The shifting drivers of global liquidity

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Abstract

Global liquidity, comprised of flows through global banks and market-based debt finance, experienced large compositional changes over recent decades. The sensitivity of global liquidity to US monetary policy also rose substantially in the immediate aftermath of the Global Financial Crisis, peaked around the time of the 2013 Fed "taper tantrum", and then reverted towards pre-crisis levels. Conversely, the responsiveness of international bank lending to global risk conditions declined considerably post-crisis and became similar to that of international debt securities. We show that the shifting roles of US monetary policy and risk have been driven by a change in the composition of banking systems, health of banks, altered regulation, and variation in convergence of advanced economy monetary policies. Meanwhile, the post-crisis fall in the sensitivity of international bank lending to global risk was mainly driven by increases in the lending shares of better-capitalized banking systems.

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1. Introduction

International capital flows channel financial resources across borders to both public and private sector borrowers. As such, they are critically important for economic growth and financial stability. Understanding their main drivers is crucial for both policymakers and researchers, as flows should contribute to economic growth and risk sharing internationally, without excessive volatility.

Both the structure and volatility of international loan and bond flows have changed considerably in the aftermath of the Global Financial Crisis (GFC). The initial sharp decline in cross-border loans was followed by a feeble recovery and a second sharp contraction during the peak of the euro area crisis (Graph 1). Meanwhile, international bond issuance remained relatively robust. As a consequence, the composition of global liquidity has shifted away from cross-border bank loans and towards international bonds in what has been dubbed "the second wave of global liquidity" (Shin, 2013). Events such as the "taper tantrum" in 2013, when the Federal Reserve signalled it would start tapering its bond buying program, were marked by especially sharp capital outflows from a number of emerging markets (Khatiwada, 2017). The existing literature has established that the two main global liquidity components, cross-border loan and bond flows through market-based participants, are impacted not only by local factors, but also by global factors. A number of empirical studies have identified advanced economy monetary policies and global risk aversion as the two most important global drivers (e.g. Forbes and Warnock, 2012a; Miranda-Agrippino and Rey, 2015; Cerutti, Claessens and Ratnovski, 2017; Cerutti, Claessens and Rose, 2017; Ha et al., 2017). Yet, little attention has been paid to the time variation in the sensitivities of key capital flows to those drivers.

In this paper, we fill an important gap in the literature by studying the nature and the causes of the time variation in the sensitivities to global factors of the respective components of global liquidity. We start by revisiting the main findings of the literature on the drivers of international capital flows. We then drill down into the observed time variation, examine its proximate reasons, and distinguish between persistent versus transitory drivers. The main message from this detailed analysis is that an unusually high sensitivity to global shocks characterized the post-crisis period, providing the stark backdrop for critiques of the

international monetary system (Rey 2013). We show that this high sensitivity stemmed from a combination of post-crisis participants in international finance heavily weighted toward large size and low risk-absorbing capacity, and a post-crisis synchronization of advanced economy monetary policies that magnified the signals from US-specific policies. Following a peak around 2013, monetary policy sensitivities re-normalized over time as banking market shares shifted toward better capitalized systems and toward more market-based financing, global liquidity composition reduced the role of the more volatile and short-term interbank lending, and policy synchronization declined. We show that some of these latter changes were correlated with regulatory changes, especially around capital and risk frameworks. Some of the effects around international bank claim sensitivity to risk are expected to persist and some of the riskier international borrowers may have shifted to more market-based finance.

Our analysis can deliver these findings as it exploits the rich dimensionality of multiple datasets. We examine the key global liquidity component from both borrower country and creditor country perspectives, distinguishing between instrument types (debt securities versus bank loans), borrowing sectors (bank versus non-bank) and borrowing country groups (advanced economies versus emerging economies). The result is a quarterly panel of international bank loan and bond flows to 64 recipient countries for the period between 2000:Q1 and 2015:Q4 using the BIS International Debt Securities (IDS) Statistics and the BIS Locational Banking Statistics (LBS), with the BIS Consolidated Banking Statistics (CBS) used to assign loan flows to individual lending banking systems. We also take advantage of information on lending banking systems' balance sheet characteristics as well as on prudential instruments and monetary policy developments in both borrowers and creditor countries.

Our first key results show the considerable change in international capital flow sensitivities to global factors since the GFC. US monetary policy became a more potent driver of both cross-border loan and international bond flows, with estimated policy impact peaking in 2013 and then partially retracing toward pre-crisis levels. A 100 basis point increase in the Federal funds rate would reduce total cross-border flows by an estimated 8 percent immediately after the crisis (12 for banks) and by 4.5 percent afterwards (6 for

banks), up from just 2 percent pre-crisis. Meanwhile, the sensitivity of cross-border bank loan flows to global risk conditions declined considerably post-crisis and became similar to the traditionally lower risk sensitivity of international bond flows. A 1 percent change in the VIX measure would reduce total cross border flows by 3 percent (4 percent for banks) pre-crisis, with this effect falling to about 1 percent after 2013. Overall, aggregate global liquidity flows (the sum of international bank loan and bond flows) have become more sensitive to US monetary policy and less sensitive to global risk.

The second key results show that the dynamics of global factor sensitivities are substantially due to the composition of participants on the creditor side and to the degree of synchronicity in policies across advanced economies. Observed from the borrower perspective, the changes are due to a combination of pre-versus-post GFC changes in the country composition of lending banking systems and in the behaviour of those creditors involved in international financial flows. Combining information from multiple databases, we show that the increased post-GFC sensitivity to US monetary policy can be attributed to increases in the responsiveness of flows from individual lending banking systems rather than to a compositional shift towards more banking systems with greater sensitivities. By contrast, the risk sensitivity declines occurred mainly as a result of a post-crisis shift in the composition of national lending banking systems towards those with lower sensitivity to global risk conditions.

Drilling deeper, our analysis shows that the shifts in the sensitivities and lending shares on individual banking systems were linked ex ante to bank business model and balance sheet characteristics and to country-specific prudential measures. The features of financial intermediaries associated with more stable domestic bank lending, like higher bank capital ratios and deposit funding and of local claims in foreign, are associated with post-GFC expansions of international market shares and declines in sensitivities to global factors.

The time variation in sensitivities post-GFC tightly ties to degree of convergence in the expected monetary policy path of the US vis-à-vis those of other major advanced economies. Higher convergence in the years immediately following the crisis drove the elevated sensitivities, with US monetary policy serving as a stronger indicator of global

monetary policy trends. This effect began to unwind as the monetary policies of major advanced economies started to diverge in 2013.

Our results have important policy implications. First, the finding that the post-GFC increases in sensitivities to US monetary policy were driven largely by the convergence in advanced economy monetary policies suggests that they were largely a transitory phenomenon. This result also implies that greater cross-country business cycle (and, consequently, monetary policy) synchronization would make the stabilisation of international capital flows more challenging. Second, the finding that the overall decline in the sensitivity of international bank flows to global risk conditions was due to increases in the lending market shares of better-capitalized banking systems, which are themselves less responsive to global risk, suggests that the post-GFC regulatory reforms had the additional benefit of stabilising international capital flows.

The remainder of the paper is organised into six sections. Section 2 reviews relevant findings of the existing literature on global liquidity and its drivers, also focusing on differences between banks and non-banks as creditors and debtors. Section 3 presents the econometric methodology that we employ in respective empirical investigations. Section 4 describes the data. Section 5 provides the empirical results and related discussion. Section 6 presents robustness tests. Section 7 concludes.

2. Previous literature

Global liquidity and drivers have been explored in many related studies. The most extensive literature is on international capital flows. The second strand of literature is more explicitly focused on global liquidity, international debt securities versus loans, and balance sheet constraints across banks and non-banks. The third thread of literature addresses international monetary policy spillovers, covering the transmission channels through banks and capital markets, interest rate and asset price co-movements, and the broader structure of the international monetary system and policy instrument availability.

The large literature on the drivers of capital flows focuses most extensively on emerging markets, and more recently considers advanced economies also as destinations of

capital. Surges in cross-border flows to EMEs reflect improved macroeconomic fundamentals of the borrowing country (pull and local factors) and more favourable global conditions of a primarily cyclical nature (push and global factors).[2] Studies of gross (as opposed to net) international flows and distinguishing across different institutional participants provide a window in the mechanisms which shocks transmit internationally. Higher volatility is observed in gross flows than in net flows, specifically in the context of business cycles and crises (Broner et. al., 2013). The most extreme capital flows episodes are driven by global factors, notably global risk aversion, particularly visible when extreme episodes are classified into four categories: surges, stops, flight and retrenchment (Forbes and Warnock, 2012b). Within the various capital flows components, the Global Financial Crisis demonstrated the dominant contraction of international banking flows and the relative stability of foreign direct investment (Milesi-Ferretti and Tille, 2011). Regional reallocations in international participation also occurred, with post-crisis declines in bank-based cross-border lending, particularly by euro area banks, alternatively described as financial deglobalization (Rose and Wieladek, 2014; Forbes et al., 2015) or "the great cross-border bank deleveraging" (Cerutti and Claessens, 2017; Bussière et al., 2018). Possible explanations include weaker economic activity, capital controls, the slower pace of financial liberalization, deleveraging, and risk aversion (CGFS 2011).

Micro-banking data analyses show which bank-specific features generated contractions or expansions post-crisis. Individual global banks received balance sheet shocks through holdings of asset-backed commercial paper (Cetorelli and Goldberg, 2012a), or later through exposure to European sovereign debt (Popov and van Horen, 2015). Transmission of impulses through global banks to their affiliate locations internationally via internal capital markets follows a pecking order, with the degree of shock transmission to countries dependent on their bank-specific importance in lending and funding activity (Cetorelli and Goldberg, 2012b). Prudential policies and unconventional monetary policy in the form of a funding for lending scheme jointly contributed to a retrenchment of UK bank cross-border lending (Forbes, Reinhardt and Wieladek, 2017). Consistent with these observations, some

[2] Examples of such studies include those by Calvo et. al. (1993), Ghosh and Ostry (1993), Fernandez-Arias (1996), Taylor and Sarno (1997), and Chuhan et. al. (1998). See Koepke (2015) for a comprehensive summary of the literature in the drivers of capital flows to emerging markets.

countries with banks that were well-capitalized pre-crisis expanded international activities post-crisis when foreign jurisdictions tightened capital requirements (Damar and Mordel, 2017 for the case of Canada). Overviews of results from macroprudential policy spillover studies and monetary policy spillovers likewise tend to find roles for bank capitalization and business models (Buch and Goldberg, 2017; Buch, Bussiere, Goldberg and Hills, 2019).

Meanwhile, bank balance sheet characteristics clearly matter for responses to shocks. Higher bank capital, and more retention of bank earnings, reduces the cost of debt financing, increases bank lending growth, and reduces the magnitude of monetary policy transmission into lending (Gambacorta and Shin 2018). US monetary policy tightening and episodes of dollar appreciation are associated with deleveraging of global banks, reduced capital flows to emerging markets, and an overall tightening of global financial conditions (Bruno and Shin, 2015). Banks have more pronounced bank lending channel responses to liquidity risk when they have low levels of capitalization and low deposit funding shares (Cornett et al. 2011; Buch and Goldberg, 2015). The evidence to date from a large cross-country initiative on monetary policy consequences for lending flows to nonbanks through global banks shows a mixture of bank characteristics matter, even while the effects are not always quantitatively large (Buch, Bussiere, Goldberg, and Hills, 2019).

Beyond banks, a post-crisis shift in international financial intermediation has occurred, with some reduction in bank lending and increase in bond market financing internationally. The bank-dominated phase of global liquidity was partially replaced by a second bond-dominated phase of global liquidity (Shin, 2013).[3] This composition links the evolution of global monetary aggregates to the financial activities of non-financial corporations (NFCs), with the non-core liabilities of NFCs reflecting global credit conditions and predicting global trade and growth (Chung et. al., 2016). Of course, these shifts also result from policy developments. Unconventional monetary policy contributed to shifting the balance of dollar credit transmission from global banks to global bond investors, as demonstrated by a post-crisis negative relationship between the term premium on 10-year Treasury bonds and international bond issuance (McCauley et. al., 2015). Regulatory changes

[3] These observations pertain to volumes of cross-border flows, not to co-movements of asset prices. During this same broad period, co-movements in international asset prices continue to be at least as strong and sensitive to global risk sentiment and liquidity conditions as pre-crisis state. This type of evidence does not support de-globalization.

also have played a role in this transition as banks were subjected to tighter requirements. Monetary policy rates across a large sample of countries can closely track advanced economy policy rates, particularly those of countries playing a central role in the international monetary system (Obstfeld, Shambaugh and Taylor, 2015). The form of exchange rate and monetary regimes in place influences the degree of co-movement. Greater near term autonomy has been linked to some restrictions on international capital movements (Klein and Shambaugh, 2008) and lower levels of banking globalization (Goldberg 2013).

Below we contribute to this broader literature by examining the flows through both banks and non-banks as borrowers and lenders. We analyse the effects of key global liquidity drivers, including risk and advanced economy monetary policy, demonstrate structural breaks, and test conjectures about why and how effects of key drivers change over time. Our analysis demonstrates the roles of micro-banking characteristics, composition of creditors, monetary policy regimes, and prudential policies of both borrowers and creditors in the shifting drivers of global liquidity.

3. Empirical strategy

The empirical strategy implemented has three main parts. The starting point is the international capital flow and global liquidity specification whereby international financial flows are explained by global (push) and country-specific (pull) drivers.[4] We replicate findings from that literature as a baseline before delving into differences in sensitivities to global (and other) factors over time, as well as across different borrower groups (banks and non-banks) and across different types of financing instrument (international claims and international debt securities). After having identified significant changes in patterns pre- and post- global financial crisis, the second part of the empirical strategy focuses on the pre- versus post patterns of changes in global liquidity sensitivity to global factors, with a specific set of tests for changes in the composition versus the behaviour of creditors. The patterns of

[4] As discussed in Cerutti, Claessens and Rose (2017), this type of specification dates back to Calvo et al (1993, 1996) and has a long history of applications. Koepke (2015) provides a review of approximately 40 papers, with recent panel regressions in Fratzscher (2011), Forbes an Warnock (2012), Broner et al (2013), Bruno and Shin (2015), and Cerutti, Claessens and Ratnovski (2017). Goldberg and Krogstrup (2018) derive similar specifications from a model of capital flow pressures using balance of payments and international portfolio demand equilibrium conditions.

composition and behaviour then are related to ex ante balance sheet conditions and regulatory policies of lending banking systems. The last part of the empirical strategy relates period-by-period time variation in the effects of advanced economy monetary policy and risk sensitivity to evolving creditor bank balance sheet characteristics and to degrees of divergence across monetary policies of advanced economies.

