Uncertainty and Cross-Border Banking Flows*

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Abstract

While global uncertainty—measured by the VIX—has proven to be a robust global "push" factor of international capital flows, there has been no systematic study assessing the role of uncertainty in driving bilateral capital flows. This paper tries to fill this gap in the literature by examining the effects of country-specific uncertainty shocks on cross-border banking flows using data from the confidential Bank for International Settlements Locational Banking Statistics. The dyadic structure of this data allows to disentangle supply and demand factors and helps identify the effect of uncertainty shocks on cross-border banking flows from other traditional factors. The results of this analysis suggest that: (i) uncertainty is both a push and pull factor that robustly predicts a decrease in outflows (lending) and inflows (depositing); (ii) banks reallocate their lending towards relatively safer foreign borrowers when facing higher uncertainty about the local economy; (iii) this reallocation occurs only towards advanced economies, but not emerging market economies.

Keywords: Uncertainty; Cross-border banking flows; Stops; Retrenchment; Portfolio rebalancing; Flight-to-safety.

JEL codes: F21; F32; F42.

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I. INTRODUCTION

Between the early 1990 and the Global Financial Crisis (GFC, thereafter), the global economy has witnessed a marked increase in cross-border banking flows, largely driven by the expansion of global operations of banks through developing networks of physical branches and subsidiaries in foreign countries. These flows were also most severely affected by the GFC (Milesi-Ferretti and Tille, 2011 and Broner et al., 2013). It is therefore not surprising that many studies have tried to examine the driving factors of these flows recently (Cetorelli and Goldberg, 2011; Kleimeier et al., 2013; Minoiu and Reyes, 2013; Bruno and Shin, 2014; Cerutti et al., 2015; Cerutti et al., 2017; Correa et al., 2017).

Fluctuations in capital flows *per se* are not necessarily destabilizing. If they are mainly driven by fundamentals, such as productivity, swings in capital flows are likely to signal reallocation of funds across countries seeking for higher returns (Benhima and Cordonier, 2017). On the other hand, if they are largely driven by non-fundamental factors, such as investor sentiment or herding behaviors, policy interventions to dampen volatile international capital flows may have strong appeal. Given that international capital flows, including cross-border banking, slowed down sharply during the GFC—a period of heightened uncertainty worldwide—, it is therefore of interest to analyze the role of uncertainty, in addition to traditional fundamental factors, such as the interest rate and output growth, in explaining these flows.

This paper contributes to the literature by providing the first analysis—to the best of our knowledge—of the effects of higher uncertainty on cross-border banking flows. Despite the fact that literature has increasingly focused on the effect of uncertainty on economic activity, an analysis of uncertainty shocks in the international context has received less attention. In particular, while the VIX—a measure of global uncertainty or global risk aversion—has proven to be a strong push factor of international capital flows,[1] only a few studies have used country-specific uncertainty to explain the pattern of international capital flows (Gauvin et al., 2014; Gourio et al., 2015; Julio and Yook, 2016). Moreover, their analyses are limited to analyzing capital flows at the aggregate level.[2]

[1] For example, see Milesi-Ferretti and Tille (2011), Forbes et al. (2012), Fratzscher (2012), Ahmed and Zlate (2014), Bruno and Shin (2014), Passari and Rey (2015), Rey (2015), among others.

[2] Previous studies on uncertainty and international capital flows have examined total capital flows (Gourio et al., 2015), portfolio flows (Gauvin et al., 2014), and FDI flows (Julio and Yook, 2016). Our identification strategy is similar to the one used by Julio and Yook (2016) to examine the effect of heightened policy uncertainty driven by presidential elections in a recipient country on FDI inflows. By limiting their analysis to FDI flows from the U.S., they control for the supply-side effect of FDI effectively and study how heterogeneity in uncertainty across countries affects FDI inflows to these economies. However, none of them has exploited large-dimensional bilateral capital flow data, as we do in this paper.

