Offshore EME bond issuance and the transmission channels of global liquidity*

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Abstract

We use panel VAR methods to guage the impact of global liqudity on emerging markets. We find that the channel of global liqudity transmission has changed from onshore issuance of international debt securities to offshore issuance of international debt securities; offshore issuance plays an important role after 2010. We also find that global liqudity shocks have positive effects on real GDP and net issuance of international debt securities of receipient economies but negative effects on sovereign bond yield of receipient economies.

Keywords: Capital flows, global liquidity, cross-border spillovers, panel VAR, international debt securities, onshore vs. offshore

*Preliminary. The views expressed here are those of the authors, not necessarily those of the Bank for International Settlements. Corresponding author, Soyoung Kim, Seoul National University soyoungkim@snu.ac.kr

1 Introduction

The defining feature of global capital markets in the years after the financial crisis of 2008 has been the surge in issuance of fixed income instruments of emerging market corporate entities in US dollars. McCauley, McGuire and Sushko (2015) estimate the outstanding USD-denominated debt of non-banks located outside the United States at $9.2 trillion at the end of September 2014, and the latest figure from the BIS Quarterly Review puts the figure at 9.6 trillion dollars, of which approximately 3.3 trillion dollars are owed by emerging market economy (EME) non-bank entities (BIS (2015)). Caruana (2013, 2014), Shin (2013), and Turner (2014) have drawn attention to the shift in the composition of liabilities of emerging marekt borrowers from bank debt to bond finance.

The objective of our paper is to investigate empirically the transmission channels of global liquidity, and how these channels may have changed with the shift in the incidence of bank and bond financing. We draw attention to the new channel of global liquidity operating through the issuance of international debt securities of emerging market corporates in the period after 2010, especially the issuance of debt securities in offshore locations. We show that this channel of global liquidity was weak at best before the global financial crisis, but has recently emerged as a prominent transmission channel of global financial conditions.

Official data on capital flows are compiled on a locational basis, with the balance of payments border serving as the boundary of what constitutes external or internal exposure. However, the prevalence of offshore issuance activity by EME corporate borrowers, whereby overseas subsidiaries are used as financing vehicles of the firm, means that the traditional balance of payments border may not be the appropriate boundary for measuring firms' international financial activity.

Chui et al. (2014) have highlighted how between 2009 and 2013, almost half of the international debt securities issued by emerging market non-bank private corporations were issued using the firms' offshore affiliates. Having obtained funds abroad, the foreign affiliate of an EME corporation could transfer funds to its home country through a variety of channels, for instance

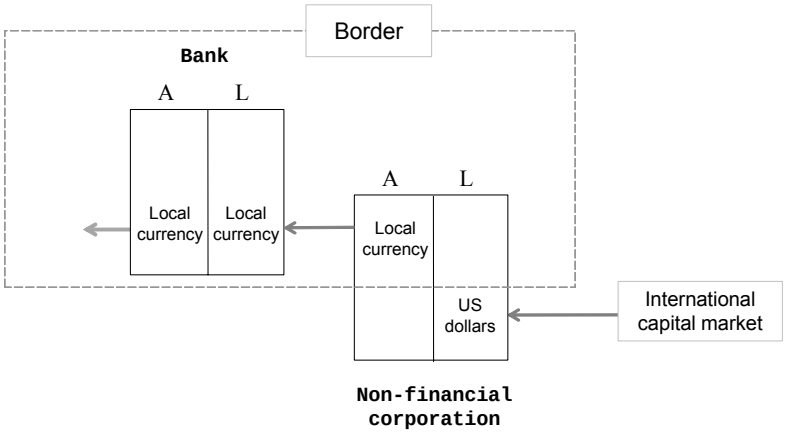

Figure 1. Example of non-financial corporation acting as a surrogate intermediary by borrowing through an offshore subsidiary and transferring the proceeds to headquarters (source: Chung et al (2015)).

by lending directly to its own headquarters (see Avdjiev et al (2014)). Figure 1 taken from Chung et al (2015) illustrates one example, where a non-financial firm taps the international capital markets through a bond issued by its offshore subsidiary, which then lends the proceeds to headquarters through a within-company loan. Figure 1 depicts the headquarters firm providing funding to a local bank, but the financing could equally be provided to a non-bank financial intermediary – for instance, a "shadow bank" that performs bank-like intermediation functions, and which operates outside the regulated banking sector. The funds brought onshore could also be used by the firm to supply credit to another firm by buying its commercial paper or other financial instruments. Irrespective of the specific form of the financial asset, the practice of bringing funds onshore will affect domestic credit conditions. Through such a channel, global financial conditions could be transmitted to the domestic economy, irrespective of how liberalised the domestic financial system is. Bruno and Shin (2015) find that dollar-denominated corporate bond issuance has the tell-tale signs of a "carry trade" in that around 25 cents of each dollar of the proceeds of the bond issuance ends up as cash on the firm's balance sheet. Moreover, when examining the determinants of dollar bond issuance, they find that EME firms are more likely to issue USD-denominated bonds if the firm already starts out with large cash

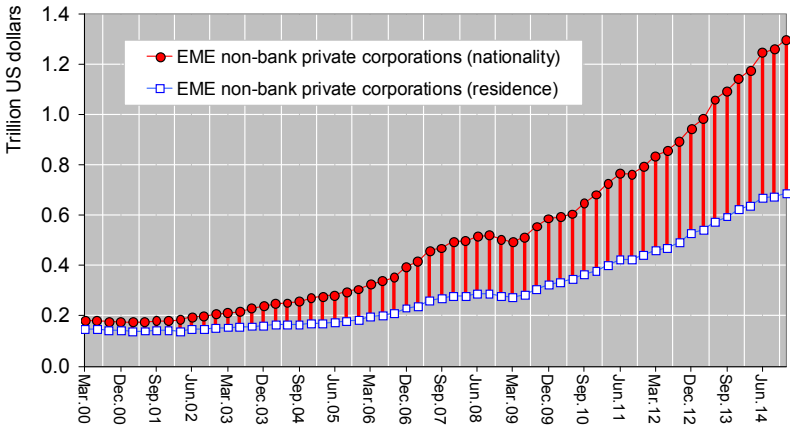

Figure 2. Emerging market non-bank private sector international debt securities outstanding by residence and by nationality (source: BIS international debt securities tables 11C, 11D, 12C and 12D).

balances.