3.1 Baseline analysis

The baseline model for global and local factors in international capital flows follows the literature by introducing push global factors and pull local factors, and is given by:

$$GrRateY_t^j = \beta_1 \Delta FFR_t + \beta_2 logVIX_t + \beta_3 \Delta logGlobalGDP_t + \beta_4 \Delta SovRating_t^j + \beta_5 ChinnIto_t^j + \beta_6 \Delta logGDP_t^j + \mu^j + \varepsilon_t^j \quad (1)$$

where j denotes borrowing country and t is time. Our baseline specification considers the issue of international capital flows and global liquidity drivers from the perspective of the borrowing country. Global liquidity is divided into component cross-border flows by instrument and by type of borrower, with these components explored separately and in aggregate. For our analysis, Y_t^j can be cross-border loans - to all sectors, to banks, to non-banks - or international debt securities - issued by all sectors, by banks or by non-banks. As is standard in the literature, the model is expressed in stationary variables to avoid problems of spurious correlations. The international flows on the left-hand side of the equation are expressed in growth rates $GrRateY_t^j$. All specifications include country fixed effects μ^j.

The right-hand-side of the equation contains three global liquidity drivers - the US federal funds rate FFR_t (as a gauge for the stance of US monetary policy), the VIX (as a measure global risk conditions) and global GDP (as an indicator of global economic activity). As the US federal funds rate does not reflect all of the monetary policy interventions for the post GFC period, we use the Wu-Xia shadow rate measure (Wu and Xia, 2016) as a proxy to reflect both conventional and unconventional monetary policies.[5] The local factors corresponding to borrowing country j and flow type include sovereign credit ratings $SovRating_t^j$, the Chinn-Ito index of financial openness $ChinnIto_t^j$ (Chinn and Ito, 2008) and local

[5] As there are multiple shadow policy rates available in the literature, we perform extensive robustness checks using alternative indicators of U.S. monetary policy. The main findings are robust to alternative proxies.

GDP growth $logGDP_t^j$. The latter measures overall economic performance. Sovereign ratings proxy the role of country risk and the perceived creditworthiness of borrowers by country. The Chinn-Ito index gauges the degree of capital account openness. The Fed funds rate and the sovereign ratings are in first differences, while local and global GDP are in growth rates. The Chinn-Ito index is in levels and the VIX enters the equation in logs.[6] The model is estimated under the assumption that the two key global liquidity drivers, the Fed funds rate and the VIX, are exogenous when controlling for local and global GDP, government ratings and degree of financial openness[7].

As both anecdotal evidence and the literature discussion of phases of financial globalization hint at the presence of a possible structural break around the global financial crisis, we modify the full time period approaches of the literature and allow for shifts in the drivers of global liquidity. Rather than exogenously imposing a particular break date, we conduct a formal search for an endogenous structural break in the parameters of the model. Using the tools developed in Bai (1994, 1997), Kurozumi (2002) and Carrion-i-Silvestre and Sansó (2006), for each quarter T starting in 2007:Q1, we estimate the following equation:

$$GrRateY_t^j = \beta' X_t^j + \mu^j + I(t \geq T)(\kappa + \gamma' X_t^j) + \varepsilon_t^j \qquad (2)$$

where

$$X_t^j = (\Delta FFR_t, logVIX_t, \Delta logGlobalGDP_t, \Delta logGDP_t^j, \Delta SovRating_t^j, ChinnIto_t^j)'$$

and $I(t \geq T)$ is an indicator function that takes the value 1 when $t \geq T$ and 0 otherwise. Notice that for each candidate break date T, all the parameters of equation (2) are different. For each type of cross-border flow Y and each quarter T we compute the sum of squared residuals (SSR) of the regression in order to get a sequence $\{SSR_T^Y\}_{T \geq 2007:Q1}$. The most likely candidate for the break is the date T that minimizes the sequence, hence maximizing the fit of the model: $T_{break}^Y = argmin_{T \geq 2007:Q1}\{SSR_T^Y\}$. Once we detect the endogenous date for the break (T_{break}^Y), we re-estimate the baseline model with the appropriate break dummy and use a Wald test on κ and γ' to determine whether the break is statistically significant. The

[6] The Chinn-Ito index is only available at an annual frequency. We have tested the robustness of the results by using a quarterly linear interpolation of the Chinn-Ito index and by eliminating the index from the regressions. In both cases, the main results of the study remain qualitatively similar.

[7] We add the following controls in robustness checks: lagged flows, the local monetary policy stance (as proxied by the change in the policy rate, the 1-year rate or the 2-year rate on government bonds), the log change of the exchange rate between the local currency and the US dollar, the change in longer maturity interest rates. See Section 6.2 for details.

vector β' captures the sensitivities of international financial flows to the drivers in X_t^j before the break. The sum $\beta' + \gamma'$ captures the post-break sensitivities.

Given our special interest in the sensitivities of international loan and bond flows to US monetary policy and global risk conditions, we then conduct an additional closer investigation of the evolution of the respective estimated coefficients. In particular, we examine the hypothesis that the post-crisis paths of the above sensitivities may have been strongest in the near term aftermath of the financial crisis, differing before and after the 2013 taper tantrum. For this purpose we sequentially estimate equation (2) with the appropriate break date, starting with the sample 2000:Q1 – 2013:Q1 and adding one quarter at time until we reach our full sample (2000:Q1 – 2015:Q4). This procedure generates a distinct set of parameter estimates for each sample-end quarter from 2013:Q1 through 2015:Q4. This allows us to track how sensitivities to US monetary policy and global risk conditions have evolved during that period. As with the baseline analysis, for this approach to time variation Y_t^j is respectively gross flows of cross-border loans to all sectors, to banks, to non-banks, and international debt securities issued by all sectors, by banks or by non-banks, all taken from borrower country *j*'s perspective[8].

3.2 Decomposing the post-crisis shifts in sensitivities

As the specifications introduce controls for local country j drivers of global liquidity, the evolution of estimated global factor coefficients β_1 and β_2 on advanced economy monetary policy and risk are associated with creditors. For any class of creditor and borrower type, the aggregate sensitivities of international bank lending flows to global factors (β_1 and β_2) can be expressed as weighted averages of the national creditor-specific sensitivities to global factors (β_1^i and β_2^i). Some changes in estimated β_1 and β_2 are attributable to a combination of shifts in the composition of international creditors (a *compositional* component) and shifts in the sensitivity of flows from each respective country creditor vis-à-vis advanced economy monetary policy and risk metrics (a *behavioural* component). While this observation is general, our derivation of the decomposition takes the perspective of international bank lending.

[8] The approach described above may be subject to shrinking confidence bands over time due to artificially larger samples. As a robustness exercise, we compute rolling window estimates with a fixed sample size of 16 quarters.

We start by re-writing $GrRateY_t^j = \frac{S_t^j}{S_{t-1}^j} - 1$ where S_t^j is the outstanding stock of all international bank lending to the residents of borrowing country *j* at the end of period *t*.

Expanding and simplifying yields:

$$\frac{S_t^j}{S_{t-1}^j} - 1 = \frac{\sum_i S_t^{i,j}}{\sum_i S_{t-1}^{i,j}} - 1 = \sum_i \left(\frac{S_t^{i,j}}{S_{t-1}^{i,j}} * \frac{S_{t-1}^{i,j}}{\sum_i S_{t-1}^{i,j}} \right) - 1 = \sum_i \left\{ \left(\frac{S_t^{i,j}}{S_{t-1}^{i,j}} - 1 \right) w_{t-1}^{i,j} \right\} \quad (5)$$

where the weight for each creditor banking system *i*, $w_{t-1}^{i,j} = \frac{S_{t-1}^{i,j}}{\sum_i S_{t-1}^{i,j}}$ equals the respective share of the outstanding stock of flows for which it accounts. The national banking system-specific counterpart to specification (1) is then written as:

$$\frac{S_t^{i,j}}{S_{t-1}^{i,j}} - 1 = \beta_1^i \Delta FFR_t + \beta_2^i logVIX_t + \beta_3^i \Delta logGlobalGDP_t + \beta_4^i \Delta SovRating_t^j + \beta_5^i ChinnIto_t^j + \beta_6^i \Delta logGDP_t^j + \mu^{i,j} + \varepsilon_t^{i,j} \quad (4)$$

Combining (4) and (5), the baseline regression specification implies that the observed borrower *j* sensitivities to the federal funds rate (β_1) and to the VIX (β_2) can be expressed as weighted averages of the respective sensitivities (β_1^i) and (β_2^i) for the individual lending national banking systems:[9]

$$\beta_1 = \sum_i \{ w_{1,t-1}^{i,j} \beta_1^i \} \text{ and } \beta_2 = \sum_i \{ w_{2,t-1}^{i,j} \beta_2^i \}. \quad (6)$$

The compositional component is captured by the $w_1^{i\prime}s$ and $w_2^{i\prime}s$ and the behavioral component is captured by the $\beta_1^{i\prime}s$ and $\beta_2^{i\prime}s$. The compositional factors $w_1^{i\prime}s$ and $w_2^{i\prime}s$ are directly observable from data on bilateral international claims. Meanwhile, we estimate the behavioural factors $\beta_1^{i\prime}s$ and $\beta_2^{i\prime}s$ using a variant of the baseline specification.

Thus, our next analytical perspective pivots from the borrowing country perspective taken in section 3.1 to instead using data from the creditor country perspective. The BIS consolidated banking statistics (CBS) is a dataset from the creditor country perspective that contains information on banks' international claims defined as the sum of cross-border claims and local claims denominated in foreign currencies. The data is bilateral and contains information on the nationality of the lending banks *i* and on the residence of the borrower *j*.

[9] A detailed explanation of the decomposition of post-crisis shifts in sensitivities can be made available upon request.

By lending country i and for estimation periods corresponding to those defined in our first stage of the analysis (pre-break period and post-break periods), the baseline model is estimated similarly to model (1), to generate lending country specific estimates of behavioural factors $\beta_1^i{}'s$ and $\beta_2^i{}'s$. Thus, we provide the creditor country history of changes in sensitivities and the precision of estimates of those sensitivities for global liquidity flows through international banks to both bank and non-bank counterparties. As comparable data is not available for market-based finance, our decomposition does not extend to international debt securities.

3.3 Determinants of the post-crisis behavioural and compositional changes

The third main empirical element of our analysis is a further investigation into the changing drivers of global liquidity. We approach this issue from a panel perspective and a time-series perspective. We begin by conducting a diff-in-diff analysis that compares the pre- and post-crisis sensitivities to global factors and the shares of national banking system i lenders. The analysis considers which pre-crisis characteristics of banking systems and policies are associated with changes to outcomes post-crisis.

We test for the main drivers of the shift in sensitivities to global factors by estimating regressions in which the changes in the estimated coefficients are regressed on a set of pre-crisis variables. In particular, we estimate the following regressions:

$$(\beta_{1,k,Post}^i - \beta_{1,k,Pre}^i) = \gamma_1{}' F_{2008}^i + \zeta_1{}' P_{2008}^i + \theta_{1,k} + \varepsilon_{1,k}^i \quad (7)$$

$$(\beta_{2,k,Post}^i - \beta_{2,k,Pre}^i) = \gamma_2{}' F_{2008}^i + \zeta_2{}' P_{2008}^i + \theta_{2,k} + \varepsilon_{2,k}^i \quad (8)$$

where $(\beta_{1,k,Post}^i - \beta_{1,k,Pre}^i)$ is the difference in coefficients for ΔFFR and $(\beta_{2,k,Post}^i - \beta_{2,k,Pre}^i)$ is the difference in the coefficients for $logVIX$ taken from equation (4), estimated for lending country i and borrowing sector *k* (banks, non-bank private sector and public sector). $\theta_{1,k}$ and $\theta_{2,k}$ are vectors of borrowing sector fixed effects. The vector F_{2008}^i includes two banking system indicators: i) the capital-to-asset ratio; ii) the average bank size. Bank capital acts as a buffer against contingencies triggered by shocks and can limit the credit effect of increased global uncertainty and volatility (Gambacorta and Shin, 2018). The vector P_{2008}^i represents the creditor banking system prudential stance and it includes two prudential measures

(capital requirements and loan-to-value limits) and a regulatory stringency index based on the World Bank's Bank Regulation and Supervision Survey. We use pre-break characteristics at the national banking system level in order to limit endogeneity issues. Since the dependent variable in those regressions is a function of estimated coefficients, each with an associated standard error around it, we use meta-regressions techniques[10].

We likewise examine the drivers of the shifts in lending banking system i weights in flows to bank and non-bank borrowers in j, applying a similar regression specification to $(w^i_{k,Post} - w^i_{k,Pre})$:

$$w^i_{k,Post} - w^i_{k,Pre} = \gamma_w' F^i_{2008} + \zeta_w{}' P^i_{2008} + \theta_{w,k} + \varepsilon^i_{w,k} \quad (9)$$

In this case, as weights are numbers with no standard error attached, we estimate equation (9) by OLS. We also test the robustness of the results by including in equations (7)-(9) additional pre-break banking system indicators: i) the average banks' expected default frequency; ii) the deposit-to-total funding ratio; iii) the ratio of net interest income to total income.

3.4 Examining the drivers of the evolution of post-crisis sensitivities

The final stage of our benchmark empirical analysis adopts a time series approach to provide complementary information on the main drivers of the evolution of post-crisis sensitivities. We conjecture that this evolution may be influenced by the overall advanced economy monetary policy stance and by the evolving characteristics of the creditor national banking systems. The degree of monetary policy convergence among advanced economies (AEs) matters as the reaction to U.S. monetary policy as a global liquidity driver could be especially pronounced if it is a signal for a broader based set of expansionary policies across AE countries. In the period between the global financial crisis and the 2013 Fed taper tantrum, there was considerable convergence between the monetary policies of advanced economies, all of which were conducting various forms of quantitative easing to stimulate the real

[10] The meta-regression allows for residual statistical heterogeneity in the results of different estimation (between-study variance) by assuming that the true effects follow a normal distribution around the linear predictor (Stanley and Jarrell, 1989). The meta-regression can be formally defined as: $y_i|\theta_i \sim N(\theta_i, \sigma_i^2)$, where $\theta_i \sim N(x_i\beta, \tau^2)$ therefore: $y_i \sim N(x_i\beta, \sigma_i^2 + \tau^2)$, where β is the vector of estimated effects of study characteristics. This type of equation is estimated by weighted least-squares, in which the weight of each estimated coefficient depends inversely of its variance and corresponds to the inverse of the sum of two standard deviations (σ^2, τ^2).

economy. In 2013 the Federal Reserve signalled that it would start tapering its bond buying program. As the central banks of other advanced economies, most notably the European Central Bank and the Bank of Japan, did not follow suit, the monetary policies of advanced economies diverged from 2013 through the end of our estimation period in 2015, with divergence metrics returning to levels that were common pre-crisis. Thus, we conjecture that the sensitivities of the main global liquidity components to of US monetary policy could be stronger during the convergence period and weaker as policy diverges.

Creditor banking system characteristics, such as lenders' dominant business models and profitability, may have also driven the post-crisis evolution in sensitivities. Institutions engaging mainly in commercial banking activities have lower costs and more stable profits than those more heavily involved in capital market activities, mainly trading. Also, retail banking has gained ground post-crisis, reversing a pre-crisis trend (Roengpitya et al., 2017).[11] The willingness to lend to riskier counterparties is particularly strong in low interest rate environments, especially when these are likely to be sustained. Thus, we conjecture that reach for yield behaviours, a push factor in global liquidity, may be stronger for the banking systems that had more depressed profitability and return on assets.