Under the integrated international financial market, higher uncertainty in one country can have important consequences on other countries. Higher uncertainty can spillover to other countries by affecting international capital outflows and also amplify shocks to domestic fundamentals by influencing capital inflows. Nevertheless, we argue that this question has not been properely addressed in previous research, because of the difficulty to separate the effect of uncertainty from other demand and supply factors affecting capital flows by using data from the balance of payments (BOP) statistics.[3]

We overcome this challenge by using data on bilateral cross-border bank claims and liabilities from the BIS Locational Banking Statistics. The dyadic structure of this data allows us to control for the counterparty-time fixed effect—that is, any global and country-level shocks affecting loan demand (or deposit supply) from a common counterparty country—and thereby helps identify the impact of higher uncertainty on these flows. With the counterparty-time fixed effect, any time-varying regressors of source countries are interpreted as difference between each country pair. Thus, our empirical strategy mitigates a common criticism that countries are often subject to heightened global uncertainty at the same time, which prevents a proper identification of the role of country-specific uncertainty in driving international capital flows. With this fixed effect, our uncertainty measure captures deviation froms the (time-varying) global mean, thereby serving an appropriate measure of country-specific uncertainty.

We first study how global banks adjust their cross-border claims (i.e., loans) in response to higher uncertainty in the local economy where they operate. Then we further investigate how lenders in foreign countries react to this uncertainty in a destination country. After controlling for various macroeconomic factors affecting credit supply in source countries, we find that an increase in uncertainty in a local economy reduces both cross-border lending (i.e., retrenchment) and depositing (i.e., stops), and this effect is economically and statistically significant.[4] In other words, both domestic and foreign investors withdraw money from abroad during periods of heightened uncertainty.

[3] One would have to control for possible macroeconomic shocks affecting credit demand in recipient countries to quantify the effect of higher uncertainty on cross-border lending correctly. Equivalently, one should control for macroeconomic shocks affecting credit supply if interested in quantifying the effect of higher uncertainty on cross-border borrowing.

[4] Forbes and Warnock (2012) define four different events regarding intertnational capital flows as follows. "Surges": a sharp increase in gross capital inflows; "Stops": a sharp decrease in gross capital inflows; "Flight": a sharp increase in gross capital outflows; and "Retrenchment": a sharp decrease in gross capital outflows. In the sixth edition of the Balance of Payments and International Investment Position Manual (BPM6), positive asset (liability) flows mean capital leaving (entering) the country on net by domestic (foreign) residents. Thus, a decrease in global banks' cross-border claims corresponds to retrenchment, while a decrease in cross-border liabilities corresponds to stops.

These findings are confirmed by using alternative proxies of uncertainty, such as the Economic Policy Uncertainty (EPU) index developed by Baker et al. (2016). We also control for gravity factors often used in the trade literature and bilateral trade flows between the reporter and counterparty countries to confirm that our finding does not simply reflect a trade slowdown in response to higher uncertainty. Moreover, despite the sharp slowdown in cross-border banking activity during the GFC, our finding is not merely driven by this important event, as higher uncertainty is found to have an adverse effect on cross-border banking activity even before the GFC.

We further contribute to the literature by analyzing the mechanism through which global banks reduce cross-bank lending in response to higher uncertainty in a local economy. To capture their portfolio reallocation behaviors, we compare foreign lending activity with domestic lending activity. Although our analysis relies on somewhat imperfect proxy due to the limited data availability, the estimation results suggest that the relative share of cross-border claims to total claims increases when uncertainty about the local economy is higher, implying that banks reallocate their lending towards foreign borrowers, who are perceived as relatively safer *ceteris paribus*. Interestingly, this portfolio reallocation mechanism hinges on the perceived riskiness of the recipient countries: the reallocation appears only when lending to advanced economies, but not to emerging market economies, suggesting the existence of the so-called *relative* "flight-to-safety." Our results are also robust to an instrument variable (IV) approach using the exogenous historical events identified by Baker and Bloom (2013).

The remainder of the paper is organized as follows. Section II describes the data on cross-border banking flows, together with data on uncertainty and various macroeconomic controls. Section III proposes the econometric methodology used in this paper to mitigate endogeneity issues and disentangle between credit demand and supply factors. Section IV presents the main results and a battery of robustness exercises. Section V concludes.

