazil	86	1,562	1,648	0.05	868
Chile	58	211	269	0.22	97
China	124	3,863	3,987	0.03	1,947
Colombia	13	61	74	0.18	37
Czech Republic	32	26	58	0.55	25
Hong Kong	155	65	220	0.70	123
India	263	1,332	1,595	0.16	657
Indonesia	54	214	268	0.20	140
Israel	15	328	343	0.04	155
Mexico	189	229	418	0.45	123
Peru	102	138	240	0.43	55
Philippines	18	57	75	0.24	28
Russia	22	665	687	0.03	348
Singapore	67	216	283	0.24	108
South Africa	22	105	127	0.17	50
Taiwan	174	1,466	1,640	0.11	758
Thailand	17	503	52	0.03	108
Turkey	11	57	68	0.16	47
Vietnam	4	50	54	0.07	29
Total	1,530	11,245	12,775	0.12	5,799

Table 6: Bond issuances by sector

	Foreign Currency	Local Currency	Total	FC/Total
Aerospace	0	66	66	0.00
Airline	13	133	146	0.09
Automotive Manufacturer	18	204	222	0.08
Beverage/Bottling	23	97	120	0.19
Building Products	52	496	548	0.09
Cable/Media	30	88	118	0.25
Chemicals	56	532	588	0.10
Conglomerate	56	277	333	0.17
Consumer Products	23	162	185	0.12
Containers	12	50	62	0.19
Electric Utility High Quality	58	131	189	0.31
Electric Utility Low Quality	0	2	2	0.00
Electric Utility Medium Quality	3	44	47	0.06
Electronics	167	802	969	0.17
Food Processing	67	360	427	0.16
Gaming	5	11	16	0.31
Gas Utility-Local Distribution	18	54	72	0.25
Gas Utility-Pipelines	3	7	10	0.30
Health Caere Facilities	6	97	103	0.06
Health Care Supply	3	32	35	0.09
Home Builders	62	746	808	0.08
Industrials -Other	49	739	788	0.06
Information/Data - Technology	55	154	209	0.26
Leisure	18	79	97	0.19
Lodging	10	92	102	0.10
Machinery	28	182	210	0.13
Metals/Mining	85	975	1,060	0.08
Oil and Gas	89	296	385	0.23
Olifield Machinery and Service	7	13	20	0.35
Pharmaceuticals	33	127	160	0.21
Publishing	7	63	70	0.10
Railroads	22	200	226	0.10
Restaurants	0	24	24	0.00
Retail Stores -Food/Drug	11	34	45	0.24
Retail Stores -Other	26	320	346	0.08
Service -Other	122	1,238	1,360	0.09
Telecommunications	100	345	445	0.22
Textil/Apparel/Shoes	45	234	279	0.16
Tobacco	0	5	5	0.00
Transportation -Other	44	733	777	0.06
Utility-Other	93	922	1,015	0.09
Vehicle Parts	11	79	90	0.11

Number of bond issuances per sector.

Table 7: Summary statistics of the PVAR variables

Variable	Description	Source	Mean	Std Dev	Min	Max
FC bond issuances in % of GDP	Foreign currency denominated bond issuances by non-financial corporations in % of nominal GDP	Thompson Reuters	0.51	1.10	0	10.49
LC bond issuances in % of GDP	Local currency denominated bond issuances by non-financial corporations in % of nominal GDP	Thompson Reuters	1.01	1.70	0	15.26
US Term Spread	Difference between 10-year US bond yields and short term rates; log first differences	Federal Reserve Board	-0.03	0.675	-1.90	1.92
VIX	Chicago Board of Options Volatility Index; log first differences	Bloomberg	-0.01	0.28	-0.60	0.95
BondFlow	Mutual fund flows into Emerging Market debt, net flows in bn US dollar	IMF Financial Stability Report	1.37	8.45	-19.5	21.2
EMBI Yield	J.P Morgan Emerging Markets Bond Index: Global Sovereign Yield Spreads; log deviations from trend	IMF Financial Stability Report	-0.02	2.46	-21.39	21.41
Exchange Rate	Nominal exchange rate against the US dollar; log first differences	Bloomberg	0.00	0.05	-0.16	0.31

Sample period 2003:Q1 to 2014:Q4, quarterly data.