This last section of empirical results thus examines the relevance of the degree of divergence among advanced economies' monetary policies by interacting it with the coefficients of ΔFFR and $logVIX$ in equation (2), while controlling for several lending banking system characteristics . The resulting model is:

$$\begin{aligned} GrRateY_t^j = {} & \beta' X_t^j + \left[\nu + \eta' \begin{pmatrix} \Delta FFR \\ logVIX \end{pmatrix}_t\right] polDiv_t + \left[\varrho + \xi' \begin{pmatrix} \Delta FFR \\ logVIX \end{pmatrix}_t\right] lenderChar_t^j \\ & + I(\geq T_{break}^Y)\left\{\kappa + \gamma' X_t^j + \left[\omega + \chi' \begin{pmatrix} \Delta FFR \\ logVIX \end{pmatrix}_t\right] polDiv_t \right. \\ & \left. + \left[\delta + \psi' \begin{pmatrix} \Delta FFR \\ logVIX \end{pmatrix}_t\right] lenderChar_t^j\right\} + \mu^j + \varepsilon_t^j \end{aligned} \tag{10}$$

[11] The link between business models and lending is developed, among others, in Lamers et al. (2016) and Martinez-Miera and Repullo (2017).

where $polDiv_t$ is a proxy for the monetary policy convergence between the US and other advanced economies; $lenderChar_t^j$ is a vector of weighted averages of the banking system characteristics of lenders to borrowers in country *j*. The weights are given by equation (5).

4. Data

We utilize three databases to capture the dimensionality needed to explore the main components of global liquidity: the BIS Locational Banking Statistics (LBS), the BIS International Debt Securities Statistics (IDSS), and BIS Consolidated Banking Statistics (CBS). The BIS LBS captures the outstanding claims and liabilities of internationally active banks located in 44 BIS LBS reporting countries[12] against counterparties residing in more than 200 countries. Banks record their positions on an unconsolidated basis, including intragroup positions to capture international flows between offices of the same banking group. The data, which are aggregated at the country level and compiled following balance of payments statistics principles, capture around 95% of all cross-border interbank business (Bank for International Settlements, 2015). The counterparty sector breakdown available in the BIS LBS enables us also to distinguish between cross-border bank lending to bank and non-bank borrowers. We use the BIS CBS in our analysis in order to obtain information on the relative importance of lending countries for a given borrowing country. The BIS IDSS data capture borrowing in money and bond markets. They encompass what market participants have traditionally referred to as foreign bonds and eurobonds. International debt securities (IDS) are issued in a market other than the local market of the country where the borrower resides (Gruić and Wooldridge, 2012). The sample used for the empirical analysis consists of quarterly data from Q1 2000 to Q4 2015. On the borrowing side, we focus on a set of 64 countries; on the bank lending side, we use data on the positions of all 44 BIS LBS and 31 CBS reporting countries.[13]

The typical lenders and borrowers connected by each flow type differ considerably in composition and size, as illustrated within Table 1. Cross-border loans are typically supplied by internationally-active banks, which tend to be relatively large. Meanwhile, the creditors in

[12] The complete list of BIS LBS reporting countries is provided at http://www.bis.org/statistics/rep_countries.htm.

[13] The complete lists of all borrowing countries and lending national banking systems are available in Annex A.

international debt securities markets are usually non-bank financial intermediaries, such as pension funds, insurance companies, money market mutual funds, and hedge funds. The variation on the borrower side is even greater. International bond issuance by non-banks tends to be dominated by sovereigns and large non-financial corporates. The latter are also important players on the borrowing side of the cross-border bank loan market, which also channels funds to export/import firms and leveraged non-bank financials.

The three global factors in our analysis include global real GDP growth, changes in the stance of US monetary policy, and global risk conditions. Appropriately capturing changes in stance of US monetary policy is key for the second factor, as the empirical literature discussed in Section 2 mainly corresponds to the period prior to the introduction of unconventional monetary policy and exclusively uses a short-term policy rate. However, monetary policy at the zero lower bound is a defining feature of the post-crisis period, and changes in communications, interest on effect reserves and quantitative easing actions became more instrumental. We use the Wu-Xia policy measure (Wu and Xia, 2016) as a sufficient statistic for the stance of US monetary policy. This construct uses the effective US Federal Funds target rate prior to Q4 2008 and estimates of the shadow Federal Funds rate from Q1 2009 through end of 2015 (Graph 2, left panel). Since all shadow rate estimates are sensitive to the underlying modelling assumptions, we also conduct robustness analysis using alternative US monetary policy measures (Section 6).

For global risk conditions we follow the literature in our baseline by using the VIX index of the implied volatility in S&P500 stock index option prices from Chicago Board Options Exchange (CBOE). As alternative metrics have been derived in the finance literature to separate out risk sentiment from underlying risk levels, we also perform robustness results using the Bekaert, Engstorm and Xu (2017) risk index. Very similar results arise as the two measures are strongly positively correlated (Graph 2, right panel).

Three borrowing country variables (pull factors) are included in baseline specifications: local real GDP growth, sovereign ratings, and the degree of financial openness. For each borrowing country, the sovereign ratings variable is defined as the average ratings across the three major credit ratings agencies (S&P, Moody's and Fitch). The

degree of financial openness is captured by the Chinn-Ito index (Chinn and Ito, 2008), normalized between 0 and 1.

The IBRN Prudential Instruments dataset covers widely-used prudential instruments, keeping track of the intensity of their usage in 64 countries between 2000 and 2014 at a quarterly frequency. The instruments that are covered are: general capital requirements, sector-specific capital requirements (split into real estate credit, consumer credit, and other), interbank exposure limits, concentration limits, loan-to-value (LTV) ratio limits, and (local currency and foreign currency) reserve requirements. We focus on the three prudential policy instruments that have been shown to have the largest impact on international bank lending: loan-to-value ratio caps, capital requirements and local currency reserve requirements (Cerutti et al., 2017; Avdjiev et al., 2017; and Buch and Goldberg, 2017).[14]

The balance sheet characteristics of national banking systems are constructed using Bankscope data. We obtain the balance sheet items of interest for the set of internationally active banks that report to the BIS consolidated banking statistics, and then aggregate bank-level characteristics to national banking system-wide variables, using weighted averages across the individual banks of a given nationality. Data are adjusted for mergers and acquisitions to correct for balance sheet jumps that are unrelated to lending (Brei et al., 2013). We gather data on i) capital to total assets, ii) average bank size, iii) deposits to total assets, iv) net interest income over total income, v) net interest income to total assets.

Two bank business model measures are considered: i) an income diversification ratio (defined as net interest income to total income); ii) net interest income to total assets. The first indicator ranges from 0 to 1 and indicates the fraction of a bank's profitability that derives from traditional intermediation activity (i.e. lending and deposits). If a bank has a large portion of non-interest income (trading income, fees and commissions for services) than this indicator tends lower values. The second indicator is the return per unit of assets that derives from traditional intermediation activity. It represents the profitability of intermediated assets that is obtained by the bank getting deposits and supplying loans.

[14] Cerutti et al. (2017) provide an extensive discussion of the properties of the quarterly changes in these prudential instruments and the cumulative changes over time.

Our proxy for monetary policy divergence among advanced economies, we take the difference between the two-year futures on the policy rate for the United States and the average of the two-year futures for the United Kingdom, Switzerland, Japan and a group of "core" Eurozone countries (Austria, Belgium, Germany, Finland, France, the Netherlands, Spain).[15] As shown in Graph 3, monetary policy divergence was unusually small in the years immediately following the Global Financial Crisis, with the gap opening up again after 2013.

5. Evidence on global liquidity drivers

5.1 Baseline results

Our empirical investigation begins with the baseline specification in equation (1) to replicate prior global liquidity results. The estimated coefficients for the entire sample 2000:Q1 – 2015:Q4, presented in Table 2, are largely in line with those obtained in the existing literature. Using data on international bank flows and international debt securities issuance from the bank and non-bank debtor perspective, the results from the baseline model indicate that an increase in global risk conditions (measured by the VIX) has a negative and strongly statistically significant effect on all flows. The US federal funds rate has a sharply negative impact on cross-border bank loans. Its estimated impact on international debt securities is also negative, albeit only marginally statistically significant. Local factors are statistically significant drivers. Borrowing countries with higher GDP growth rates and with better sovereign credit ratings tend to attract more cross-border loans. The degree of financial openness, as reflected in the Chinn-Ito index, has a positive (and statistically significant) effect on the international bond flows, especially to banks.

As described in Section 3.1 we formally examine the stability over time of the above estimated coefficients from equation (1) are stable over time. Rather than exogenously imposing an ad-hoc break date, we test for its presence and exact timing endogenously. We find that the most likely break date for both cross-border loan flows and international bond flows is 2009:Q1. Wald (or Chow) tests on the coefficients κ and γ' in equation (2) indicate

[15] Summary statistics for the explanatory variables used in our empirical analysis are presented in Table B1 in Annex B. Graph B2 shows the advanced economy monetary policy divergence indicator.

that the break is statistically significant for the global liquidity components that we examine.[16]

Table 3 summarizes the estimated sensitivities to the main global drivers (the VIX and the federal funds rate) during the pre-crisis and the post-crisis periods, respectively. Two sets of estimates are provided for the post-crisis period – one for the full sample (ending in Q4:2015) and one for a sub-sample ending in Q1:2013. The latter set of results allows us to examine whether the 2013 Fed taper tantrum, which started the divergence across advanced economy monetary policies, marked a turning point in the post-crisis sensitivities to global factors[17].

The results confirm that the relationship between the main global factors and international capital flows (from the borrowing country perspective) has changed profoundly since the Global Financial Crisis[18]. The impact of US monetary policy on cross-border loans, which was already negative and statistically significant during the pre-crisis period, rose even further in the immediate aftermath of the GFC. While prior to the crisis a 100-basis point increase in the federal funds rate was associated with a 3 percent decline in cross-border bank lending flows, in the aftermath of the crisis this effect rose to 8 percent. The respective negative impact on international bond issuance, which was not statistically significant prior to the crisis, also increased considerably after the GFC. In quantitative terms, the impact of a 100-basis point increase in the federal funds rate on international bond issuance surged from slightly more than 1 percent before the crisis to 8 percent immediately after the crisis.

After 2013, global liquidity sensitivities to US monetary policy reverted towards their respective pre-crisis levels, especially for cross-border loans. Once the sample is extended to include the post-taper tantrum period, a 100-basis point increase in the federal funds rate becomes associated with an approximate 3 percent decrease in loan flows, a level of

[16] Test results are available upon request.

[17] As a robustness exercise, we replicate the analysis using a smaller sample pre-crisis (2002:Q1 – 2008:Q4) to match the span of the post-crisis one (2009:Q1 – 2015:Q4). The signs, magnitudes and time patterns of the coefficients are very similar and qualitatively the same as those in Table 3.

[18] Table B2 in Annex B presents the time differences between the coefficients in Table 3: post-break – up to 2015:Q4 or up to 2013:Q1 – minus pre-break, as well as post-break up to 2015:Q4 minus post-break up to 2013:Q1. Each temporal difference is accompanied by its robust standard error; the stars represent the usual conventional significance levels, computed using a t-test on the difference between the two coefficients.

responsiveness much closer to the one observed prior to the crisis. The responsiveness of international bond flows reverted to about 4 percent.

The sensitivity of both loans and bonds to global risk conditions declined sharply. Whereas prior to the crisis a 1 percent change in the actual VIX measure was associated with an approximate 4 percent contraction in loan flows, after the crisis this effect became statistically insignificant and about 32 basis points in magnitude. Similarly, the sensitivity of bonds to a 1 percent increase in the VIX declined from a peak of about 3 percent right after the crisis to slightly more than 1 percent afterwards. These findings are in line with the argument of Shin (2016) that the VIX has lost its power as a barometer of banks' appetite for leverage since the GFC.

The post-crisis evolution of the sensitivities of aggregate global liquidity flows (i.e. the sum of international bank loans and bond flows) was in line with the respective evolutions for the main global liquidity components. Namely, the responsiveness of aggregate flows to US monetary policy rose sharply between the GFC and the 2013 taper tantrum. It subsequently reverted towards pre-crisis levels, but remained at relatively high levels. By contrast, aggregate global liquidity flows became much less sensitive to global risk since the GFC.

Some convergence appears across the global factor sensitivities of the two main global liquidity components. Table 4 shows the difference between the sensitivities of cross-border loans and international debt securities to the global factors, before and after the GFC. In the pre-crisis period, the differences were mostly negative and significant, indicating that cross-border loans were significantly more sensitive than international debt securities to both global risk conditions and US monetary policy. In the post-crisis period, most differences are no longer statistically significant, signalling that the two types of flows have become more similar in their responsiveness to global factors.

5.2 Decomposing the shifts in sensitivities to global factors

As described in Section 3.2, the shifts in the sensitivities of external flows to global factors can be decomposed into compositional component and behavioural components. The factors that capture the composition of lending national banking systems (the $w_1^{i\prime}s$ and the

$w_2^i's$) are directly observable and are obtained from the CBS matrix of bilateral stocks of international claims. Meanwhile, the factors that capture the behavioural component, i.e. the national banking system-specific sensitivities to global factors (the $\beta_1^i's$ and the $\beta_2^i's$), are obtained as the estimated coefficients on the respective global factors in the creditor banking system-specific regressions presented in equation (6).

Having obtained the pre- and post-crisis lender-specific weights and lender-specific sensitivities to global drivers, we estimate the contributions of the behavioural components (the first terms on the right-hand side of equations (7) and (8)) and compositional components (the second terms on the right-hand side of equations (7) and (8)) to the shifts in sensitivities from the perspective of borrowers.[19] Recall that a borrower can experience a changing sensitivity of financing flows to global factors if there is an evolution in the composition of creditors, where the creditors have distinct sensitivities, and if there is an evolution of the behavioural sensitivities of creditors.

The results from the decompositions of borrower sensitivities into the composition and behaviour of creditors are summarized in Graph 4. The behavioural component dominates the shifts in realized borrower sensitivities to US monetary policy (Graph 4, left-hand panel). For all three borrowing sectors, the estimated contributions of the behavioural component are negative (i.e. they increase the absolute value of the estimated sensitivity). The contributions of the behavioural component dominate the respective contributions of the compositional component. These results show strongly that, on average, the post-crisis increases in the sensitivity of international bank lending flows to US monetary policy are driven by increases in the sensitivities of individual banking systems rather than by shifts in the composition of international lending from less to more sensitive banking systems.