II. DATA

We use data on cross-border claims and liabilities from the Bank for International Settlements (BIS)' Locational Banking Statistics (LBS) as our main source. These statistics provide information about the currency composition of banks' balance sheets and the geographical breakdown of their counterparties. The LBS data capture outstanding claims and liabilities of internationally active banks located in reporting countries against counterparties residing in more than 200 countries. Banks record their positions on an unconsolidated basis, including intragroup positions between offices of the same banking

group. The data is compiled following the residency principle that is consistent with the balance of payments (BOP) statistics.[5]

Currently, banking offices located in 46 countries, including many offshore financial centers, report the LBS. The LBS capture around 93 percent of all cross-border interbank business (Bank for International Settlements, 2017).[6] One might argue that nationality is a more meaningful indicator than the residence of global banks in the world where global banks operate through their affiliates in many other countries (Ehlers and Wooldridge, 2015). To the extent that ultimate economic decisions are made in a country where the headquarters of these banks locate, uncertainty regarding the home country of global banks might be more relevant. However, the Consolidated Banking Statistics (CBS) based on the nationality principle do not have information on currency breakdown, while the BIS LBS provides the exchange-rate adjusted flows in cross-border bank claims and liabilities.[7] More importantly, the BIS CBS does not provide information on the liability side of bank balance sheets.

The adjustment for exchange rate movements is crucial in our setup because contractions in cross-border banking flows tend to coincide with significant currency movements and heightened uncertainty (Avdjiev and Elod Takáts, 2014). Thus, ignoring the valuation effect could bias the results of the effect of uncertainty shocks on cross-border banking flows.[8] In Table 1, we summarize the data availability in the BIS International Banking Statistics by reproducing Table 1 in Avdjiev and Elod Takáts (2014). This summary demonstrates the available information of each statistics, together with their limitations, thereby helps our understanding of the data structure.

Most previous studies on capital flow rely on proxies for net capital flows, especially in emerging market economies, because net capital flows have been more volatile and a higher risk factor for the real sector in these economies. However, in the recent financial crisis, advanced economies have been affected more, mainly due to their higher engagement in the increasing international financial market integration since the 1990s. As highlighted in

[5] While the data is made public by the BIS at the aggregate level, the data on bilateral claims and liabilities between reporting (source) and counterparty (recipient) countries is available to reporting central banks. Because we follow the residency principle of BPM6, we use reporting (counterparty), source (recipient), and local (foreign) countries interchangeably throughout the paper. For example, higher uncertainty in a local economy denotes uncertainty in Mexico, not in the U.K for the British banks operating in Mexico.

[6] Although there is no similar estimate for the share of cross-border bank lending to non-banks in the LBS, Adjiev et al. (2017) estimate that it is likely to exceed 90 percent of all cross-border bank to non-bank business.

[7] The adjusted change is calculated by first converting U.S. dollar-equivalent amounts outstanding into their original currency using end-of-period exchange rates, then calculating the difference in amounts outstanding in the original currency, and finally converting the difference into a U.S. dollar-equivalent change using average period exchange rates (Bank for International Settlements, 2017).

[8] Adjusted changes in amounts outstanding are calculated, as an approximation for flows. In addition to exchange rate fluctuations, the quarterly flows in the locational datasets are corrected for breaks in the reporting population.

Forbes and Warnock (2012), Broner et al. (2013), and Bruno and Shin (2014), the dramatic increase in gross capital flows has posed a challenge to the traditional approach to international finance based on net capital flows where financial flows are seen only as the counterpart to the current account.

While we do not attempt to summarize the mounting literature on international capital flows, a large body of the literature has focused on long-run trends in gross capital flows (Lane and Milesi-Ferretti, 2007; Obstfeld, 2012) or gross capital flows during specific episodes (Milesi-Ferretti and Tille, 2011; Fratzscher, 2012). In contrast, our paper analyzes the cyclicalical pattern of gross capital flows, focusing on the effect of uncertainty on cross-border banking flows. In this regard, the major advantage of the BIS LBS data, compared to the banking flows collected from the Balance of Payments (BoP) statistics, is the detailed breakdown of the reported series by counterparty countries. This feature enables us to identify changes in the supply factors of cross-border lending from changes in loan demand in counterparty countries.

Throughout the analysis, we drop offshore financial countries from our sample using the IMF classification because their behaviors might differ substantially from the rest of the sample. In our benchmark analysis—after dropping offshore financial centers—we focus on the 25 reporting countries where a measure of uncertainty and macroeconomic control variables are available. Similarly, after dropping offshore financial centers from the list of counterparties, we are left with the 50 counterparty countries in our analysis. Following Correa et al. (2017), we also drop observations with the size of cross-border positions less than $5 million, or with negative total outstanding claims. Dependent variables in the upper and lower one percentile of the distribution are excluded from the sample to eliminate outliers. Table A.1 in the appendix lists the final sample of reporting countries and their counterparties used in the analysis. It is apparent that most reporting countries are advanced economies, while counterparties include both advanced and emerging market economies, highlighting the asymmetric nature of the bilateral LBS data.