Identification Assumption

Equation (1) can then be written as:

$$\begin{pmatrix} a_{1,1} & 0 & 0 & 0 & 0 & 0 \\ a_{2,1} & a_{2,2} & 0 & 0 & 0 & 0 \\ a_{3,1} & a_{3,2} & a_{3,3} & 0 & 0 & 0 \\ a_{4,1} & a_{4,2} & a_{4,3} & a_{4,4} & 0 & 0 \\ a_{5,1} & a_{5,2} & a_{5,3} & a_{5,4} & a_{5,5} & 0 \\ a_{6,1} & a_{6,2} & a_{6,3} & a_{6,4} & a_{6,5} & a_{6,6} \end{pmatrix} * \begin{pmatrix} R_t^{US} \\ VIX_t \\ BondFlow_t \\ R_t^{EM} \\ e_t \\ BondIssue_t \end{pmatrix} =$$

$$\eta_i + \begin{pmatrix} b_{1,1} & b_{1,2} & 0 & 0 & 0 & 0 \\ b_{2,1} & b_{2,2} & 0 & 0 & 0 & 0 \\ b_{3,1} & b_{3,2} & b_{3,3} & b_{3,4} & b_{3,5} & b_{3,6} \\ b_{4,1} & b_{4,2} & b_{4,3} & b_{4,4} & b_{4,5} & b_{4,6} \\ b_{5,1} & b_{5,2} & b_{5,3} & b_{5,4} & b_{5,5} & b_{5,6} \\ b_{6,1} & b_{6,2} & b_{6,3} & b_{6,4} & b_{6,5} & b_{6,6} \end{pmatrix} * \begin{pmatrix} R_{t-1}^{US} \\ VIX_{t-1} \\ BondFlow_{t-1} \\ R_{t-1}^{EM} \\ e_{t-1} \\ BondIssue_{t-1} \end{pmatrix} + \dots$$

Bringing Equation (1) in the reduced form:

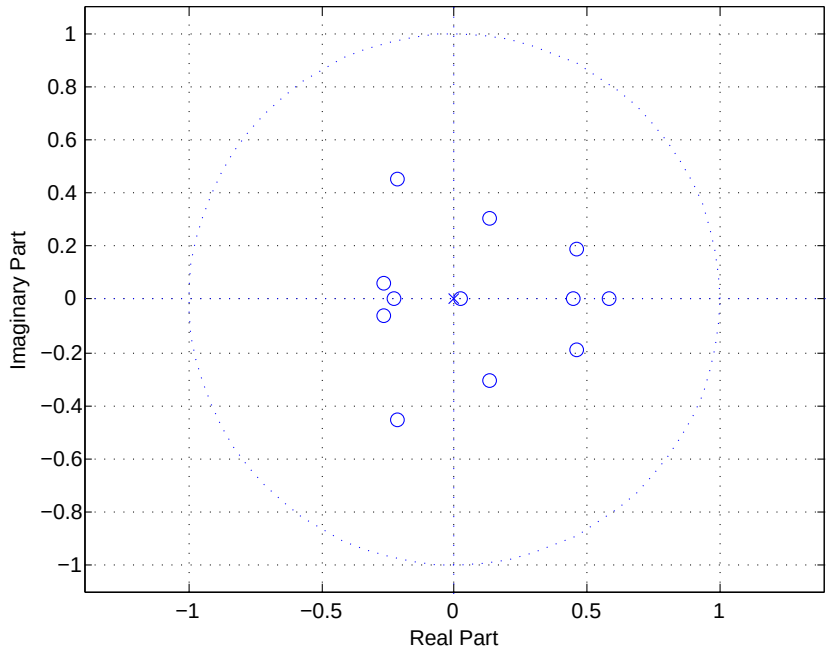
$$y_{it} = \eta_i + A^{-1}B_k y_{i,t-k} + A^{-1}\epsilon_{it}$$