The decomposition of the sensitivities to the VIX show that the contributions of the compositional component are all positive and much larger than their counterparts for the US monetary policy sensitivities (Graph 4, right-hand panel). The behavioural component is not as dominant as in the case of US monetary policy. The behavioural component plays a significant role only for lending to the public sector. When it comes to lending to the non-

[19] By design, these decompositions represent approximations of the underlying estimation procedure. Even though the "synthetic" sensitivities derived as a weighted average of the lender-specific sensitivities tend to be very close to the global sensitivities obtained using the benchmark regression specification, the two measures do not overlap perfectly.

bank private sector and interbank lending, the overall declines in sensitivities to the VIX are clearly driven by the compositional component.

The sensitivities of international bank lending flows to the public sector increase considerably during the post-crisis period vis-à-vis both the US monetary policy and the VIX. These results could be interpreted as evidence that banks have adjusted treatment of sovereign risk since the crisis. Such an interpretation would be consistent with evidence that banks treated (most of) their sovereign exposures as virtually risk-free before the crisis, but started to assess sovereign risk in a more realistic manner after the crisis (Acharya et al., 2013; Farhi and Tirole, 2016; De Grauwe and Ji, 2013).

5.3 Determinants of the post-crisis shifts in sensitivities and weights

The next set of results uncovers the main drivers of the shift in the lender-specific sensitivities to global factors in a diff-in-diff framework by regressing the change in the (pre- and post-crisis) coefficients on a small set of potential explanatory (pre-crisis) variables per equations (7) and (8).

The results for changes in the sensitivities to US monetary policy $\left(\beta^{i}_{1,\mathrm{k},Post} - \beta^{i}_{1,\mathrm{k},Pre}\right)$ are reported in Column (I) of Table 5. Banking systems that were better capitalised pre-GFC experienced a smaller change in the sensitivity of their international lending to US monetary policy in the post-crisis period.[20] This result is consistent with a broad literature showing that well-capitalised banks are perceived as less risky by depositors and other bank creditors, have easier access to funding, and are, consequently less affected by monetary policy shocks (Gambacorta and Shin, 2016). Cross-country evidence, based on micro-banking data, shows that the international transmission of both, liquidity risk and monetary policy, is weaker for banks with more capital and more stable funding sources.[21]

The result does not depend on a different initial prudential stance, as the regression also includes prudential policy measures (cumulative prudential measure index and loan-to-

[20] Since the differences between the (pre- and post-break) estimated parameters tend to be negative, a positive value of the coefficients in the meta-regressions implies a smaller change in the (pre- and post-break) sensitivities.

[21] On liquidity risk, Strahan et al. (2011) has similar findings in a US domestic lending setting, while international evidence is in Buch and Goldberg (2015) and related studies of the International Banking Research Network published in *IMF Economic Review* 2015 provide. On monetary policy transmission, cross-country evidence is discussed in Buch et al (2019).

value ratio cap index) and a regulatory stringency index at the time of the structural break. As indicated by the second column of Table 6, the result holds also including additional pre-crisis banking system indicators to control for different level of risk and specific business model characteristics (expected default frequency, deposit to total asset ratio and net interest income over total income). This test is particularly relevant because banking systems were subject to different level of stress during the GFC and those with higher shares of deposits funding and total income from traditional sources of intermediation activity could have reacted differently, independently of total bank capitalisation. For example, banks that have a large deposit base suffered lower adjustment costs in their funding post-crisis (Gambacorta and Marques, 2011), while banks involved less in capital market activities resulted less vulnerable to shifts in global economic conditions (Roengpitya et al., 2014).

The right-hand panel (Columns III-IV) of Table 5 investigates the determinants of the structural break in the sensitivity of international bank lending to global risk. The dependent variable in those specifications is $\beta^{i}_{1,\mathrm{k},Post} - \beta^{i}_{1,\mathrm{k},Pre}$ (estimated from equation (8)), for lending country i and borrowing sector k. As in the case of the sensitivities to US monetary policy, the main determinant of the changes in the sensitivities to global risk also appears to be the capitalization level of the respective creditor banking system. The better capitalized a given banking system was at the time of the structural break, the more likely it was that the sensitivity of its international lending to global risk declined during the post-crisis period.

The main drivers of the shifts in the composition of international lending (approximated by the lending weights defined above) between the pre- and the post-crisis periods. We estimate equation (9), in which the difference in lending national banking system weights before and after the crisis ($w^{i}_{\mathrm{k},Post} - w^{i}_{\mathrm{k},Pre}$) is regressed on a set of pre-crisis business model indicators.

The first column of Table 6 indicates that the banking systems that were more likely to gain market share during the post-crisis period were those that were ex-ante better capitalized. The result does not change including additional banking systems characteristics (the second column of the Table 6).

The results could be affected by the business model of a banking system to lend abroad. That is why, in the last column of Table 6 we have included the average level of local claims over foreign

claims for each banking system as an additional control variable.[22] The results on bank capital are qualitatively similar. Interestingly, those banking systems with higher local lending resulted to be more resilient and to have increased their lending weight at the expense of banking systems with a different business model. This result is consistent with the findings in Cetorelli and Goldberg (2012a), who demonstrated a pecking order across their bank subsidiaries, with the core business locations less sensitive than peripheral ones.

The higher the ratio of local to foreign claims, the more a banking system relies on its subsidiaries and branches abroad as opposed to obtaining foreign claims by dealing with borrowers directly from its headquarters. Our result match with the fact that local claims have been relatively stable after the crisis, because banks have reduced foreign lending by cutting down operations from their headquarters (Gambacorta and van Rixtel, 2013). Indeed, the latter require a well-functioning wholesale and interbank market, which are very vulnerable to global uncertainty. De Haas and van Horen (2013) find that banks reduced credit less to markets where they operated a subsidiary and where they were integrated into a network of domestic co-lenders.

5.4 Drivers of the time variation in the post-crisis period

While the previous empirical exercises examined the difference between the pre- and post-crisis periods, deeper analysis of the data reveals considerable variation in the estimated parameters of interest across global factors through the post-crisis period (Graphs 5 and 6). The graphs also include in each panel a black line designating the pre-crisis estimates of comparable sensitivities.

The post-crisis evolution of the sensitivity to US monetary policy is dramatic, and common across instruments and borrowing sectors (Graph 5). It is strongest right before the start of the US taper tantrum and becomes gradually weaker afterwards. By the end of our sample, sensitivities remain stronger than during the pre-crisis period for all but one global liquidity components.

The sensitivity to global risk conditions gradually decreases (Graph 6). Notably, even though sensitivity of global liquidity flows is still significantly lower than zero in mid-2013,

[22] This indicator is not available for Chile, Hong Kong, Luxemburg and Mexico, and therefore, considering three sectors, the number of observations drops to 75.

this is not the case by 2015. In the case of cross-border loans, the sensitivity to global risk conditions is significantly weaker in the post-crisis period than in pre-crisis. The sensitivity of international debt securities to the VIX is almost always not significantly different from zero, with the only exception being flows of bonds issued by non-banks[23].

Our conjecture is that the evolution of post-crisis sensitivities could be due to the signal value of US monetary policy changes, or due to the frictions binding banks, which in turn correspond to banking system characteristics. During periods in which the monetary policies of advanced economies move together, a unit change in the federal funds rate could, all else the same, have a larger impact on cross-border bank lending than during periods of divergence. In the former case, changes in the stance of US monetary policy could have a signalling effect about upcoming matching moves by other AE monetary policy authorities. This effect could amplify the consequences of changes in the federal funds rate for cross-border bank lending. Banking system characteristics matter, as lenders' dominant business models and profitability affect the responsiveness of their cross-border lending to shocks. The low-interest rate environment in the post-crisis period may have affected banks that rely primarily in interest income in a different manner from banks with less traditional business models.

Tests for the roles of monetary policy divergence between the US and other advanced economies, and for a weighted average of proxies for the business models of banking systems lending to country *j*, are shown in Table 7. Monetary policy convergence plays a large and highly significant role in driving the sensitivity of international bank lending flows to US monetary policy within the early post-crisis period. The sensitivity of international flows to US monetary policy weakens after 2013, when expected monetary policy paths start to diverge. The lending country banking system characteristics (proxied in the table by the relevance of traditional intermediation activity) do not drive the post-crisis evolution of global factor sensitivities in the majority of the examined cases. Importantly, the significance of monetary policy convergence is robust to the inclusion of several proxies of lenders' business models, namely their capitalization, profitability and relevance of interest earnings (as opposed to commissions and fees).

[23] These results are qualitatively the same when we study the time-variation of the parameters using a rolling window of 16 quarters.

These results have important implications. To the extent that the post-crisis convergence of the monetary policies of advanced economies was only a temporary phenomenon, the dramatic increase in sensitivities to US monetary policy may not persist. By contrast, the compositional effect of international lending shares shifting towards better capitalised banking systems, which would naturally lead to more stable bank lending flows, is likely to be much more persistent.

6. Robustness

We conduct several sets of robustness checks. First, all benchmark specifications are re-estimated using alternative shadow federal funds rates. Second, all bond flow regressions are redone using an alternative international bond flow measure. Third, our main regressions are re-estimated separately for advanced economies versus emerging markets. Fourth, we re-estimate our benchmark specifications, using alternative metrics of risk conditions.

6.1 Alternative measures of US monetary policy

The baseline results for the sensitivities to US monetary policy are in part obtained using the Wu-Xia shadow rate measure, which is generated by a discrete time multi-factor term structure model and assumed to be a linear function of three latent variables which follow a VAR (1) process. The latent factors and the shadow rate are estimated with the extended Kalman filter.

As each of several alternative measures has its own advantage and disadvantages (see discussion of trade-offs by Lemke and Vladu, 2017), our robustness checks use the alternative measures by Krippner (2014) and by Bauer and Rudebusch (2016), as well as two-year Treasury bond yields. Krippner (2014) is based on a two state-variable shadow yield curve model estimated using the iterated extended Kalman filter on month-end US yield curve data from 1985 with times to maturity spanning 0.25 to 30 years. Bauer and Rudebusch (2016) replace the affine short-rate specification of standard dynamic term structure models with an identical affine process for an unobserved shadow short rate. The Wu-Xia shadow

rate tends to be in between the two alternative shadow rates.[24]. Tests using the one-year and two-year US Treasury bond rates allow us to test the sensitivity of our main results to replacing the model-based shadow rates with rates that are based on hard market data, as in Swanson and Williams (2014).

In Annex B, Table B3 reports the estimations using the two alternative shadow rates as well as one and two-year US Treasury bond rates, showing coefficients that remain negative and significant, consistently with the results using the Wu-Xia rate in Table 2. Table B4 shows the estimated coefficients with a structural break in 2009:Q1. The post-crisis sensitivities to the VIX diminish, as in our baseline estimates with the Wu-Xia; the post-crisis sensitivities to US MP are not significant in most cases. Our baseline estimates, instead, show increasing sensitivities to US MP post-crisis up to the Taper Tantrum and a return to the pre-crisis sensitivities afterwards. This is not surprising given the very different behaviour of the Wu-Xia shadow rates with respect to the 1-year or the 2-year rates.

6.2 Additional controls

We perform robustness exercises including the following additional controls into the equations of Table 2 and 3: lagged growth rates of cross-border loans or international debt securities; policy rates, 1 or 2-year rates of the receiving country to account for the local monetary policy stance; 10-year US rates to account for yield curve effects; exchange rates vis à vis the US dollar; other advanced economy policy rates. Tables C5 and C6 in Appendix C contain the results.

In Table B5 the sensitivities to US monetary policy are negative and significant, although smaller in absolute value; the sensitivities to the VIX are negative but they are often not significant: when we use local policy rates as a proxy for the local MP, we get significant sensitivities to the VIX in most cases. On the contrary, the sensitivities are not significant when we use 1-year or 2-year rates to proxy for the local MP. However, this result could be due to the smaller sample size of the latter two specifications (1-year and 2-year rates are not available for many countries in many points in time). In Table B6 (i.e. estimation with a structural break), using local policy rates to proxy for the local monetary policy stance, the

[24] This is the case for both levels (Graph B1, left-hand panel) and first differences (Graph B1, right-hand panel).

sensitivities to US monetary policy increase post-crisis up to the Taper Tantrum and revert back to the pre-crisis level afterwards; the sensitivities to the VIX are smaller in absolute value post-crisis; using local 1 or 2-year rates to proxy for local MP, we still get results that are in line with our baseline ones for total flows (debt securities and cross-border loans to all sectors), but not necessarily for the breakdowns by instrument or borrower type; again, this result could be due to the smaller sample size.

6.3 Alternative international bond flow measures

Our benchmark regressions use international debt securities as measure of bond flows, defined as those issued in a market other than the local market of the country where the borrower resides (Gruić and Wooldridge, 2012). For most borrowing countries and sectors, the universe of international debt securities tends to largely overlap with the universe of debt securities held by external investors. The match is imperfect as securities issued in foreign markets may be purchased and held by domestic residents, and domestically issued debt securities could be bought by external investors. For robustness, the international debt securities series used in our benchmark regressions are replaced with data on portfolio debt from the Balance of Payments, using the quarterly growth rate of the respective (gross) outstanding IIP stocks.[25] The estimated impacts of US monetary policy and global uncertainty on portfolio debt flows remain negative and statistically significant for aggregate flows and their main sectoral (bank and non-bank) components (Table B7 in Annex B).

7. Conclusions

Drivers of global liquidity are critically important to macroeconomic stabilization, growth, and international interconnectedness. In the aftermath of the global financial crisis, the composition of international capital flows shifted away from bank lending and towards international debt securities, and lending shares evolved across major national banking systems.

[25] The exact series we use is '*Portfolio Investment Debt, Liabilities*' (Line *79led*).

We document the important changes that have occurred in the sensitivity to global factors across the main components of global liquidity, cross-border bank loans and international debt securities. The impact of US monetary policy changes on all major types of international financial flows to borrowers increased dramatically after the GFC. By contrast, the responsiveness of cross-border loan flows to global risk conditions declined significantly. Borrowers experienced these altered sensitivities because of changes in both the composition of creditors and in the behaviour of these creditors. Composition matters since international creditors have distinct characteristics and a change in the distribution of those creditors carries over into the effective sensitivity of flows observed by borrowers. Behavioural changes by international creditors are also important, as some bank business models became more sensitive to US monetary policy and less sensitive to global risk conditions.

The post-crisis rise in the sensitivity of international bank lending flows to US monetary policy was driven mainly by increases in the sensitivities of individual banking systems. Conversely, compositional changes were primarily responsible for the decline in the sensitivity of international bank lending to global risk conditions. National banking systems that were ex ante better capitalized experienced smaller increases in sensitivities to US monetary policy and larger increases in their market shares in international lending. Higher ex ante shares of deposits in total funding and local claims in foreign claims were also associated with larger increases in international lending market share. Certain prudential policy measures, such as local currency reserve requirements, were also associated with gains in the relative stability of international loan supply.

Using the BIS international banking statistics, which provide multiple perspectives on the evolution of effects, we demonstrate that the post-crisis evolution of the sensitivities of international bank flows to global push factors appears to be driven by a combination of transitory drivers and others that are potentially more persistent. Increases in the sensitivities of individual banking systems to US monetary policy were largely driven by the convergence in advanced economy monetary policies that took place in the immediate aftermath of the GFC. As the monetary policies of advanced economies started to diverge in 2013, these transitory effects gradually weakened. By contrast, the effects related to the increased market

shares of better-capitalized lending banking systems, which tend to be less responsive to fluctuations in global risk conditions, could turn out to be more persistent.