The importance of taking account of offshore issuance of bonds is illustrated in Figure 2, which plots BIS data on the amount outstanding of international debt securities of emerging market non-bank private sector borrowers. The nationality series measures the total outstanding debt securities of borrowers whose ultimate parent is an emerging market firm, while the residence series takes account only of the residence of the borrowing entity. Thus, the bonds issued by the financial subsidiary of an emerging market firm registered in the Cayman Islands are included in the nationality series, but not in the residence series. The nationality series is almost twice the size of the residence series, indicating that our procedure of consolidating the borrowing at the ultimate parent level provides a more accurate picture of the activities (and hence the exposures) of emerging market borrowers. Figure 3 shows the same information in flow terms. It shows the quarterly onshore and offshore net issuance of international debt securities of emerging market countries. Until the 1990s, international debt securities were issued onshore mostly, but from the 2000s, significant portion were issued offshore. From 2010, offshore

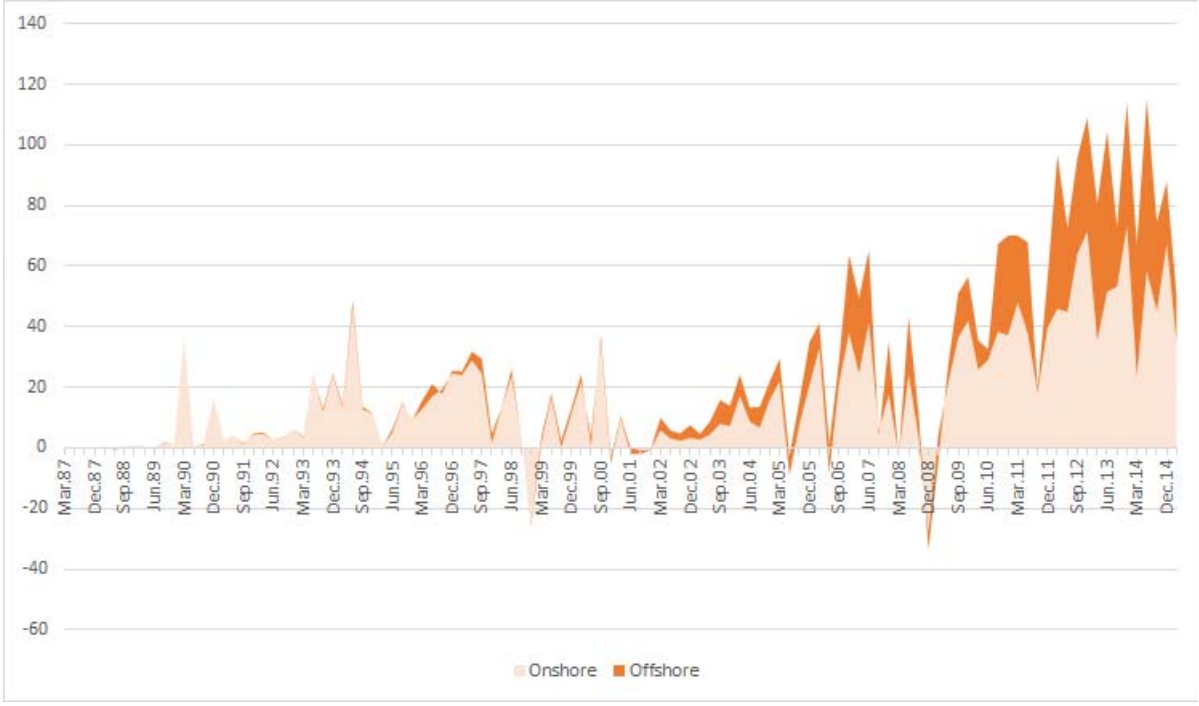

Figure 3. Onshore and Offshore Net Issues in International Debt Securities of Emerging and Developing Countries

net issuance has taken up almost a half of total net issuance. In addition, we see that offshore net issuance is even more volatile than onshore net issuance.

Moreover, the currency composition of offshore corporate bond issuance by emerging market firms has been heavily tilted toward the US dollar, as first noted by McCauley, Upper and Villar (2013), and further investigated by McCauley, McGuire and Sushko (2015). In this way, emerging market borrowers have become sensitive to US dollar funding conditions and interest rates even though they may be remote from the United States geographically.

In terms of empirical methods, we use panel vector autoregressions (VAR) that identify shocks to global financial conditions. The use of panel methods has two important advantages for our investigation. First, since our empirical investigation covers a relatively short time peiord after 2010, the use of cross-sectional information conveyed by the panel structure of our data

strengthens our statistical inference by allowing us to utilize the information in the cross-section of capital recipient countries.

Second, the panel structure of our investigation allows us to make inferences on the common factors that influence a wide range of jurisdictions in similar ways. The term "global liquidity" denotes the influence of such common factors, and the panel VAR method is ideally designed to analyze the effect of the common component on recipient economies in similar ways.

Our approach is to arrange the variables in the panel VAR into two groups - the variables at the source (which we take to be the United States) and those at the destination (a group of 22 emerging countries). As our variables at the source, we take the real GDP of the U.S. and the US domestic credit, as measured by the BIS. GDP and total credit are taken together as the summary of the financial system at the core, indicating the state of the economy and credit conditions at the source. Global (or US) liquidity shocks are identified as orthogonal to US GDP innovations, to correctly infer the effects of global liquidity shocks by excluding endogenous responses of global liquidity from aggregate economic activities. Then, in extended experiments, we additionally consider U.S monetary policy variable to take account of US liquidity changes due to US monetary policy actions. As our variables at the destination countries, we take each country's real GDP, government bond yield, and various variables representing the transmission channels such as the net issuance of private sector international debt securities.