$$\begin{pmatrix} R_t^{US} \\ VIX_t \\ BondFlow_t \\ R_t^{EM} \\ e_t \\ BondIssue_t \end{pmatrix} = \begin{pmatrix} a_{1,1}b_{1,1} & a_{1,1}b_{1,2} & 0 & 0 & 0 & 0 \\ a_{2,1}b_{2,1} + a_{2,2}b_{2,1} & a_{2,1}b_{2,1} + a_{2,2}b_{2,2} & 0 & 0 & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \end{pmatrix} * \begin{pmatrix} R_{t-1}^{US} \\ VIX_{t-1} \\ BondFlow_{t-1} \\ R_{t-1}^{EM} \\ e_{t-1} \\ BondIssue_{t-1} \end{pmatrix} +$$

$$\begin{pmatrix} \tilde{a}_{1,1} & 0 & 0 & 0 & 0 & 0 \\ \tilde{a}_{2,1} & \tilde{a}_{2,2} & 0 & 0 & 0 & 0 \\ \tilde{a}_{3,1} & \tilde{a}_{3,2} & \tilde{a}_{3,3} & 0 & 0 & 0 \\ \tilde{a}_{4,1} & \tilde{a}_{4,2} & \tilde{a}_{4,3} & \tilde{a}_{4,4} & 0 & 0 \\ \tilde{a}_{5,1} & \tilde{a}_{5,2} & \tilde{a}_{5,3} & \tilde{a}_{5,4} & \tilde{a}_{5,5} & 0 \\ \tilde{a}_{6,1} & \tilde{a}_{6,2} & \tilde{a}_{6,3} & \tilde{a}_{6,4} & \tilde{a}_{6,5} & \tilde{a}_{6,6} \end{pmatrix} \begin{pmatrix} \epsilon^{R^{US}} \\ \epsilon^{VIX} \\ \epsilon^{BondFlow} \\ \epsilon^{R^{EM}} \\ \epsilon e \\ \epsilon BondIssue \end{pmatrix}$$