Overall, our analysis makes important contributions by investigating the dynamism in global liquidity drivers, as well as international monetary policy spillovers and risk effects. This dynamism, not previously explored in depth, is relevant for debates on the use and potential efficacy of capital controls, prudential instruments, and even the autonomous use of monetary policy. Regardless of the degree of integration with international financial markets, funding flows may be more responsive when policy cycles of advanced economies are more aligned. Funding flows through global banks appear to be less volatile for banks with greater capital buffers, more traditional funding models, and when global banks utilize local affiliates to a greater degree in their international lending.

The results demonstrate that initiatives to make banking systems more robust in advanced countries, for example through prudential instrument changes and policies aimed at boosting capitalisation and stable funding levels, have had the positive side effect of reducing the amplitude of fluctuations in some forms of international capital flows to both advanced and emerging markets. Such policies complement the debates over borrower country macro-prudential policies and capital flow management instruments. Open questions still remain around the behaviour of international debt securities and await both richer data and more research on these financing flows.

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Table 1 – Typical Lenders and Borrowers

	Typical Lenders	**Typical Borrowers**	***Notes***
Cross-border loans (XBL) to banks	Internationally-active banks	Banks (all sizes)	*Interbank market (unsecured and repo)*
Cross-border loans (XBL) to non-banks	Internationally-active banks	Large non-financial corporates; exporting/importing firms; Leveraged non-bank financials	*Syndicated loan market; trade credit; project financing*
International debt securities (IDS) issued by banks	Pension funds; Insurance companies; MMMFs; Hedge funds	Large and mid-sized banks	*Smaller investor base than for IDS issued by non-banks*
International debt securities (IDS) issued by non-banks	Pension funds; Insurance companies; MMFs; Hedge funds	Non-financial corporates; governments; Insurance companies	*Broader investor base than for IDS issued by banks*

Table 2 – Locational baseline regressions (by borrowing country)

	Dependent variable: ΔCross-border loans †			Dependent variable: ΔInternational debt securities ‡		
Explanatory variables	All	to banks	to non-banks	All	by banks	by non-banks
ΔFed funds rate (1)	-1.95***	-2.48***	-1.86***	-1.76***	-2.26**	-1.44**
	(0.38)	(0.58)	(0.34)	(0.66)	(0.95)	(0.69)
Log(VIX)	-2.75***	-2.51***	-3.10***	-2.31***	-5.22***	-1.49*
	(0.59)	(0.96)	(0.62)	(0.75)	(1.77)	(0.83)
ΔReal GDP	0.54***	0.57***	0.50***	0.09	0.20	0.08
	(0.09)	(0.12)	(0.08)	(0.10)	(0.24)	(0.13)
ΔSovereign rating (2)	2.80***	4.37***	0.02	0.56	-1.50	0.30
	(1.06)	(1.40)	(0.84)	(0.85)	(2.82)	(1.05)
Chinn-Ito index (3)	-1.35	-3.03	0.30	8.11***	10.72**	4.87
	(1.79)	(2.87)	(1.85)	(2.89)	(4.61)	(3.03)
ΔReal global GDP	0.50***	0.81***	0.34**	0.00	-0.18	-0.15
	(0.16)	(0.24)	(0.16)	(0.26)	(0.79)	(0.30)
Observations	3,327	3,327	3,327	3,327	2,961	3,326
R-squared	0.11	0.07	0.08	0.05	0.03	0.03

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4. The regressions include a full set of country fixed effects. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. (2) Long term foreign currency sovereign rating, average across 3 agencies (S&P, Moody's and Fitch). (3) Measure of financial openness developed in Chinn and Ito (2008).

Table 3 - Locational baseline regressions (by borrowing country) with a structural break

	Dependent variable: ΔCross-border loans †			Dependent variable: ΔInternational debt securities ‡			Dependent variable: ΔTotal cross-border flows (loans and debt securities)		
	All	to banks	to non-banks	All	by banks	by non-banks	All	to banks	to non-banks
Pre									
ΔFF (1)	-3.19***	-3.44***	-3.42***	-1.42	-1.26	-0.90	-2.07***	-2.57***	-2.09***
	(0.49)	(0.81)	(0.56)	(1.03)	(1.36)	(1.20)	(0.36)	(0.71)	(0.37)
VIX (2)	-3.94***	-4.43***	-4.36***	-1.09	-5.63**	-0.21	-3.11***	-4.09***	-2.70***
	(0.94)	(1.63)	(1.07)	(1.28)	(2.66)	(1.56)	(0.67)	(1.39)	(0.69)
Post - up to 2013:Q1									
ΔFF (1)	-8.07***	-10.79***	-6.16***	-8.17***	-20.23	-8.00***	-7.96***	-11.50***	-6.44***
	(1.336)	(2.088)	(1.188)	(2.510)	(12.75)	(2.542)	(1.00)	(1.96)	(0.93)
VIX (2)	-2.68**	-2.12	-2.87***	-3.07**	-5.60	-2.51*	-3.14***	-2.73*	-2.88***
	(1.071)	(1.671)	(1.063)	(1.476)	(5.225)	(1.517)	(0.83)	(1.61)	(0.79)
Post - up to 2015:Q4									
ΔFF (1)	-3.68***	-5.56***	-2.29***	-5.19***	-9.82***	-4.88***	-4.37***	-5.84***	-3.85***
	(0.71)	(1.02)	(0.72)	(0.92)	(3.79)	(0.93)	(0.47)	(0.84)	(0.49)
VIX (2)	-0.32	0.77	-0.99	-1.55	-1.25	-0.83	-1.18*	0.41	-1.13*
	(0.81)	(1.27)	(0.77)	(1.06)	(3.12)	(1.04)	(0.60)	(1.18)	(0.58)

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. (2) Log(VIX). The regressions include ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP and their interaction with a break dummy that takes value 1 after the break date (2009:Q1). The regressions also include a full set of country fixed effects.

Table 4 – Convergence between loan and bond sensitivities

	Coefficients ($XBL^{\dagger}$) – Coefficients ($IDS^{\ddagger}$)		
Explanatory variables	All	to banks	to non-banks
Pre			
ΔFed funds rate (1)	-1.77*	-2.18*	-2.52**
	(1.14)	(1.58)	(1.32)
Log(VIX)	-2.85**	1.20	-4.14**
	(1.59)	(3.12)	(1.89)
Post			
ΔFed funds rate (1)	1.51	4.25	2.59**
	(1.16)	(3.92)	(1.18)
Log(VIX)	1.23	2.02	-0.15
	(1.33)	(3.37)	(1.29)

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † cross-border loans to borrowers in country j. ‡ international debt securities issued by borrowers in country j. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. The regressions include ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP and a break dummy that takes value 1 after the break date (2009:Q1). The regressions also include a full set of country fixed effects.

Table 5 - Drivers of the shifts in lender-specific sensitivities

	Dependent variable: Structural change in the coefficient for ΔFed funds rate $\beta_1^{Post} - \beta_1^{Pre}$		Dependent variable: Structural change in the coefficient for Log(VIX) $\beta_2^{Post} - \beta_2^{Pre}$	
Explanatory variables	(I)	(II)	(III)	(IV)
Pre-break capital ratio (2008)	0.507**	0.371*	0.706**	0.788**
	(0.214)	(0.211)	(0.310)	(0.334)
Pre-break average bank size (2008)	1.340**	1.343**	1.194	1.369
	(0.627)	(0.579)	(0.904)	(0.921)
Prudential measures and regulatory stringency index (1)	yes	yes	yes	yes
Other controls (2)	no	yes	no	yes
Sectoral fixed effects	yes	yes	yes	yes
Observations	275.4	242.6	240.8	230.9
Q (3)	79	76	79	76
Degrees of Freedom test Q	0.713	0.687	0.672	0.671
I^2 (4)	15.62	11.87	30.02	30.92
τ^2 (5)	17.90	34.78	24.52	26.58
Adjusted R-squared	0.277	0.347	0.245	0.231

Note: Coefficients are obtained from the baseline model with structural breaks (equation (2)). This model is estimated for each of the available 29 lending countries (we excluded South Korea for which data are not available in the pre-break period) and for three different borrowers: banks, public sector and non-banks. We obtain therefore 29*3=87 observations. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. (1) Prudential measures include loan-to-value ratio caps and capital requirements. The regulatory stringency index is based on the World Bank's Bank Regulation and Supervision Survey. The index takes a value between 0 (least stringent) and 1 (most stringent) based on 18 questions about bank capital requirements, the legal powers of supervisory agencies, etc. (2) They include the following pre-break average banking system characteristics: expected default frequency, deposit to total asset ratio and net interest income over total income. (3) The Q Measure evaluates the level of homogeneity/heterogeneity among studies. It is calculated as the weighted squared difference of the estimated effects with respect to the mean. The statistical distribution of this measure follows a $\chi 2$ distribution. The null hypothesis of the test assumes homogeneity in the effect sizes. (4) This percentage represents the magnitude of the level of heterogeneity in effect sizes and it is defined as the percentage of the residual variation that it is attributable to between study heterogeneity. It is defined as the difference between the Q measure and the degrees of freedom divided by the Q measure. Although there can be no absolute rule for when heterogeneity becomes important, Harbord and Higgins (2008) tentatively suggest adjectives of low for I2 values between 25% and 50%, moderate for 50%-75% and high for values larger than 75%. (5) $\tau 2$ is a measure of population variability in effect sizes. It depends positively on the observed heterogeneity (Q measure) and its difference with respect to the degrees of freedom. The expected value of Q measure under the null hypothesis of homogeneity is equal to the degrees of freedom; a homogeneous set of studies will result in this statistic equal to zero. Under the presence of heterogeneity this estimate should be different from zero.

Table 6 - Drivers of the shifts in lender-specific weights

	Dependent variable: Change in the lending national banking system weights $w^{Postbreak} - w^{PreBreak}$		
Explanatory variables	(I)	(II)	(III)
Pre-break capital ratio (2008)	0.189**	0.205**	0.238**
	(0.093)	(0.100)	(0.114)
Pre-break average bank size (2008)	0.507*	0.464	0.537*
	(0.292)	(0.297)	(0.308)
Local claims over Foreign claims (2008)			0.051**
			(0.021)
Prudential measures and regulatory stringency index (1)	yes	yes	yes
Other controls (2)	no	yes	yes
Sectoral fixed effects	yes	yes	yes
Observations	87	87	75
Adjusted R-squared	0.097	0.119	0.235

Note: The dependent variable is the difference in lending national banking system weights, expressed in percentage terms. Weights are available for 29 lending countries (we excluded South Korea for which data are not available in the pre-break period) and 3 different sectors (total of 29*3=87 observations). In the last column the number of observations drops to 75 because the average level of local claims over foreign claims is not available for Chile, Hong Kong, Luxemburg and Mexico. Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. (1) Prudential measures include loan-to-value ratio caps and capital requirements. The regulatory stringency index is constructed as an index based on the World Bank's Bank Regulation and Supervision Survey. The index takes a value between 0 (least stringent) and 1 (most stringent) based on 18 questions about bank capital requirements, the legal powers of supervisory agencies, etc. (2) They include the following pre-break average banking system characteristics: expected default frequency, deposit to total asset ratio and net interest income over total income.

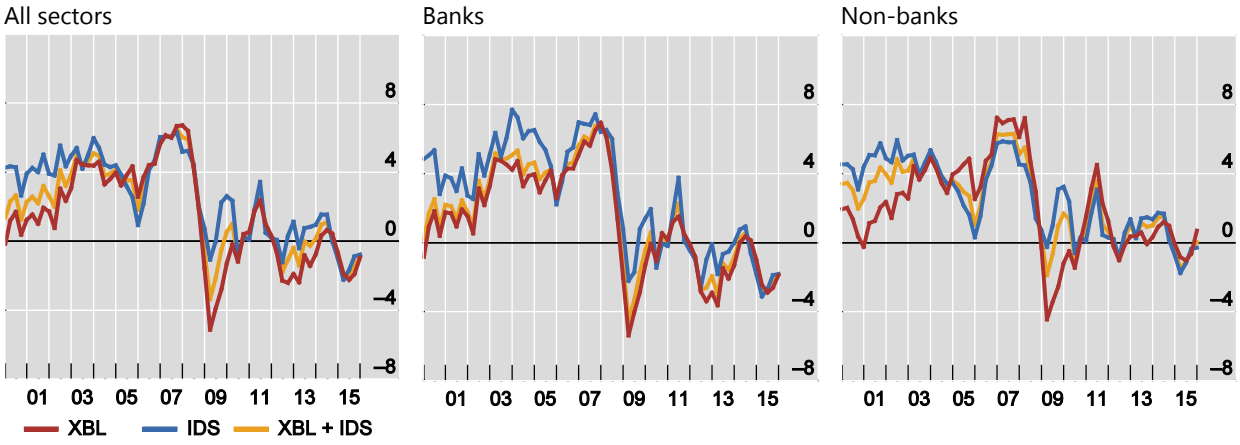
Table 7 Monetary Policy Divergence and Banking Net Interest Share in Time Varying Sensitivities

Explanatory variables	Cross-border loans					International debt securities				
Post										
ΔFFR (1)	-9.437***	-11.31***	-8.428***	-5.913**	-5.987**	-5.913**	-8.95**	-7.164**	-5.85	-6.86*
	(1.865)	(2.624)	(1.870)	(2.630)	(2.702)	(2.630)	(8.684)	(3.246)	(23.11)	(34.33)
Log(VIX)	-4.647***	-3.790	-4.548***	-4.378**	-3.628*	-4.378**	-8.65**	-5.767**	-3.81	-2.44
	(1.350)	(2.314)	(1.290)	(1.837)	(1.903)	(1.837)	(7.665)	(2.638)	(28.69)	(42.34)
ΔFFR (1) * PolicyDivergence (2)	8.739***	8.334***	8.585***	7.707***	7.963***	2.789	2.129	0.386	2.670	0.200
	(2.365)	(2.453)	(2.535)	(2.277)	(2.531)	(2.625)	(2.741)	(3.022)	(2.683)	(2.997)
Log(VIX) * PolicyDivergence (2)	10.06***	10.28***	10.26***	7.051***	6.702***	5.361*	5.012	3.464	4.539	1.564
	(2.330)	(2.322)	(2.403)	(2.460)	(2.525)	(3.119)	(3.124)	(3.185)	(3.135)	(3.254)
Lenders' capitalization (3)	no	yes	no	no	yes	no	yes	no	no	yes
Lenders' profitability (4)	no	no	yes	no	yes	no	no	yes	no	yes
Lenders' interest margins (5)	no	no	no	yes	yes	no	no	no	yes	yes
Borrowing country FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	3,377	3,327	3,327	3,327	3,327	3,377	3,327	3,327	3,327	3,327
R-squared	0.168	0.172	0.181	0.176	0.197	0.071	0.075	0.081	0.074	0.089