Following much of the recent literature on the link between uncertainty and economic activity (for example, Bloom, 2009), we use stock market volatility as a proxy for uncertainty.[9] To maximize the coverage of data, we take the quarterly realized volatility from Baker and Bloom (2013) instead of using implied volatility. In principle, implied volatility is a better measure of uncertainty of the economy than realized volatility, as it contains

[9] The empirical distinction between risk and uncertainty is far from being clear. For example, prior studies on international capital flows often use the VIX as a measure of global risk aversion (Milesi-Ferretti and Tille, 2011; Forbes and Warnock, 2012; Bruno and Shin, 2015; Rey, 2015). We contribute to this literature by also examining the effect of economic policy uncertainty.

forward-looking information. In practice, however, the difference is minor.[10] For each country, annualized realized volatility RV_t at a quarterly frequency is calculated by using daily stock prices p_t as follows: $RV_{i,t} = 100 \times \sqrt{252/T_i \sum_{t=1}^{T_i} r_{i,s}^2}$, where $r_{i,s}$ are daily returns of the stock market in a country i from each trading day s and T_i is the stock market i's number of trading days in a given quarter.[11]

We present the size of total cross-border claims and liabilities as a share of the GDP in 2010Q4 for the 25 reporting countries in Table 2. Table 2 demonstrates the dominance of advanced economies in shaping the cross-border banking system. When normalized to the size of the domestic GDP, both cross-border claims and liabilities of emerging market economies are smaller than those of advanced economies almost by two orders of magnitude. For example, cross-border claims and liabilities in Mexico are only five and seven percent of the GDP, while they account for 640 and 380 percent of the GDP in the U.K. The mounting role of European countries in the cross-border banking system is also apparent. European countries engage in cross-border banking much more heavily than the U.S. and other advanced economies when the size of the economy is considered. While global banks operating in advanced economies have more cross-border claims than liabilities, this pattern is reversed in emerging market economies, which differentiates net lenders and net borrowers in this market.

To provide a first look at the underlying dynamics, we plot the fluctuations in the uncertainty index with aggregate cross-border claims and liabilities for three countries (the U.S., Germany, and Brazil) in Figure 1. Three observations stand out from this figure. First, the different scales of the y-axis in these graphs re-emphasize the dominance of advanced economies in an absolute term. Compared to the U.S. or Germany, the size of cross-border banking flows into/from Brazil—one of the largest emerging market economies—is trivial. Second, the figure shows that heightened uncertainty in a local economy is often associated with a reduction in both cross-border bank claims and liabilities.[12] Such a positive co-movement between the cross-border banking sector claims and liabilities is consistent with the earlier finding that gross capital inflows and outflows are positively correlated (Forbes and Warnock, 2012; Broner et al., 2013; Avdjiev et al., 2017). Third, the slowdown in cross-border banking flows during the GFC is at the unprecedented level in all three countries. Due

[10] For example, in the U.S., the correlation between two measures exceeds 0.9 in the period 1990:01-2014:12 (Choi, 2017).

[11] We do not use the GARCH-class models to estimate volatility of financial variables because models based on high frequency realized variances are known to perform better.

[12] Gross flows can be both positive and negative because existing capital flow datasets net out disinvestment from gross asset flows and repayments from gross liabilities flows. See Avdjiev et al. (2017) for more comprehensive discussion about the commonly used capital flow datasets.

to the dominance of the GFC, we test the robustness of our findings by controlling for this period.

However, looking at the aggregate cross-border banking flows alone does not account for the fact that uncertainty also reduces demand for investment (Bernanke, 1983; Bloom, 2009; Choi et al., forthcoming) via real option value or financial constraint channels. To disentangle supply and demand factors of banking flows, we exploit the dyadic structure of the LBS data. To illustrate the dyadic structure, Figure 2 presents examples of bilateral cross-border claims and liabilities between the three countries (the U.S., Germany, and Brazil). Compared to Figure 1, Figure 2 shows some heterogeneity in the pattern of cross-border claims and liabilities among different country-pairs. At the individual country-pair, the correlation between cross-border claims and liabilities is much lower, and the cyclical pattern of the flows differs between advanced and emerging market economies. Our identification strategy exploits this heterogeneity.