Some past studies empirically examined the effects of global liquidity on emerging countries, but none of them focused on the international transmission channels of global liquidity. For example, Choi et al (2014) investigated the effect of global liquidity momenta on emerging countries, using panel FAVAR, but they focused on macroeconomic effects and policy responses. Chen et al (2012) analyzed the effects of global liquidity on growth rate of receiving countries. On the other hand, Moore et al (2012) examined the effects of changes in long-term U.S. Treasury yields on foreign ownership share of emerging market bonds and government bond yields in emerging countries, to infer the effects of U.S. large scale asset purchases. Our study is different in that we examine detailed transmission mechanism, by making a distinction between onshore

and offshore issuance, and deal with the effect of global liquidity directly.[1]

We have two main findings. First, an impulse to US credit aggregates elicits a positive response in the destination country's GDP and a negative response in its sovereign bond yield. Credit expansion in the center is associated with more permissive financial conditions and real activity in the recipient economies. These results are broadly consistent with past studies such as Chen et al (2012), Choi et al (2014), and Moore et al (2012).

Secondly and more importantly, we find that an impulse to the US aggregate credit variable leads to a strong positive response of the *offshore* bond issuance activity. Interestingly, such a positive response is strongly present only in the period after 2010. Such responses are not or only weakly found in the earlier sample period. Caruana (2013, 2014), Shin (2013) and Turner (2014) have recently argued that the channels of transmission of global liquidity has changed in recent years from bank-led transmission to a bond market-led transmission channel, by simply showing the trends in outstanding bank loan and on-shore and off-shore debt securities. We view our results as adding weight to the arguments by providing empirical evidence based on a formal econometric analysis.

Section 2 discusess institutional background and the recent developments in global financing methods and global financial environments. Section 3 explains the empirical restuls. Seciton 4 presents the results from the baseline model. Section 5 reports the results from extended analysis. Section 6 concludes.

[1]The empirical methodology is also different. Moore et al (2012) estimate the effect by employing a reduced form VAR model and a static regression method.

2 Empirical Method

We will suppose that an economy i can be described by the following structural form VAR model:

$$G(L)\, y^i(t) = d^i + e^i(t),\ i = 1, 2, ..., I \tag{1}$$

where $G(L)$ is an $m \times m$ matrix polynomial in lag operator L, $y^i(t)$ is an $m \times 1$ data vector d^i is an $m \times 1$ constant matrix, m is the number of variables in the model, and $e^i(t)$ denotes a vector of structural disturbances. Assuming that structural disturbances are mutually uncorrelated, $var(e^i(t))$ can be denoted as Λ, which is a diagonal matrix whose diagonal elements are the variances of structural disturbances. The individual fixed effect, d^i, is introduced to control for the country-specific factors that are not included in the model but that affect each variable in the model.

We assume that the structural form model, equation (1), can be expressed in block triangular form as

$$y^i(t) = \begin{bmatrix} y_1(t) \\ y_2^i(t) \end{bmatrix},\ G(L) = \begin{bmatrix} G_{11}(L) & 0 \\ G_{21}(L) & G_{22}(L) \end{bmatrix},\ d^i = \begin{bmatrix} d_1 \\ d_2^i \end{bmatrix},\ e^i(t) = \begin{bmatrix} e_1(t) \\ e_2^i(t) \end{bmatrix} \tag{2}$$

where $y_1(t)$, d_1, and $e_1(t)$ are $m_1 \times 1$ vectors, $y_2^i(t)$, d_2^i, and $e_2^i(t)$ are $m_2 \times 1$ vectors, and $G_{11}(L), G_{21}(L)$, and $G_{22}(L)$ are $m_1 \times m_1$, $m_2 \times m_1$, and $m_2 \times m_2$ matrix polynomials in lag operator L, respectively. We assume that $G_{12}(L) = 0$. This assumption is the restriction of block-exogeneity, which implies that $y_1(t)$ is not affected by not only current but also lagged $y_2^i(t)$. In the empirical model, $y_1(t)$ is the vector of US variables and $y_2^i(t)$ is the vector of each emerging country i's variables. This assumption can be justified because most emerging countries in our sample are considered as small open economies. In addition, this block-exogeneity mitigates the degree of freedom problem, compared to a usual VAR model.

We pool the data and estimate the following reduced form block-exogenous panel VAR model with the individual fixed effect:

$$y^i(t) = c^i + B(L)y^i(t-1) + u^i(t), i = 1, 2, ...I \tag{3}$$

where c^i is an $m \times 1$ constant matrix, $u^i(t)$ is an $m \times 1$ residual matrix, $var(u^i(t)) = \sum$. In addition,

$$B(L) = \begin{bmatrix} B_{11}(L) & 0 \\ B_{21}(L) & B_{22}(L) \end{bmatrix}, \; c^i = \begin{bmatrix} c_1 \\ c_2^i \end{bmatrix}, \; u^i(t) = \begin{bmatrix} u_1(t) \\ u_2^i(t) \end{bmatrix} \tag{4}$$

where c_1 and $u_1(t)$ are $m_1 \times 1$ vectors, c_2^i, and $u_2^i(t)$ are $m_2 \times 1$ vectors, and $B_{11}(L), B_{21}(L)$, and $B_{21}(L)$ are $m_1 \times m_1$, $m_2 \times m_1$, and $m_2 \times m_2$ matrix polynomial's in lag operater L, respectively. Because the variables on the right hand side are different in this reduced form block-exogenous VAR model, OLS provides inefficient estimates. Therefore, we estimate the reduced form block-exogenous VAR model with seemingly unrelated regression (SUR). Then, to recover the structural form model, equation (1), from the estimated reduced form model, equation (3), we impose the restriction that the contemporaneous structural parameters are lower triangular, that is, $G_{11}(0)$ and $G_{22}(0)$ are lower triangular matrices, as in Sims (1980).