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 – 2015:Q4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. (2) Difference between the 2-year futures on the policy rate for the United States and the average of the 2-year futures for the United Kingdom, Switzerland, Japan and a group of "core" Eurozone countries (Austria, Belgium, Germany, Finland, France, the Netherlands, Spain). (3) Weighted average of lenders' capitalization for borrowers in country *j*. (4) Weighted average of lenders' net interest to total assets for borrowers in country *j*. (5) Weighted average of lenders' net interest income to total income. The regressions include ΔFFR, Log(VIX), ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP and lenders' characteristics. Please note that both pre-break and post-break coefficients enter independently and interacted with monetary policy divergence and with lenders' characteristics. For the sake of brevity, only Post-Break coefficients are reported in the table. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

External debt flows, all borrowers

Four-quarter moving average of quarterly growth rates, in per cent — Graph 1

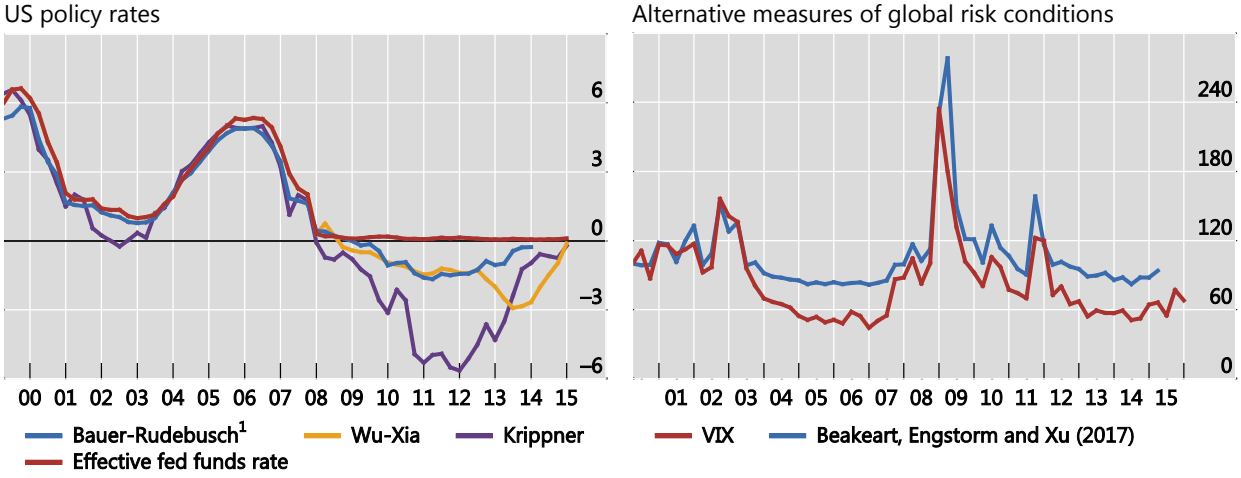


XBL = Cross-border loans: Quarterly Growth Rate$_t$ = (Outstanding Stock$_t$ / Outstanding Stock$_{t-1}$)-1; IDS = International Debt Securities: Quarterly Growth Rate$_t$ = (Outstanding Stock$_t$ / Outstanding Stock$_{t-1}$)-1.

Sources: BIS Locational Banking Statistics by residence; BIS International Debt Securities Statistics.

US policy rates and measures of global risk conditions

Graph 2

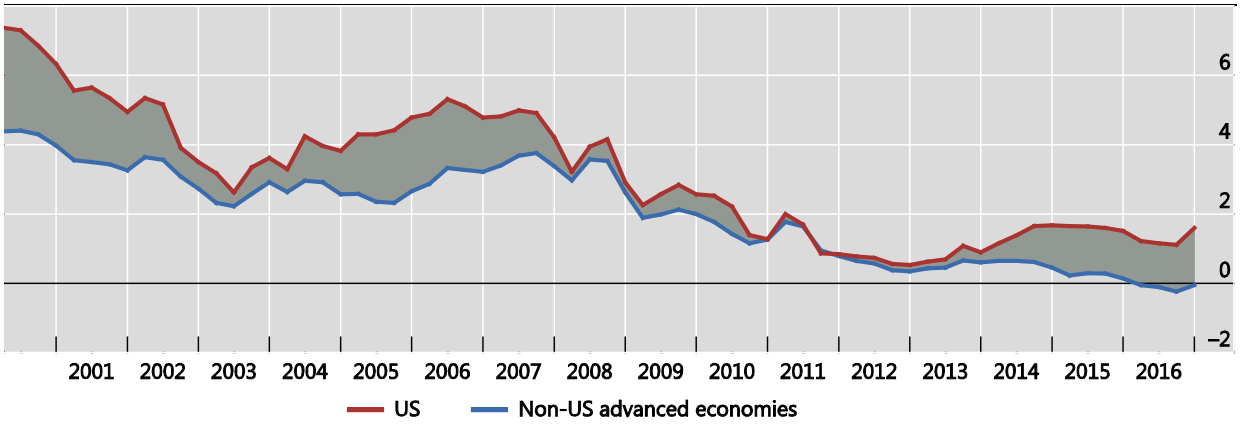


[1] Median of 12 shadow rate estimates.

Sources: Bauer and Rudebusch (2016); Beakeart, Engstorm and Xu (2017); Krippner (2014); Wu and Xia (2015); Datastream.

AE monetary policy divergence

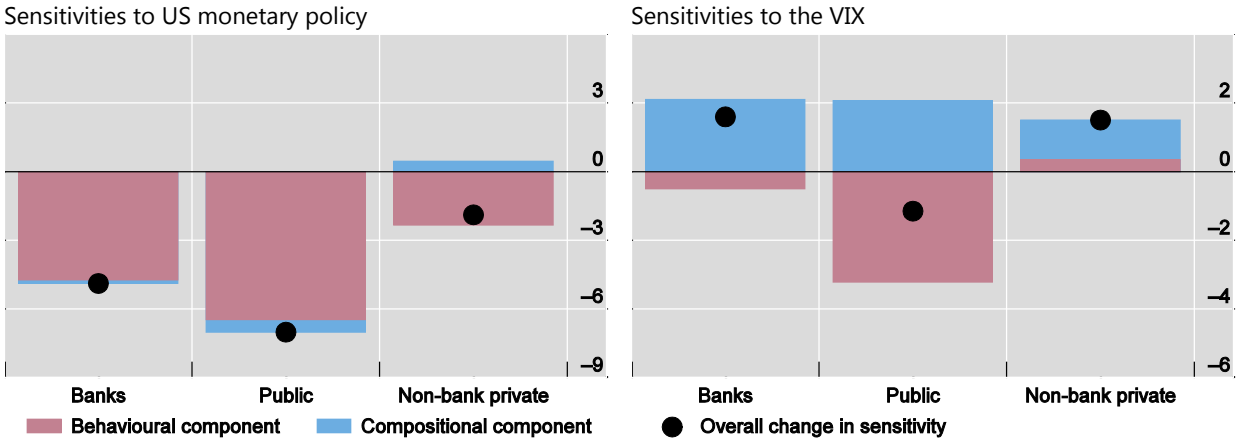
2-year futures on the policy rate — Graph 3



Non-US advanced economies equals the average of the 2-year futures for the United Kingdom, Switzerland, Japan and a group of "core" euro area countries (Austria, Belgium, Germany, Finland, France, the Netherlands and Spain).

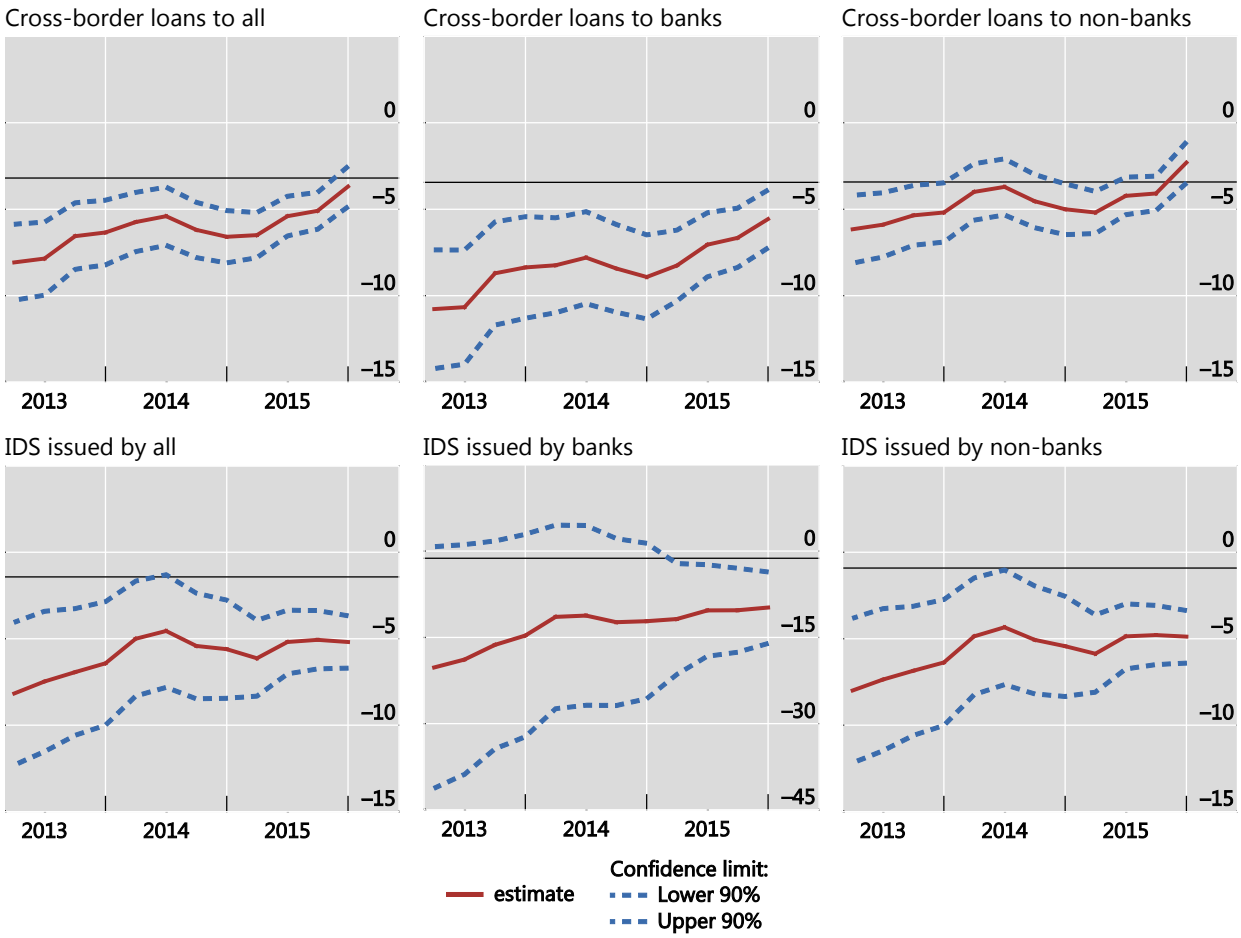
Sources: Bloomberg; authors' calculations.

Decomposing the shifts in lender-specific sensitivities, by borrowing sector — Graph 4



Sources: BIS consolidated banking statistics; authors' calculations.

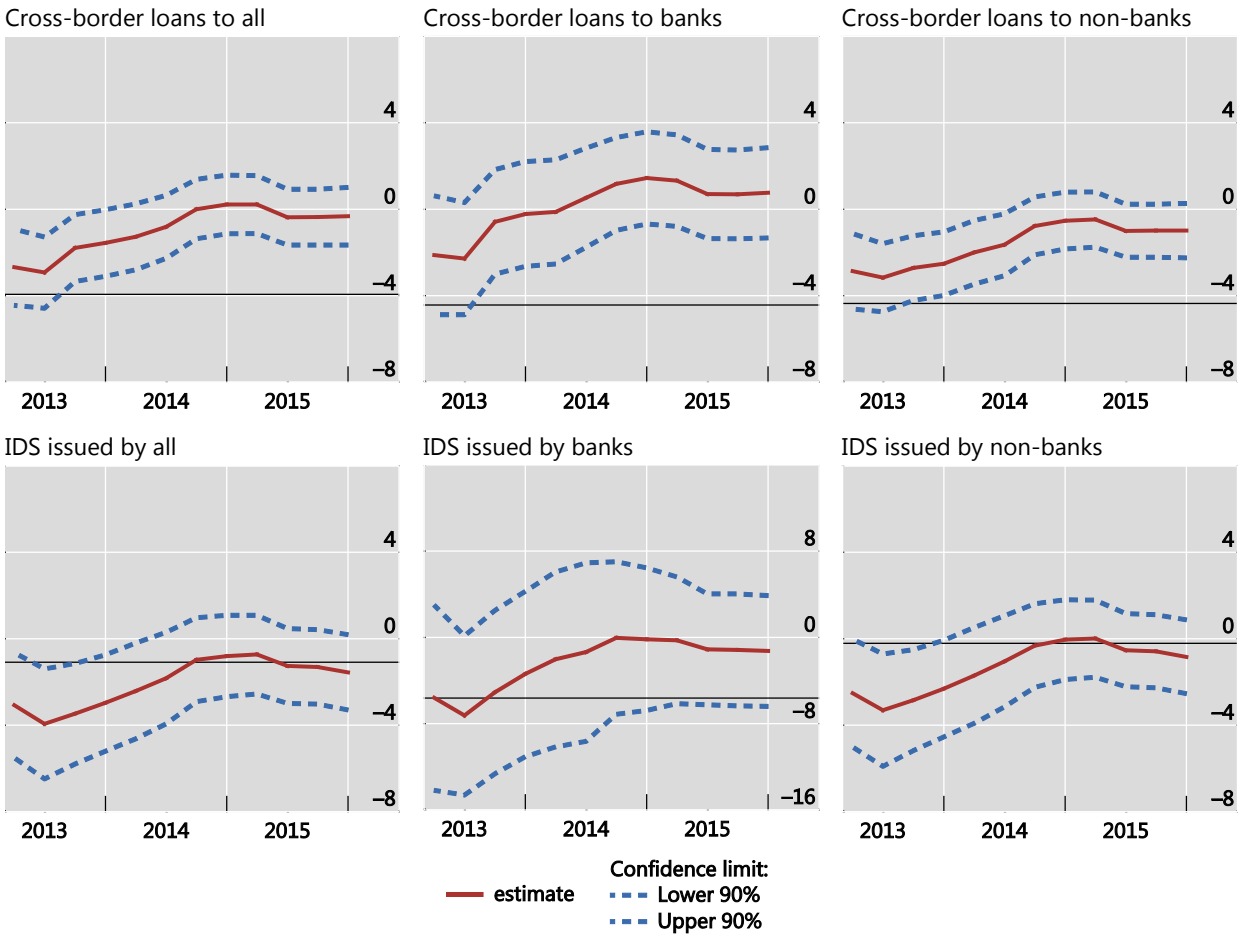
Post-break sensitivities to ΔFFR, evolution over time Graph 5



The graph shows the evolution over time of sensitivities to the ΔFFR. For each quarter t, the charts show the post-break coefficient (and its 90% confidence interval) obtained by estimating the model with a sample from 2000:Q1 up to quarter t, with a break in 2009:Q1. The model includes the log(VIX), ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP, ΔFFR (i.e. ΔEffective federal funds rate for the period 2001:Q1 – 2008:Q4, ΔWu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4) as explanatory variables. The black line in each panel represents the pre-break estimate of the sensitivity to ΔFFR.