Because the LBS data structure allows us to control for time-variant unobserved factors in recipient countries, we only need to control for macroeconomic variables in source countries to identify the causal effect of higher uncertainty on the cross-border banking flows. Based on the extensive literature on international capital flows, we consider the following set of controls: real GDP growth, stock market growth, the inflation rate, the monetary policy rate, nominal exchange rate growth,[13] private credit growth, and the external debt to GDP ratio.

We include central bank policy rates to capture a standard bank lending channel of monetary policy in the global context (Bruno and Shin, 2014; Rey, 2015; Correa et al., 2017)—we use interbank rates when policy rates are not available. To the extent that monetary policy stance and uncertainty are systematically related (Bekaert et al., 2013), controlling for policy rates is crucial. Following Bloom (2009), we further control for stock market returns to disentangle second-moment shocks—our baseline measure of uncertainty—from first-moment shocks to the stock market. Table 3 presents the summary statistics of the variables used in the analysis. Notably, the average growth rates of cross-border claims and liabilities are about three percent, while their standard deviations exceed 40 percent, similar to the finding of Correa et al. (2017).

III. METHODOLOGY

Any empirical investigation of factors affecting bank credit must note that variations in the volume of credit reflect not only the supply-side but also the demand-side factors because demand for credit is also responsive to changes in macroeconomic conditions—including uncertainty—which, in turn, affects the expected return and risks on investment

[13] An increase in the nominal exchange rate denotes the depreciation of local currencies against the U.S. dollar.

projects. We exploit the dyadic structure of the LBS data (that is, multiple reporting countries linked to multiple counterparties), to control for unobserved time-variant factors in a counterparty country, thereby controlling for all possible demand-side factors effectively. This approach delivers a clear identification of the role of uncertainty as both a push and pull factor of cross-border banking flows.

To gauge the effects of higher uncertainty in a local economy on determining cross-border claims (i.e., a push factor of cross-border lending), we first estimate the following equation, similar to Correa et al. (2017):

$$\Delta L_{i,j,t} = \alpha_{j,t} + \beta X_{i,t-1} + \gamma UNC_{i,t-1} + \varepsilon_{i,j,t}, \quad (1)$$

where *i* and *j* respectively indicate the reporting ('source') and counterparty ('recipient') countries, and *t* denotes time. Following Bruno and Shin (2014), our main dependent variable $\Delta L_{i,j,t}$ denotes the quarterly growth (log difference) in cross-border claims of banks in a country *i* in a country *j*; $X_{i,t}$ is the set of macroeconomic controls described earlier. $\alpha_{j,t}$ are counterparty-time fixed effects, included to control for any macroeconomic shocks affecting recipient countries, including external and idiosyncratic recipient-specific shocks as well as indirect impact of uncertainty trough other recipient countries. γ is the coefficient of our interest.

The inclusion of counterparty-time fixed effects also maximizes the sample coverage of our analysis because many of counterparty countries do not necessarily have data on every control variable. A negative (positive) γ indicates that global banks decrease (increase) cross-border lending in an absolute term when the local economy faces higher uncertainty. Following Bruno and Shin (2014), all explanatory variables are lagged by one-quarter to mitigate reverse causality issues stemming from feedback effects of, for example, cross-border lending on economic growth, monetary policy stance, or uncertainty. We adopt the most conservative clustering setup by clustering standard errors at the reporter and counterparty-pair levels.

One main advantage of the BIS LBS data is that the currency composition of cross-border claims and liabilities is available so that cross-border banking flows expressed in the U.S. dollars are adjusted for movements in exchange rates. To the extent that heightened uncertainty episodes coincide with significant fluctuations in the exchange rate (De Bock and Filho, 2015; Choi, 2017), it is crucial to obtain a real measure of cross-border flows. Because the BIS LBS only reports the exchange rate-adjusted flows, we reconstruct the stock of the cross-border claims ($L_{i,j,t}$) by adding the exchange rate-adjusted flows to the initial stock (taken from 1990Q1) and take the log difference to obtain the growth rate $\Delta L_{i,j,t}$.