The baseline model is constructed as follows. In the first block, we include two variables, U.S. domestic credit (as given by the BIS series) and U.S. real GDP. We include the real GDP of US since it represents aggregate economic activities of US that are likely to affect credit condition in the center and economic conditions of emerging countries. In this block, U.S. real GDP is assumed to be contemporaneously exogenous to U.S. credit because aggregate economic activity is likely to respond sluggishly to changes in financial variables while changes in financial variables reflect all the information instantaneously. A similar assumption is used in many past studies such as Sims and Zha (2006), Kim (1999), and Kim and Roubini (2000). In addition, this assumption implies that we control for aggregate economic activities when we identify shocks to liquidity or credit at the center. If we do not control for aggregate economic activities of the U.S. when we identifying shocks to U.S. liquidity, it is hard to infer the true effects of shocks to U.S. liquidity on emerging countries. The underlying reason for the difficulty is that U.S. liquidity is likely to be endogenous to aggregate economic activities.of the U.S. and that aggregate economic activities of the U.S. as well as U.S. liquidity are likely to affect emerging countries. Bekaert et al (2013) identified U.S. monetary policy shocks with a similar identifying assumption.

In the second block of the panel VAR, we include three variables for each capital recipient

country: real GDP, net issuance of international debt securities, and long-term government bond yield of each emerging country. The latter two variables are of our main interests; we are interested in how U.S liquidity shocks affect credit availability and long-term interest rate of emerging countries. Real GDP is included since it represents aggregate economic activities that are likely to affect the latter two variables. In this block, real GDP and net issuance of international debt securities are assumed to be contemporaneously exogenous to long-term government bond yield. This assumption can be justified because we use the end of period data for long-term government bond yield. That is, real GDP and net issuance of international debt securities over each quarter is naturally contemporaneously exogenous to long-term government bond yield at the end of each quarter. Then, we assume that real GDP is contemporaneously exogenous to net issuance of interantional debt securities. Again, this assumption is based on sluggish real sector and fast-adjusting financial sector. Also, note that the ordering among these three variables does not matter when examining the effects of shocks to US credit that is exogenous to all these variables.

Two types of data on net issuance of international debt securities are available, the *nationality*-based and the *residence*-based measures. We use the *residence*-based measure as the proxy for the onshore measure, and the difference between the *nationality*-based and the *residence*-based measures as the proxy for the offshore measure. If foreigners do not issue international debt securities within the border of the emerging countries, our measures are exactly the same as the onshore and the offshore measures. The proportion of foreign debt security issuers within the border of the emerging countries is likely to small, so we will use these proxies throughout the paper. Then, under our definitions of the variables, the *nationality*-based measure is the sum of *onshore* and *offshore* measures, so the *nationality*-based measure comprises the whole issuance of international debt securities better than the *residence*-based measure. Therefore, we use the *nationality*-based measure in the baseline model. In the extended models, we also investigate how different measures respond to shocks to global liquidity.

Our sample includes 22 emerging countries: eight Asian countries/regions (including China, Hong Kong, India, Indonesia, Korea, Malaysia, Thailand, and the Philippines), five Latin Amer-

ican countries (Brazil, Chile, Colombia, Mexico, and Peru), and nine European countries (Bulgaria, Czech Republic, Hungary, Latvia, Poland, Romania, Russia, Turkey, Ukraine). Quarterly data is used, and sample periods vary among countries. The earliest sample starts from the first quarter of 2000, although different across countries, while the latest sample ends at the first quarter of 2013. See Appendix for further details of data. For liquidity and real GDP, we take logs and multiply by 100. Net issuance of international debt securities is divided by the trend GDP and multiplied by 100.[2] Finally, our statistical inference is not problematic in the presence of unit roots and cointegrating relations because we follow the Bayesain inference. We use the Monte-Carlo integration method, described in RATS (2013) to construct posterior probability bands for impulse responses. See Sims (1988) and Sims and Uhlig (1991) for general discussion on Bayesian inference in the presence of unit roots and cointegrating relations.

3 Empirical Results

3.1 Results from Baseline Model

Figure 4 reports the impulse responses over eight years, with 90% probability bands. The labels for the shocks are denoted at the top of each column while the name of the responding variables are denoted at the far left of each row. The first column of graphs shows the impulse responses to U.S. real GDP shocks. US real GDP increases approximately by 0.59% initially, with increasing further up to approximately 0.86 % in three quarters, and then decreasing toward the initial level. The effect is persistent; the positive real GDP response is still different from zero with 95% probability after eight years. In response to such U.S real GDP shocks, US credit aggregate increases persistently. The response reaches to approximately 1.3% rise in 4 years, and stays at a similar level even in eight years. Positive spillover effects are found in emerging countries; GDP of emerging countries increase strongly. The peak effect of approximately 0.61% increase

[2] A linear trend is assumed. The results are similar when other trends (e.g., a quadratic trend, HP fileter, and so on) are used. The results are also similar when actual GDP, instead of the trend GDP is used. Also note that other inflows such as offshore net issuance of international debt securities, equity inflows and bank loans inflows are transformed in the same way.