Sources: authors' calculations.

Post-break sensitivities to log(VIX), evolution over time Graph 6



The graph shows the evolution over time of sensitivities to the log(VIX). For each quarter t, the charts show the post-break coefficient (and its 90% confidence interval) obtained by estimating the model with a sample from 2000:Q1 up to quarter t, with a break in 2009:Q1. The model includes the log(VIX), ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP, ΔFFR (i.e. ΔEffective federal funds rate for the period 2001:Q1 – 2008:Q4, ΔWu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4) as explanatory variables. The black line in each panel represents the pre-break estimate of the sensitivity to the log(VIX).

Sources: authors' calculations.

Annex A: Country lists

Borrowing countries (64)

Argentina (AR), Australia (AU), Austria (AT), Belgium (BE), Brazil (BR), Bulgaria (BG), Canada (CA), Chile (CL), China (CN), Colombia (CO), Croatia (HR), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (GR), Hong Kong SAR (HK), Hungary (HU), Iceland (IS), India (IN), Indonesia (ID), Ireland (IE), Israel (IL), Italy (IT), Japan (JP), Korea (KR), Kuwait (KW), Latvia (LV), Lebanon (LB), Lithuania (LT), Luxembourg (LU), Malaysia (MY), Malta (MT), Mexico (MX), Mongolia (MN), Netherlands (NL), New Zealand (NZ), Nigeria (NG), Norway (NO), Peru (PE), Philippines (PH), Poland (PL), Portugal (PT), Romania (RO), Russia (RU), Saudi Arabia (SA), Serbia (RS), Singapore (SG), Slovakia (SK), Slovenia (SI), South Africa (ZA), Spain (ES), Sweden (SE), Switzerland (CH), Taiwan (TW), Thailand (TH), Turkey (TR), Ukraine (UA), United Kingdom (GB), United States (US), Uruguay (UY), Vietnam (VN).

CBS lending bank nationalities (31)

Australia (AU), Austria (AT), Belgium (BE), Brazil (BR), Canada (CA), Chile (CL), Denmark (DK), Finland (FI), France (FR), Germany (DE), Greece (GR), Hong Kong SAR (HK), India (IN), Ireland (IE), Italy (IT), Japan (JP), Korea (KR), Luxembourg (LU), Mexico (MX), Netherlands (NL), Norway (NO), Panama (PA), Portugal (PT), Singapore (SG), Spain (ES), Sweden (SE), Switzerland (CH), Taiwan (TW), Turkey (TR), United Kingdom (GB), United States (US).

Annex B: Additional tables and graphs

Table B1 - Descriptive statistics of the explanatory variables

Variables	Obs.	Mean	Std. Dev.	Min	Max
Global factors					
ΔFed fund rates (1)	4,069	-0.08	0.52	-1.73	1.00
Log (VIX)	4,069	2.97	0.34	2.40	4.07
ΔGlobal GDP	4,069	3.66	1.67	-2.49	5.75
ΔOther AE monetary policy (2)	4,069	-0.08	0.48	-1.64	1.73
Δ1-year US Treasury rates	4,069	-0.09	0.40	-1.51	0.60
Δ2-year US Treasury rates	4,069	-0.09	0.40	-1.46	0.77
Δ10-year US Treasury rates	4,069	-0.07	0.34	-0.83	0.72
Country-specific variables					
ΔGDP	3,658	3.15	3.91	-19.30	28.10
ΔSovereign ratings (3)	3,901	0.01	0.26	-4.67	2.43
Chinn-Ito index (4)	3,872	0.74	0.32	0.00	1.00
ΔPolicy rates	2,551	-0.10	1.47	-39.44	33.91
Δ1-year rates	2,395	-0.08	0.70	-5.94	5.09
Δ2-year rates	2,042	0.008	2.49	-11.12	82.05
ΔExchange rate vis à vis the US dollar	3,879	0.002	0.04	-0.17	0.42
Prudential tools (5)					
LTV caps (6)	1,149	0.47	1.73	-3.00	8.00
Capital requirements (7)	3,192	0.16	0.41	0.00	2.00
Lenders' balance sheet characteristics					
Pre-break capital ratio (8)	30	0.08	0.04	0.04	0.24
Pre-break average bank size (8)	30	14.92	1.14	12.84	17.01
Pre-break deposits to total assets (8)	30	0.75	0.10	0.53	0.94
Net interest income to total assets (9)	4,069	0.63	0.50	-3.81	2.96
Interest income to total income (9)	4,069	0.66	0.03	0.52	0.77
Equity to total assets (9)	4,069	0.12	0.02	0.07	0.19
Monetary policy divergence proxy					
Spread on 2-year futures on the policy rate (10)	4,069	1.05	0.76	0.01	3.00

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4, except for the prudential tools for which the data end in 2014:Q4. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. (2) Simple average of the Krippner shadow rates for the Euro area, the UK and Japan. (3) Long term foreign currency sovereign rating, average across 3 agencies (S&P, Moody's and Fitch). (4) Measure of financial openness developed in Chinn and Ito (2008). (5) A higher prudential index indicates a tightening. (6) Cumulative caps on loan to value ratio. (7) Cumulative capital requirements. Each cumulative prudential index is obtained in each quarter by adding the non-cumulative prudential index up to that quarter. (8) These aggregate balance sheet characteristics of the banking sector pertain to the 30 lending countries in our sample. They refer to the end of the year 2008, right before the structural break in our model. (9) This variable is borrower-specific and is computed as the weighted average for all countries lending to a specific borrower. (10) Difference between 2-year futures contract on the US policy rate and the simple average of similar futures contracts for other advanced economies (CH, EUR, JP, UK).

Table B2 – Time difference in the coefficients of US monetary policy and global risk

	Dependent variable: ΔCross-border loans †			Dependent variable: ΔInternational debt securities ‡			Dependent variable: ΔTotal cross-border flows (loans and debt securities)		
	All	to banks	to non-banks	All	by banks	by non-banks	All	to banks	to non-banks
Difference between post-break – up to 2013:Q1 – and pre-break coefficients									
ΔFF (1)	-4.82***	-7.23***	-2.76**	-6.63***	-19.15*	-6.97***	-5.82***	-8.77***	-4.29***
	(1.42)	(2.24)	(1.31)	(2.71)	(12.82)	(2.81)	(1.06)	(2.08)	(1.00)
VIX (2)	1.56	2.88	1.51	-1.76	-0.28	-2.06	0.16	1.84	-0.06
	(1.41)	(2.32)	(1.50)	(1.94)	(5.84)	(2.16)	(1.05)	(2.12)	(1.05)
Difference between post-break – up to 2015:Q4 – and post-break – up to 2013:Q1 – coefficients									
ΔFF (1)	4.39***	5.21**	3.87	2.98	10.42	3.12	3.59***	5.60***	2.60***
	(1.51)	(2.32)	(1.39)	(2.67)	(13.30)	(2.71)	(1.11)	(2.13)	(1.05)
VIX (2)	2.36	2.91*	1.87*	1.52	4.35	1.69	1.96**	3.16*	1.75**
	(1.34)	(2.10)	(1.31)	(1.82)	(6.09)	(1.84)	(1.03)	(2.00)	(0.98)
Difference between post-break – up to 2015:Q4 – and pre-break coefficients									
ΔFF (1)	-0.43	-2.02*	1.11	-3.65***	-8.73**	-3.85***	-2.23***	-3.17***	-1.70***
	(0.86)	(1.30)	(0.91)	(1.38)	(4.02)	(1.52)	(0.59)	(1.10)	(0.61)
VIX (2)	3.92***	5.79***	3.38***	-0.24	4.08	-0.37	2.12***	5.00***	1.69**
	(1.22)	(2.05)	(1.31)	(1.65)	(4.07)	(1.85)	(0.88)	(1.81)	(0.89)

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. (2) Log(VIX). The regressions include ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP and their interaction with a break dummy that takes value 1 after the break date (2009:Q1). The regressions also include a full set of country fixed effects.

Table B3 – Locational baseline regressions (by borrowing country) with alternative measures of US monetary policy

	Dependent variable: ΔCross-border loans †			Dependent variable: ΔInternational debt securities ‡		
Explanatory variables	All	to banks	to non-banks	All	by banks	by non-banks
Krippner rates as a measure of US monetary policy						
Δ Krippner (1)	-1.12***	-0.77**	-1.21***	-0.81	-1.72**	-0.73
	(0.27)	(0.39)	(0.29)	(0.54)	(0.84)	(0.54)
Log(VIX)	-3.87***	-2.88**	-4.29***	-2.85***	-7.47***	-2.09**
	(0.71)	(1.16)	(0.78)	(0.99)	(2.53)	(0.97)
Bauer-Rudebusch rates as a measure of US monetary policy						
Δ Bauer-Rudebusch (2)	-1.78***	-1.84***	-1.99***	-2.04**	-0.24	-1.78***
	(0.44)	(0.64)	(0.49)	(1.00)	(1.54)	(0.44)
Log(VIX)	-3.33***	-2.99***	-3.77***	-3.04***	-4.72**	-3.34***
	(0.63)	(1.04)	(0.68)	(0.78)	(2.14)	(0.63)
1-year US treasury bond rates as a measure of US monetary policy						
Δ 1-year US rates (3)	-2.313***	-1.872**	-3.074***	-1.707	-0.700	-1.098
	(0.564)	(0.857)	(0.615)	(1.441)	(1.998)	(1.528)
Log(VIX)	-2.956***	-2.041*	-3.879***	-2.402***	-4.207*	-1.405
	(0.675)	(1.090)	(0.715)	(0.896)	(2.245)	(0.995)
2-year US treasury bond rates as a measure of US monetary policy						
Δ 2-year US rates (4)	-2.156***	-1.436*	-2.848***	-0.585	-0.280	-0.256
	(0.558)	(0.848)	(0.607)	(1.370)	(1.973)	(1.514)
Log(VIX)	-3.008***	-1.828	-3.932***	-1.613*	-3.916*	-0.799
	(0.702)	(1.137)	(0.748)	(0.966)	(2.298)	(1.065)

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2014:Q4. The regressions include a full set of country fixed effects. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Estimate of the Fed fund shadow rate based on Krippner (2014). (2) Measure of the Fed fund shadow rate based on Bauer and Rudebusch (2016). (3) Interest rates on 1-year US Treasuries. (4) Interest rates on 2-year US Treasuries. The regressions include ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP and their interaction with a break dummy that takes value 1 after the break date (2009:Q1). The regressions also include a full set of country fixed effects.

Table B4 - Locational baseline regressions (by borrowing country) with alternative measures of US monetary policy and with a structural break

	Dependent variable: ΔCross-border loans †			Dependent variable: ΔInternational debt securities ‡			Dependent variable: ΔTotal cross-border flows (loans and debt securities)		
	All	to banks	to non-banks	All	by banks	by non-banks	All	to banks	to non-banks
1-year US treasury bond rates as a measure of US monetary policy									
Pre									
ΔFF (1)	-3.17***	-2.74***	-4.06***	-1.87	-2.16	-1.12	-2.12***	-1.73**	-2.42***
	(0.62)	(0.98)	(0.71)	(1.55)	(1.71)	(1.71)	(0.43)	(0.86)	(0.47)
VIX (2)	-4.86***	-5.02**	-5.75***	-2.10*	-6.77*	-0.94	-3.71***	-4.00**	-3.64***
	(1.15)	(2.04)	(1.31)	(1.25)	(3.58)	(1.68)	(0.81)	(1.74)	(0.86)
Post - up to 2013:Q1									
ΔFF (1)	3.81	4.76	3.19	7.61	29.63	6.99	4.59	4.68	2.88
	(4.24)	(6.53)	(3.82)	(6.20)	(43.60)	(6.38)	(3.47)	(6.23)	(3.24)
VIX (2)	-2.33*	-1.70	-2.56**	-2.11	-1.61	-1.65	-2.66***	-2.35	-2.63***
	(1.23)	(1.89)	(1.25)	(1.71)	(10.10)	(1.77)	(0.97)	(1.88)	(0.96)
Post - up to 2015:Q4									
ΔFF (1)	0.33	-2.19	2.17	-4.50	4.47	-4.50	-2.62	-4.12	-3.66
	(3.66)	(5.30)	(3.46)	(4.71)	(28.43)	(4.84)	(2.82)	(4.78)	(2.71)
VIX (2)	-0.07	0.80	-0.58	-1.86	-0.06	-1.16	-1.29*	0.20	-1.41**
	(0.91)	(1.42)	(0.90)	(1.26)	(6.28)	(1.27)	(0.68)	(1.31)	(0.69)
2-year US treasury bond rates as a measure of US monetary policy									
Pre									
ΔFF (3)	-2.90***	-2.02**	-3.83***	-0.67	-1.46	-0.11	-1.77***	-1.12	-1.89***
	(0.62)	(0.98)	(0.71)	(1.45)	(1.47)	(1.70)	(0.42)	(0.88)	(0.46)
VIX (2)	-4.82***	-4.36**	-5.82***	-0.75	-6.06*	0.25	-3.47***	-3.38*	-3.19***
	(1.20)	(2.15)	(1.37)	(1.29)	(3.51)	(1.80)	(0.84)	(1.84)	(0.88)
Post - up to 2013:Q1									
ΔFF (3)	-0.54	-2.09	1.05	8.69**	8.06	4.93	1.67	-1.28	2.45
	(2.61)	(3.70)	(2.63)	(4.08)	(21.91)	(3.14)	(2.05)	(3.51)	(2.05)
VIX (2)	-3.07***	-2.99*	-2.80**	-1.13	-4.37	-1.52	-2.97***	-3.42*	-2.47***
	(1.18)	(1.81)	(1.22)	(1.85)	(8.75)	(1.74)	(0.93)	(1.78)	(0.92)
Post - up to 2015:Q4									
ΔFF (3)	-1.44	-3.96	1.17	3.21	0.75	0.21	-1.30	-4.10	-0.39
	(2.48)	(3.46)	(2.50)	(3.64)	(18.41)	(2.89)	(1.88)	(3.19)	(1.90)
VIX (2)	-0.46	0.15	-0.59	-0.49	-0.49	-0.51	-1.24*	-0.22	-1.01
	(0.98)	(1.48)	(0.97)	(1.53)	(6.66)	(1.31)	(0.72)	(1.36)	(0.73)

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Interest rates on 1-year US Treasuries. (2) Log(VIX). The regressions include ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP and their interaction with a break dummy that takes value 1 after the break date (2009:Q1). The regressions also include a full set of country fixed effects. (3) Interest rates on 2-year US Treasuries.