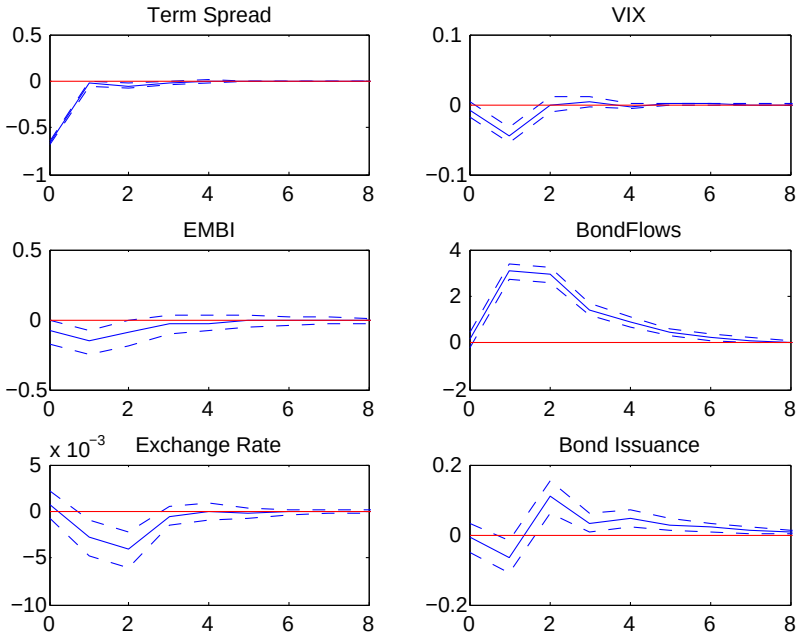
Model Specification

Figure 8: Eigenvalues of the PVAR



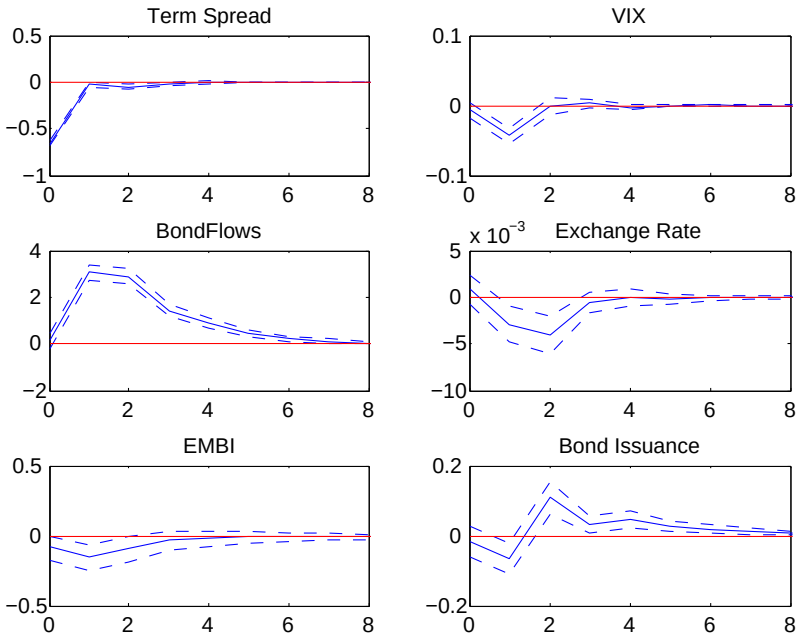
Robustness Checks

Figure 9: Different ordering I: EMBI ordered before BondFlow



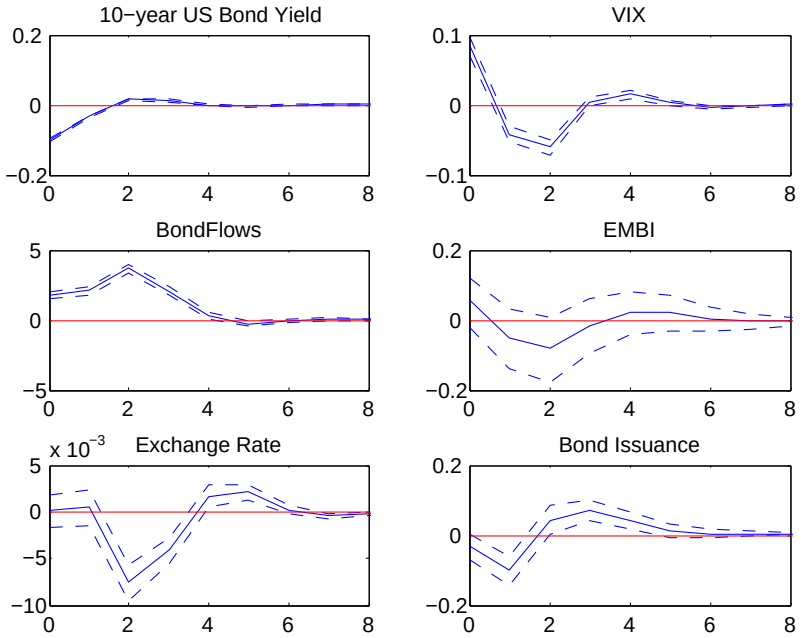
The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repititions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