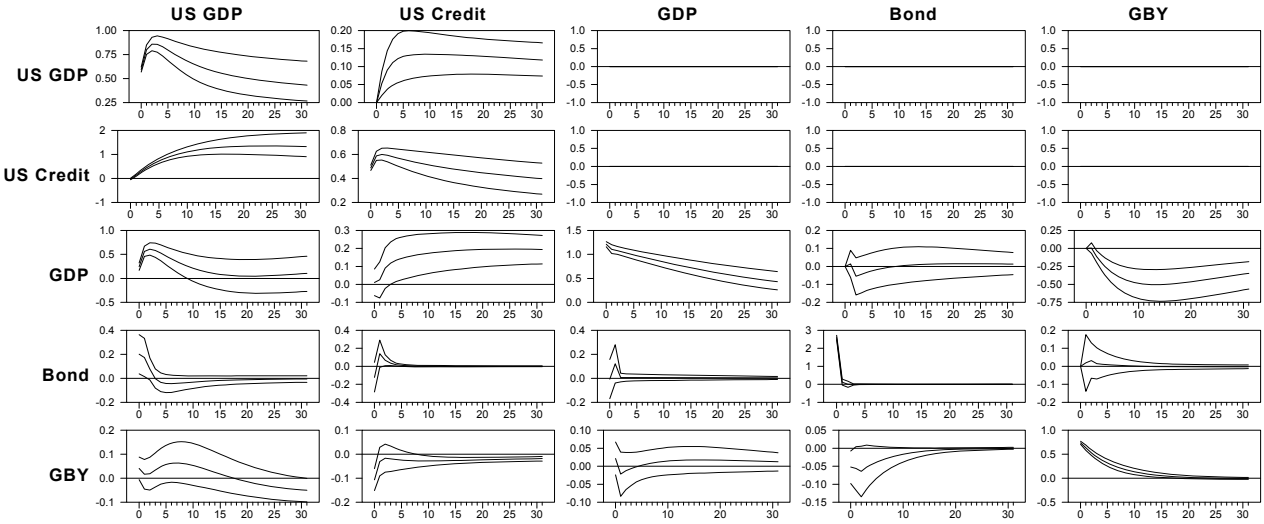

Figure 4. Impulse Responses in the panel VAR model (Baseline Model): The labels for the shocks are denoted at the top of each column while the name of the responding variables are denoted at the far left of each row.

is found in three quarters. Net issuance of international debt securities increase in the short-run. Government bond yield of emerging countries tend to increase in the short run but the probability bands are wide.

These results also suggest that it is crucial to control for real GDP shocks when identifying liquidity shocks in order to properly capture the effects of liquidity shocks. Remember that we have constructed US credit shocks as orthogonal to US real GDP shocks, which implies that endogenous responses of US credit to US real GDP shocks are excluded from the identified US credit shocks. In fact, we observe that real GDP shocks affect US credit and the variables in the emerging countries substantially. If we don't control for real GDP shocks, the effects of US credit shocks on emerging countries are likely to be obscured by the effects of real GDP shocks on emerging countries.

The second column of graphs shows the impulse responses to US credit shocks that are of our main interests. The US credit increases on impact by approximately 0.49%, further increases in

the next few quarters, up to around 0.6%, and then decreases over time. The increase is highly persistent; even in eight years, US credit increase is 0.4% above the initial level. In response to such US credit shocks, US real GDP increases substantially and persistently. The peak response is approximately 0.13% increase, which is found in about two years. The long-term government bond yield declines persistently, which is different from zero with 95% probability at most horizons. The point estimates show that the initial effect is 0.11% point decline and the effect after eight years is 0.02% point decline. The fall in government bond yields is likely to reflect the economic condition of emerging countries in which more credit is available as US liquidiity spills over to emerging countries. Net issuance of international debt securities increase significantly in the short run. The increase at the third and the fourth quarters is different from zero with 95% probability. 0.066% point increase is found at the third quarter horizon. This implies that the issuance of international debt securities is an important channel through which US has a credit spillover effect to emerging countries. The real GDP of emerging countries also increases over time; from the third quarter horizon, the increase is different from zero with 95% probability. This long run increase in real GDP is probably related to the decline in long-term interest rate.

We now turn to the responses to other shocks. Shocks to net issuance of international debt securities have a negative effect on government bond yields because the ease of international credit condition via the issuance of international debt securities is likely to decrease the interest rate. Shocks to government bond yield is associated with strong and persistent decline in real GDP. An increase in the long term interest rate is likely to decrease investments and real GDP. Finally, shocks to real GDP of emerging countries do not have significant effects on the net issuance of international debt securities and long term government bond yield.

We also investigate the results for more recent sample period. Figure 5 reports the impulse responses with 90% probability bands for the post-crisis period (from the first quarter of 2010 to the third quarter of 2014). The effects of US credit shocks on US real GDP, and long-term government bond yields and the real GDP of emerging countries are qualitatively similar to those of the full sample period. US real GDP increases strongly and persistently. The real GDP