Table B5 – Locational baseline regressions (by borrowing country) with additional controls

	Dependent variable: ΔCross-border loans †			Dependent variable: ΔInternational debt securities ‡		
Explanatory variables	All	to banks	to non-banks	All	by banks	by non-banks
Controls for **local policy rates**, exchange rates, 10-year US rates and lagged flows						
Δ Fed funds rate (1)	-1.550***	-2.230***	-1.337**	-0.807*	-1.831	-0.606
	(0.484)	(0.729)	(0.543)	(0.474)	(1.378)	(0.481)
Log(VIX)	-1.364	-0.578	-2.696***	-1.875**	-3.483	-0.493
	(0.845)	(1.336)	(0.985)	(0.748)	(3.734)	(0.970)
ΔReal GDP	0.639***	0.810***	0.534***	0.0902	0.0474	-0.00160
	(0.0931)	(0.141)	(0.102)	(0.0916)	(0.372)	(0.102)
ΔSovereign rating (2)	0.337*	0.757***	0.204	-0.0636	-0.544	0.149
	(0.197)	(0.270)	(0.197)	(0.178)	(0.769)	(0.226)
Chinn-Ito index (3)	2.836*	3.371*	0.311	-0.779	-1.059	-0.913
	(1.553)	(2.031)	(1.281)	(1.086)	(2.382)	(1.256)
ΔReal global GDP	-1.526	-2.730	-0.678	6.706***	8.553	3.605**
	(2.380)	(3.431)	(2.518)	(1.691)	(6.323)	(1.792)
Δ Local policy rates	0.320	-0.152	0.551**	-0.0635	2.031	-0.275
	(0.256)	(0.458)	(0.251)	(0.229)	(1.249)	(0.288)
Δ 10-year US rates	0.669	1.388	-0.657	0.969	1.789	1.728*
	(0.692)	(1.011)	(0.783)	(0.600)	(4.506)	(1.049)
Δ Log(exchange rates) (4)	-42.92***	-53.85***	-32.26***	-34.39***	-93.51***	-32.72***
	(4.193)	(6.356)	(4.563)	(3.504)	(30.09)	(3.725)
Δ other AE MP (5)	0.56	2.58**	1.43	0.04	1.82**	1.31
	(0.97)	(1.24)	(1.23)	(0.27)	(1.14)	(1.35)
Lagged dependent var.	yes	yes	yes	yes	yes	yes
Observations	2,252	2,252	2,252	2,252	2,021	2,252
R-squared	0.151	0.111	0.086	0.091	0.041	0.063
Controls for **local 1-year rates**, exchange rates, 10-year US rates and lagged flows						
Δ Fed funds rate (1)	-1.199***	-1.020*	-1.895***	-1.263	-1.732	-1.226
	(0.418)	(0.586)	(0.487)	(1.025)	(1.057)	(1.044)
Log(VIX)	-0.522	1.037	-2.511***	-0.567	-4.843*	-0.159
	(0.679)	(0.970)	(0.825)	(1.115)	(2.504)	(0.940)
ΔReal GDP	0.250***	0.289***	0.168**	0.103	-0.122	0.139
	(0.0674)	(0.0984)	(0.0848)	(0.129)	(0.214)	(0.141)
ΔSovereign rating (2)	0.770***	1.112***	0.588***	0.197	0.890	-0.112
	(0.144)	(0.213)	(0.153)	(0.335)	(0.578)	(0.318)
Chinn-Ito index (3)	0.397	1.407	-1.417**	-1.138	-5.788	-0.264
	(0.527)	(0.891)	(0.712)	(1.084)	(5.012)	(1.013)
ΔReal global GDP	-9.986***	-10.03***	-8.180***	7.026	-5.903	5.273
	(2.547)	(3.710)	(2.942)	(4.404)	(7.631)	(4.592)
Δ Local policy rates	0.530**	0.529	0.350	-1.219**	-0.903	-0.928*
	(0.251)	(0.405)	(0.352)	(0.530)	(1.034)	(0.475)
Δ 10-year US rates	0.332	1.353*	-0.852	2.202*	-0.977	1.906*
	(0.533)	(0.757)	(0.673)	(1.229)	(1.865)	(1.016)
Δ Log(exchange rates) (4)	-50.75***	-60.62***	-36.21***	-47.64***	-56.09***	-45.08***
	(3.819)	(5.503)	(4.367)	(7.491)	(14.01)	(7.577)
Δ other AE MP (5)	0.23	3.32**	1.03	0.36	1.21**	1.12
	(0.76)	(1.41)	(1.09)	(0.91)	(0.58)	(0.99)
Lagged dependent var.	yes	yes	yes	yes	yes	yes
Observations	2,145	2,145	2,145	2,145	2,003	2,143
R-squared	0.195	0.143	0.103	0.091	0.083	0.076

Controls for **local 2-year rates**, exchange rates, 10-year US rates and lagged flows

Δ Fed funds rate (1)	-1.248***	-1.377**	-1.903***	-0.649	-2.267	-0.246
	(0.423)	(0.567)	(0.517)	(0.454)	(1.502)	(0.426)
Log(VIX)	-0.754	-0.00211	-2.286***	0.157	-0.303	1.732*
	(0.727)	(1.076)	(0.885)	(0.694)	(4.347)	(0.974)
ΔReal GDP	0.246***	0.304**	0.170*	0.0488	-0.804	0.0514
	(0.0866)	(0.134)	(0.0990)	(0.0901)	(0.578)	(0.110)
ΔSovereign rating (2)	0.951***	1.321***	0.697***	0.0647	0.688	0.149
	(0.156)	(0.224)	(0.172)	(0.169)	(0.747)	(0.227)
Chinn-Ito index (3)	1.820***	2.232**	-0.445	0.712	-3.812	0.935
	(0.670)	(1.014)	(0.850)	(0.794)	(5.071)	(0.736)
ΔReal global GDP	-6.550**	-5.006	-5.171	3.265	2.972	3.576
	(3.184)	(4.832)	(3.444)	(2.945)	(12.44)	(2.840)
Δ Local policy rates	-0.0113	-0.128	0.102*	-0.0991	-0.194	-0.308**
	(0.0548)	(0.104)	(0.0573)	(0.0731)	(0.188)	(0.122)
Δ 10-year US rates	-0.165	0.356	-0.607	2.129***	3.830	3.199***
	(0.569)	(0.822)	(0.702)	(0.577)	(5.019)	(1.153)
Δ Log(exchange rates) (4)	-52.66***	-62.54***	-35.46***	-43.93***	-92.36**	-39.82***
	(3.926)	(5.603)	(4.688)	(3.577)	(36.89)	(3.934)
Δ other AE MP (5)	0.10	1.02**	3.34	1.06	1.61**	1.23
	(0.56)	(0.48)	(4.95)	(0.82)	(0.79)	(1.15)
Lagged dependent var.	yes	yes	yes	yes	yes	yes
Observations	1,955	1,955	1,955	1,955	1,907	1,955
R-squared	0.184	0.136	0.091	0.142	0.046	0.104

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4. The regressions include a full set of country fixed effects. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Interest rates on 1-year US Treasuries. (2) Long term foreign currency sovereign rating, average across 3 agencies (S&P, Moody's and Fitch). (3) Measure of financial openness developed in Chinn and Ito (2008). (4) Exchange rates vis à vis the US dollar. (5) Simple average of the Krippner shadow rates for the Euro area, the UK and Japan.

Table B6 - Locational baseline regressions with additional controls and structural breaks

	Dependent variable: ΔCross-border loans †			Dependent variable: ΔInternational debt securities ‡			Dependent variable: ΔTotal cross-border flows		
	All	to banks	to non-banks	All	by banks	by non-banks	All	to banks	to non-banks
Controls for **local policy rates**, exchange rates, 10-year US rates and lagged flows									
Pre									
ΔFF (1)	-3.40***	-3.94***	-3.40***	-0.81	-1.97	-0.95	-2.22***	-3.22***	-2.41***
	(0.70)	(1.06)	(0.83)	(0.68)	(2.31)	(0.70)	(0.48)	(0.96)	(0.50)
VIX (2)	-4.04***	-4.68*	-5.36***	-1.99	-7.99	-0.33	-3.13***	-4.61**	-3.18***
	(1.44)	(2.41)	(1.79)	(1.30)	(5.09)	(1.83)	(1.01)	(2.22)	(1.07)
Post - up to 2013:Q1									
ΔFF (1)	-4.30**	-6.52**	-2.20	-1.42	-14.98	-1.98	-2.88**	-5.90**	-2.22*
	(2.07)	(2.80)	(2.14)	(1.56)	(10.49)	(1.74)	(1.29)	(2.63)	(1.31)
VIX (2)	0.06	0.31	-0.39	-4.63**	-7.63	-3.72*	-0.85	-0.29	-1.52
	(1.64)	(2.22)	(1.82)	(1.90)	(11.79)	(2.04)	(1.12)	(2.10)	(1.18)
Post - up to 2015:Q4									
ΔFF (1)	-1.13	-3.01**	0.69	-1.86***	-5.28*	-1.63**	-1.28**	-2.74**	-0.83
	(0.94)	(1.29)	(1.02)	(0.65)	(2.84)	(0.69)	(0.59)	(1.13)	(0.55)
VIX (2)	1.34	2.66*	0.30	-2.19**	-0.37	-0.86	0.30	2.05	-0.08
	(1.07)	(1.54)	(1.13)	(1.02)	(5.94)	(1.10)	(0.71)	(1.38)	(0.75)
Controls for **local 1-year rates**, exchange rates, 10-year US rates and lagged flows									
Pre									
ΔFF (1)	-2.51***	-1.19	-4.21***	-1.72	0.41	-2.16	-1.55***	-1.08	-2.05***
	(0.64)	(0.96)	(0.82)	(1.70)	(1.89)	(1.74)	(0.47)	(0.85)	(0.53)
VIX (2)	-2.31*	-0.10	-6.99***	-1.49	-7.54**	-1.10	-1.88*	-0.74	-3.23***
	(1.34)	(2.04)	(1.79)	(1.47)	(3.78)	(1.71)	(0.98)	(1.79)	(1.07)
Post - up to 2013:Q1									
ΔFF (1)	-2.22	-2.65	-2.11	-5.30	-7.61*	-6.00	-2.34*	-3.19	-2.10
	(1.50)	(2.22)	(1.60)	(3.92)	(4.33)	(3.93)	(1.20)	(1.95)	(1.33)
VIX (2)	-0.31	0.15	-0.30	-1.07	-10.29	-1.17	-0.35	-0.16	0.08
	(1.18)	(1.67)	(1.32)	(2.44)	(7.31)	(2.21)	(0.97)	(1.54)	(1.04)
Post - up to 2015:Q4									
ΔFF (1)	-0.75	-2.01**	0.32	-2.96***	-3.26*	-2.63***	-1.15**	-2.17***	-0.64
	(0.70)	(0.95)	(0.78)	(0.95)	(1.74)	(0.97)	(0.48)	(0.79)	(0.47)
VIX (2)	0.85	2.26**	-0.22	-0.15	-4.05	0.30	0.65	1.88**	0.33
	(0.78)	(1.06)	(0.84)	(1.55)	(3.13)	(1.27)	(0.61)	(0.94)	(0.64)
Controls for **local 2-year rates**, exchange rates, 10-year US rates and lagged flows									
Pre									
ΔFF (1)	-2.76***	-2.64***	-3.69***	-0.34	-2.27	-0.19	-1.59***	-2.11***	-1.68***
	(0.60)	(0.81)	(0.78)	(0.66)	(2.25)	(0.62)	(0.44)	(0.70)	(0.48)
VIX (2)	-2.14*	-1.34	-5.63***	-0.32	-5.39	1.72	-1.32	-0.92	-1.67*
	(1.19)	(1.80)	(1.63)	(1.38)	(4.53)	(2.10)	(0.89)	(1.54)	(1.00)
Post - up to 2013:Q1									
ΔFF (1)	-2.94*	-2.60	-3.84**	-2.09	-19.86*	-1.78	-2.99**	-2.96	-2.59*
	(1.65)	(2.32)	(1.72)	(1.55)	(11.94)	(1.80)	(1.33)	(1.98)	(1.44)
VIX (2)	-0.40	0.41	-0.75	-1.32	3.62	-0.29	-0.30	0.39	-0.11
	(1.42)	(2.01)	(1.54)	(1.20)	(15.41)	(1.31)	(1.13)	(1.81)	(1.10)
Post - up to 2015:Q4									
ΔFF (1)	-1.12	-2.16*	-0.02	-1.77***	-5.60**	-1.31**	-1.55***	-2.30***	-0.95*
	(0.90)	(1.17)	(0.98)	(0.57)	(2.72)	(0.61)	(0.59)	(0.89)	(0.57)
VIX (2)	0.68	1.58	-0.14	0.25	3.91	1.65**	1.15*	1.65	1.16*
	(0.93)	(1.32)	(0.97)	(0.76)	(7.89)	(0.80)	(0.69)	(1.09)	(0.69)

Notes: Quarterly data, 64 recipient countries, 2000:Q1 - 2015:Q4. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † to borrowers in country j. ‡ issued by borrowers in country j. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. (2) Log(VIX). The regressions include country fixed effects, lagged dependent variable, ΔReal GDP, ΔSovereign Ratings, Chinn-Ito Index, ΔReal Global GDP, ΔLocal policy rates, Δ10-year US rates, Δ Log(exchange rate v. USD), Δother advanced economy monetary policy, computed as the simple average of the Krippner shadow rates for the Euro Area, Japan and the UK and interaction with a dummy that equals 1 after 2009:Q1.

Table B7 – Baseline model with alternative measures of portfolio debt flows

	Dependent variable: ΔPortfolio debt flows †		
Explanatory variables	All	by banks	by non-banks
ΔFed funds rate (1)	-1.69***	-1.81***	-1.85***
	(0.26)	(0.50)	(0.27)
Log(VIX)	-3.08***	-4.96***	-2.56***
	(0.44)	(0.83)	(0.46)
ΔReal GDP	0.04	0.10	0.03
	(0.04)	(0.08)	(0.05)
ΔSovereign rating (2)	1.10***	2.91***	0.48
	(0.40)	(0.82)	(0.56)
Chinn-Ito index (3)	3.17**	4.81*	-0.31
	(1.31)	(2.88)	(1.31)
ΔReal global GDP	0.058	0.26	-0.01
	(0.09)	(0.18)	(0.102)
Observations	2,592	2,447	2,592
R-squared	0.07	0.07	0.05

Notes: The sample includes quarterly data for 64 recipient countries over the period 2000:Q1 - 2015:Q4. The regressions include a full set of country fixed effects. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. † growth rate of outstanding stocks of debt issued by borrowers in country j, winsorized at the 10% level. (1) Effective federal funds rate for the period 2001:Q1 – 2008:Q4, Wu-Xia Shadow rate for the period 2009:Q1 – 2015:Q4. (2) LT foreign currency, average across 3 agencies. (3) Measure of financial openness developed in Chinn and Ito (2008).