Figure 10: Different ordering II: Exchange rate ordered before EMBI



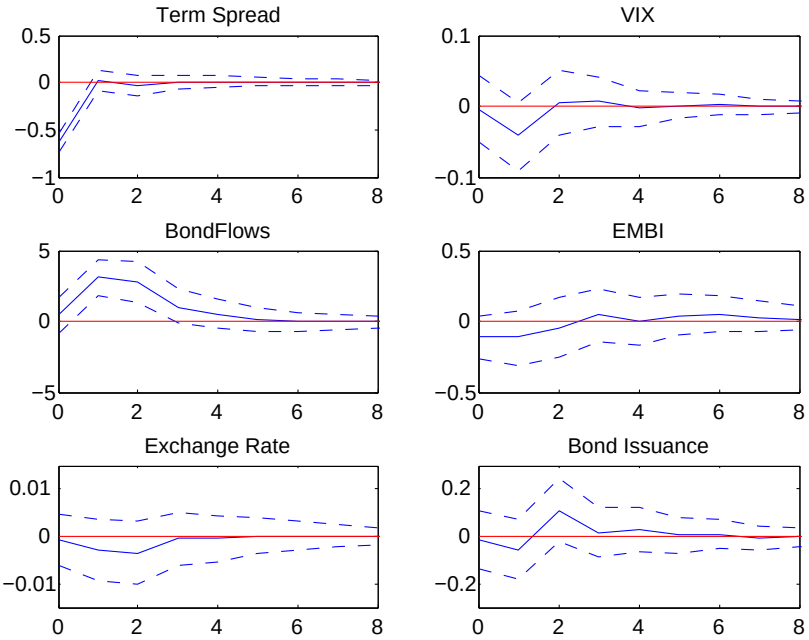
The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repititions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

Figure 11: Different proxy for US monetary policy



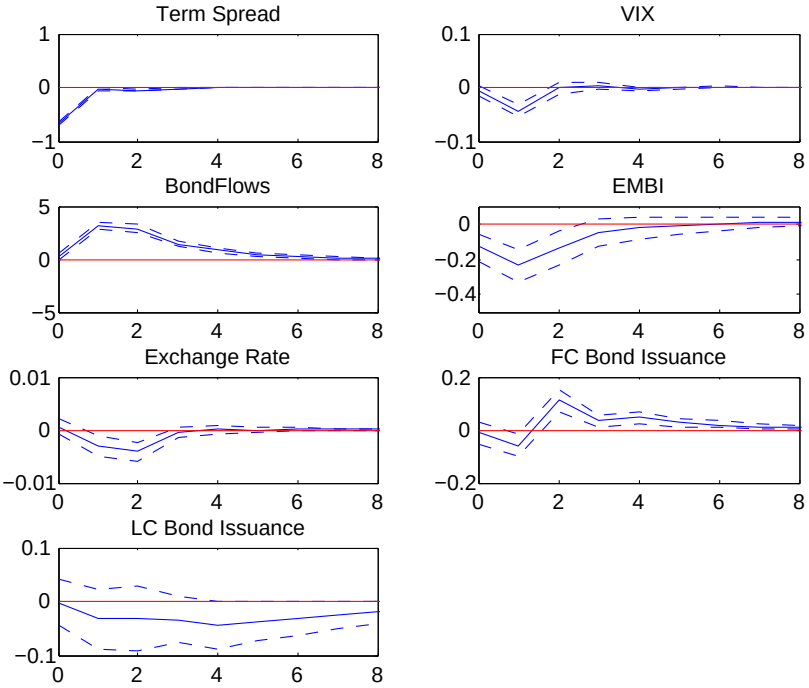
The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repititions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