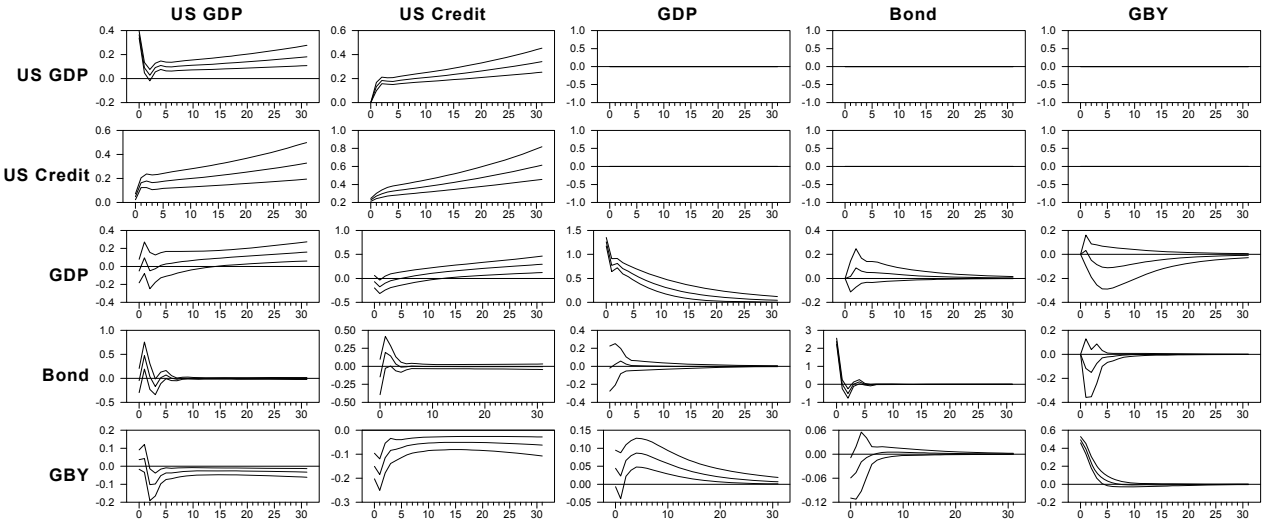

Figure 5. Impulse Responses: Post-Crisis Period

of emerging countries also increase persistently. The long-term government bond yield declines significantly. Net issue in international debt securities increase significantly, which is different from zero with 95% probability at the third quarter horizon.

3.2 Onshore vs. Offshore International Debt Securities

In the baseline model, we investigate how US credit shocks affect the *nationality*-based issuance of international debt securities. However, the *residence*-based measure is often used in the traditional analysis. Here we investigate whether the result is still the same when we use different measures of the issuance of international debt securities. Figure 6 show the results for three measures: the *residence*-based issues (or *onshore* issues), the difference between the *residence*-based issues and the *residence*-based issues (or *offshore* issues), and the *nationality*-based issues (or the sum of *onshore* and *offshore* issues). To investigate how the results change over time, we report the results for three sub-periods: the full-sample period, the pre-crisis period (from

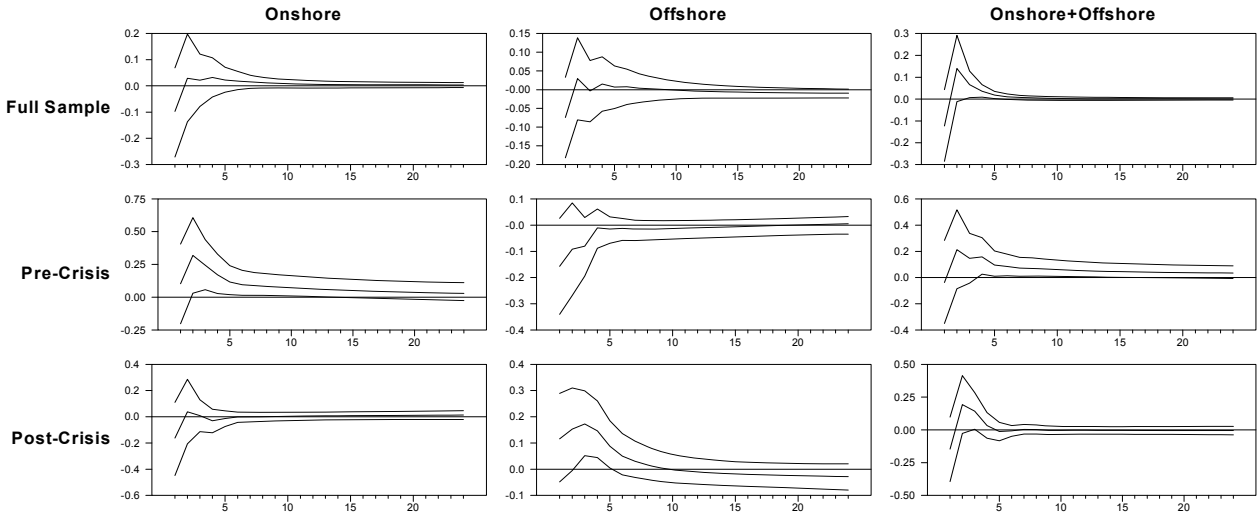

Figure 6. Impulse Responses to US Credit Shocks: Onshore and Offshore Issues in International Debt Securities

the first quarter of 2000 to the last quarter of 2006), and the post-crisis period (from the first quarter of 2010 to the third quarter of 2014).

The results show a clear change in the transmission channel over time. During the pre-crisis period, onshore issuance increases significantly but offshore issuance response is not signfiicant. The increase of onshore issuance from the second to the thirteen quarters is different from zero with 95% probability, but for offshore responses, the probability bands include the zero at all horizons. However, during the post-crisis period, the opposite role of onshore vs. offshore issuance is observed. During the post-crisis period, offshore issuance increases significantly but onshore issuance response is not significant. The increase of offshore issuance from the third to fifth quarters is different from zero with 95% probability, but for onshore responses, the probability bands include the zero at all horizons. These results suggest that the transmission channel of US credit shocks has changed from onshore to offshore international debt securities issuance.

If one uses the traditional measure, that is, *residence*-based measure, the transmission of

global liquidity through the issuance of international debt security may not be captured properly for the post-crisis period. As reported in Figure 6, credit shocks affect only offshore issuance significantly (not onshore issuance) during the post-crisis period. Therefore, one may falsely conclude that the issuance of interantional debt security is not an important channel in the transmission of global liqudiity when using the *residence*-based measure. In contrast, by using the *nationality*-based measure that comprises both *onshore* and *offshore* issuance, the significant effect on the issuance of international debt security can be captured. as reported in Figure 6. Full sample estimations reported in Figure 6 also show that the significant role of international debt security issuance can be captured by using the *nationality*-based measure, but not by using *residence*-based measure.

4 Extended Analysis

4.1 Transmission of US Monetary Policy Shocks

There can be various sources of global liquidity movements, but the US monetary policy action is the one that is of most interests. In this section, we analyze whether international debt security is an important international transmission channel for U.S. monetary policy shocks. We extend the baseline model to add an additional variable for monetary policy actions in the U.S. (or world) block. During the pre-crisis period, the conventional monetary policy, that is, changes in the Federal Funds rate, was used, but during the post-crisis period, unconventional monetary policy was mostly used while the Federal Funds rate remain at the zero level. Therefore, we construct different models for the pre- and the post-crisis periods. In the model for the pre-crisis period, we additionally include the Federal Funds rate to represent conventional monetary policy actions. In the model for the post-crisis period, we additionally include the term spread (10 year bond yield minus the Federal Funds rate).to represent unconventional monetary policy. Unconventional monetary policy actions such as purchases of long-term bonds with quantitative easing, operation twist, and forward guidance are likely to affect the term spread. In fact, some past studies such as Baumeister and Benati (2013) and Kapetanios et al (2012) used the term

spread to represent unconventional monetary policy actions. In the U.S. block, we assume that the U.S. real GDP is contemporaneously exogenous to the policy variable as policy actions are likely to react to contemporaenous output changes. We also assume that the policy variable is contemporaneously exogenous to US credit because we would like to examine the effects of monetary policy actions that can affect credit contemporaenously. We also experiment with the alternative identification that US credit is contemporaneously exogenous to the policy variable, but the main results are similar.

Figure 7 reports the results. In Figure 7, the names of responding variables are denoted at the far left while the names of shocks are described at the top. The first two columns of graphs show the results for the pre-crisis period and the last two columns the results for the post-crisis period. To be more comparable with the baseline model in which positive credit shocks are examined, we consider expansionary monetary policy shocks (decreases in the Federal Funds rate and the term spread). In both periods, the expansionary monetary policy shocks increase the US credit strongly and signfiantly, which suggests that the monetary policy shock is an important source of US credit changes. Both US GDP and emerging countries' GDP tend to increase.The long-term government bond yield of emering countries tend to decline. Most importantly, net issuance of international debt securities increase significantly. Then, by taking out the effects of moneary policy shocks, the effects of credit shocks become weaker. In both perods, positive credit shocks tend not to signficantly increase net issuance of international debt securities.

We also estiamte the model by replacing the *nationality*-based issuance with the *residence*-based issuance, and with *offshore* issuance. The results are reported in Figure ... In the pre-crisis period, expansionary monetary policy shocks (FFR shocks) increase onshore issuance, which is different from zero with 95% probability from four to fourteen quarter horizons. They also increase offshor issuance but only at the initial quarter. As the positive effect on onshore issuance is far more persistent than the effect on offshore issuance, we may conclude that onshore issaunce is more important channel than offshore issuance during the pre-crisis period. Credit shocks do not increase neither onshore nor offshore issuances significantly. In the post-crisis

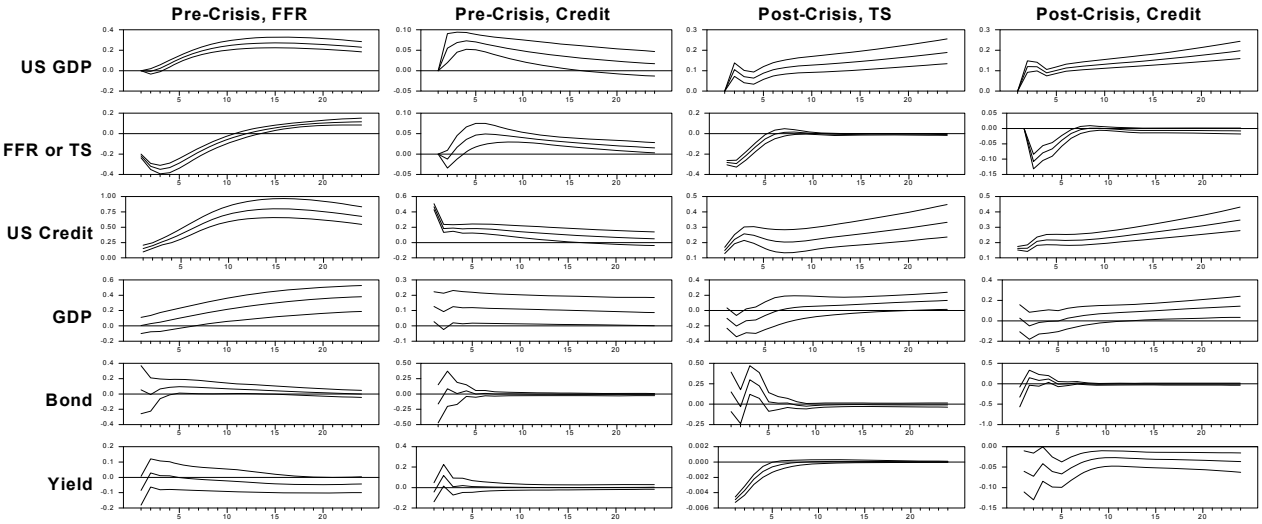

Figure 7. Effects of US Monetary Policy and Credit Shocks

period, expansionary monetary policy shocks (TS shocks) increase both onshore and offshore issuance, which is different from zero with 95% probability at some horizons. In the post-crisis, credit shocks also increases offshore issuance, which is different from zero with 95% probability at the third quarter horizon while the effects on onshore issuane are mixed. Overall, the effects of two types of liquidity shocks on offshore issuance are stronger in the pre-crisis period than in the post-crisis period.

4.2 Dropping Block-Exogeneity

To check the robustness of our main results, we allow feedback relation from emerging countries to the U.S. by dropping the assumption of block-exogeneity. That is, now $G_{12}(L)$ (in equation 2) is not necessarily zero. We estimate five-variable panel VAR model with recursive zero restrictions on contemporaneous structural parameters. We assume that US variables are only contemporaneously exogenous to variables of each emerging country.