Figure 12: Mean Group Estimator



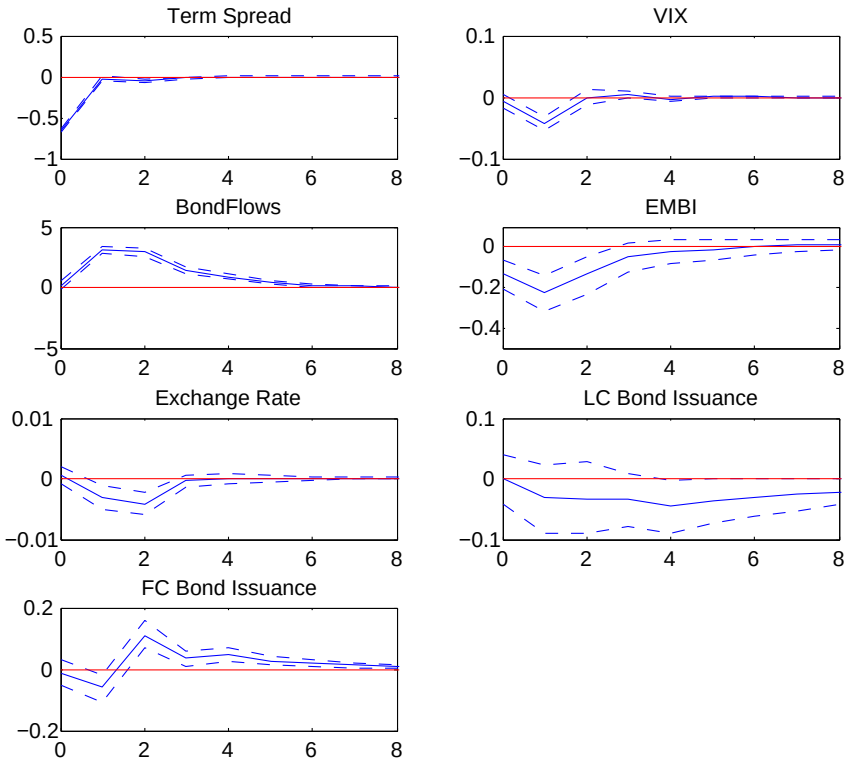
The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repititions. The x-axis displays the number of quarters after the initial shock. The six variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

Figure 13: Seven-variable PVAR (incl FC and LC bond issuance)



The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repititions. The x-axis displays the number of quarters after the initial shock. The seven variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

Figure 14: Seven-variable PVAR (incl FC and LC bond issuance): Alternative Ordering



The solid line displays the point estimate of the impulse response function and dotted lines represent the 68% confidence interval. Bootstrapped confidence intervals are based on 2,000 repititions. The x-axis displays the number of quarters after the initial shock. The seven variable PVAR(2) is estimated using quarterly data from 2003:Q2 to 2014:Q3 for 13 countries.

Table 8: Firm-level evidence: Baseline Results (OLS)

Dummy dependent varible: 1 if the issue is a FC bond, 0 if the issue is LC bond

	(1)	(2)	(3)	(4)	(5)
US Term Spread	-0.0301***	-0.0268***	-0.0294***	-0.0391***	-0.0324***
	(0.0087)	(0.0080)	(0.0095)	(0.0098)	(0.0089)
VIX	-0.0016**	-0.0020***	-0.0012	-0.0014*	-0.0018**
	(0.0008)	(0.0008)	(0.0008)	(0.0008)	(0.0009)
Amount Issued		0.0744***			0.0717***
		(0.0063)			(0.0065)
Maturity		-0.0104			-0.0164
		(0.0095)			(0.0106)
REER			-0.0012***		-0.0009*
			(0.0004)		(0.0005)
ExchVol			-0.0099***		-0.0076***
			(0.0021)		(0.0023)
BondCap				-0.0003**	-0.0006***
				(0.0001)	(0.0001)
Sov. Rating				0.0057	0.0087
				(0.0079)	(0.0068)
PolicyRate				-0.0060	-0.0059*
				(0.0044)	(0.0047)
Country-fixed effects	Yes	Yes	Yes	Yes	Yes
Sector-fixed effects	Yes	Yes	Yes	Yes	Yes
Sector*quarter-fixed effects	Yes	Yes	Yes	Yes	Yes
# observations	12,591	11,560	12,198	11,380	10,381
R-squared	0.29	0.38	0.30	0.26	0.36

The dependent variable is a dummy variable that takes the value 1 if a firms has issued a bond in foreign currency and the value of 0 if a firm has issued a bond in local currency. The sample spans from 2003:Q1 to 2014:Q4. Each firm-quarter observation corresponds to a new debt issuance (foreign or local currency bond). If in a given quarter a firm has not issued new debt, the observation will not be included in the sample. The regression is estimated via OLS with error terms clustered by quarter. All regressions include a constant which is not reported. ***,**,* indicate statistical significance at the 1%, 5% and 10% level, respectively.