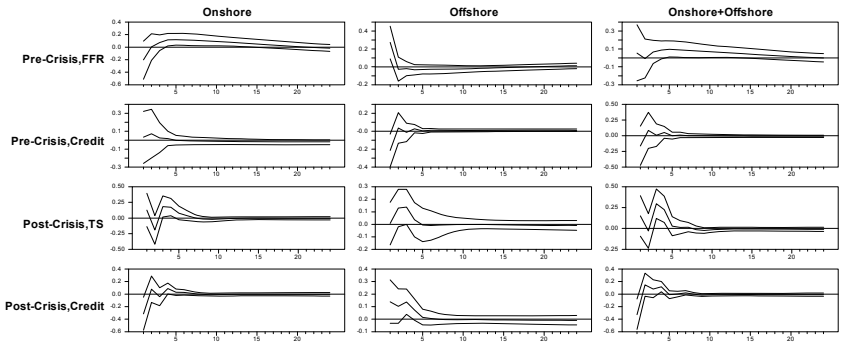

Figure 8. Impulse Responses to Monetary Policy Shocks: Onshore and Offshore Debt Issuance

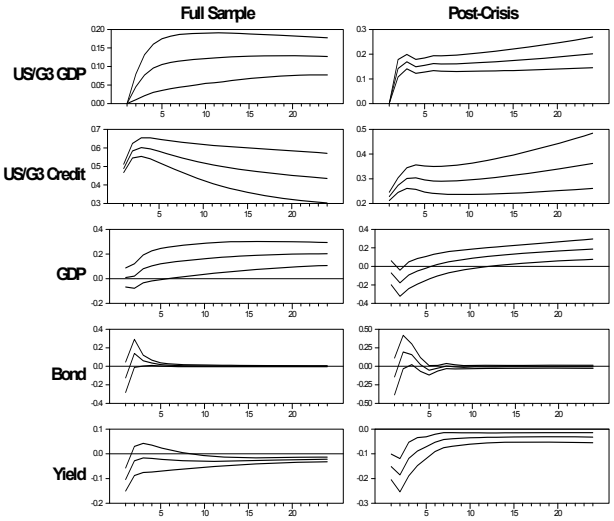

Figure 9. Impulse Responses to Credit Shocks: Model without Block-Exogeneity

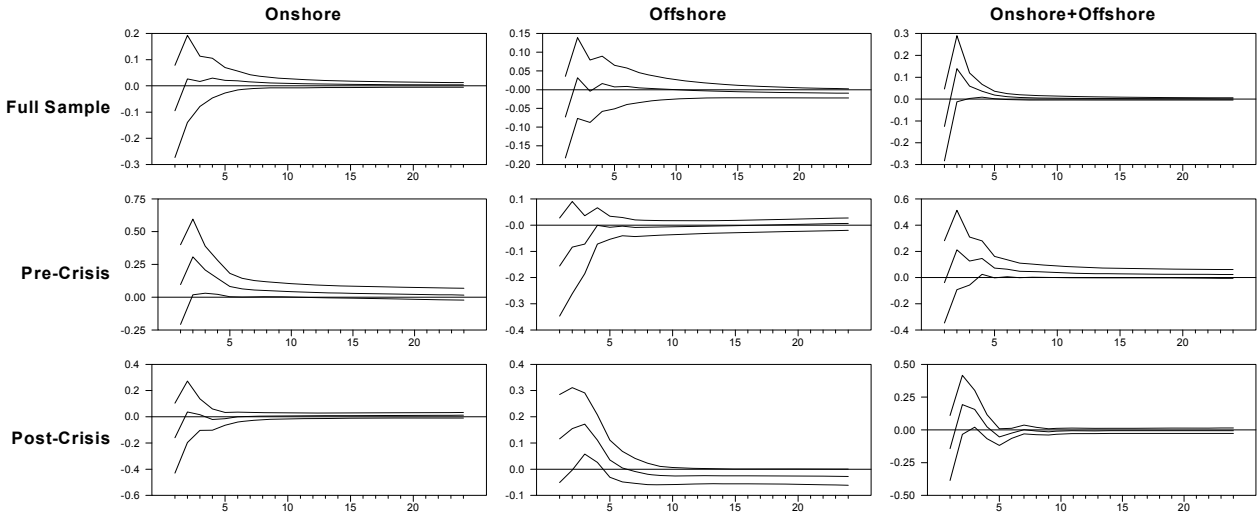

Figure 10. Impulse Responses to Credit Shocks: Onshore and Offshore Debt Issuance in the Model without Block-Exogeniety

Figure 9 shows the impulse responses to US credit shocks in two models for the full sample and the post-crisis periods. Most results are very similar to those in the baseline model. .

Figure 10 shows the impulse responses of onshore, offshore, and the sum of onshore and offshore net issuance of international debt securities for the full sample, the pre-crisis, and the post-crisis periods. Again, the results are very similar to those in the baseline model.

5 Conclusions

Our study of the transmission channels of global liquidity highlights the shifting channels of cross-border transmission of financial conditions. In particular, we have seen the greater importance of the bond issuance channel in the period after 2010, especially the offshore issuance of international debt securities by emerging market borrowers. Our results highlight the importance of keeping track of institutional developments in international banking and capital

markets. In particular, our results point to the need to study, in a greater depth, the factors determining the relative weight between bank and bond financing, and how the relative incidence of bank and bond financing is affected by monetary policy and financial conditions at the core of the global financial system. Our results also suggest that emerging markets should be aware of this recent change in transmission channels of global liquidity, to properly prepare against possible future reversals.

A Appendix. Data

Real and nominal GDP of U.S, Japan and the Euro area are obtained from *OECD Statistics*. Real and nominal GDP of emerging countries are obtained from *International Financial Statistics*. Long-term government bond yield is obtained from *Bloomberg*. US Dollar domestic credit and net issues in international debt securities based on residents and nationality are obtained from the web-page of Bank for International Settlements.

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