Similarly, we also analyze the effect of higher local uncertainty on cross-border liabilities of its banking sector, by replacing the growth of cross-border claims ($\Delta L_{i,j,t}$) in equation (1) with the growth of cross-border liabilities ($\Delta B_{i,j,t}$) and use the same set of control variables:

$$\Delta B_{i,j,t} = \alpha_{j,t} + \beta X_{i,t-1} + \gamma UNC_{i,t-1} + \varepsilon_{i,j,t}. \quad (2)$$

Again, we focus on a reporting country only due to the asymmetry in the LBS data.[14] In this case, a negative (positive) γ indicates that global banks receive less (more) cross-border deposits in an absolute term when their local economy faces higher uncertainty. To the extent that bank deposits take account for a bulk of bank liabilities and banks have little incentive to reject them (Kleimeier et al., 2013), our identification strategy answers how uncertainty in a local economy changes deposit flows into the economy from other compounding factors.

IV. EMPIRICAL FINDINGS

A. Baseline results

Table 4 shows the results obtained by estimating equation (1) and (2), separately. After dropping outliers and missing observations, our baseline estimation covers an unbalanced panel of 687 reporter-counterparty country pairs from 1995Q1 to 2012Q4. We discuss the results of estimating equation (1) first, and then we present the results of estimating equation (2). Due to the limited availability of some control variables, we start presenting a specification which controls for only real GDP growth, stock market growth, the inflation rate, the policy rate, and nominal exchange rate growth, which have a greater coverage than other control variables.

The signs of control variables are mostly consistent with the previous findings regarding the determinants of international capital flows. For example, once controlling for credit demand, global banks in a country with higher economic growth lend more to foreign borrowers. It is because the health of banking system improves with domestic economic conditions, enabling them to expand cross-border lending activity. Domestic monetary policy tightening has a positive effect on gross cross-border claims, which is consistent with the robust finding of Correa et al. (2017).[15] The depreciation of local currencies with respect to the U.S. dollar is associated with a slowdown in cross-border bank lending, consistent with

[14] In principle, we could replace counterparty-time fixed effects with reporter-time fixed effects and study the role of higher uncertainty in counterparty countries. However, counterparty countries often include emerging and developing economies where various macroeconomic variables are not necessarily available at a quarterly frequency.

[15] When replacing the short-term policy rate with the interbank rate, we obtain similar results.

the risk-taking channel of Bruno and Shin (2015). Nevertheless, the effect is not necessarily robust across the specifications.

Importantly, higher uncertainty in a local economy reduces gross cross-border bank lending (retrenchment), and this effect is both economically and statistically significant. For example, an increase in the level of uncertainty from the historical median to the level observed during the GFC is associated with a reduction in cross-border claims of 1.6-2.8 percentage points. In column (II) and (III), we include additional control variables such as private credit growth and external debt to GDP. While an increase in domestic private credit growth is associated with an increase in cross-border bank lending, this effect is not statistically significant. In contrast, the share of external debt in GDP is negatively related to cross-border lending activity, and this effect is highly statistically significant. The inclusion of the external debt to GDP ratio reduces the size and the statistical significance of real GDP growth. Despite the reduced sample size due to the limited availability of these variables, the effect of uncertainty on cross-border bank lending remains broadly unchanged.

In column (IV) to (VI), we summarize the same set of results for cross-border liabilities of a reporting country. In other words, we examine whether higher uncertainty in a local economy reduces cross-border deposits into the banking sector (stops). In column (IV), higher real GDP growth and policy rates in the reporting countries are associated with an increase in cross-border depositing, although the latter is no longer statistically significant. Importantly, the sign of uncertainty is negative and statistically significant, suggesting that uncertainty reduces gross inflows to the domestic banking sector. We check the robustness of our empirical findings first, then discuss a mechanism to explain the findings in the following section.

Link to the previous studies on emerging market economies

To the best of our knowledge, there are only a few studies on the relationship between uncertainty and capital flows using country-specific uncertainty and they are restricted to the case of emerging market economies. It is mostly because net capital flows have been more volatile and a higher risk factor for the real sector in these economies. For example, using a large panel of emerging market economies, Gourio et al. (2015) find that an increase in domestic uncertainty, measured by the realized stock market volatility in each emerging market economy, decreases capital inflows (stops) and capital outflows (retrenchment).[16] Gauvin et al. (2014) study how uncertainty about macroeconomic policies in advanced countries spills over to emerging market economies by analyzing bond and equity inflows to a group of emerging market economies. These studies rely on either balance of payment data (Gourio et al., 2015) or the Emerging Portfolio Fund Research (EPFR) data aggregated at the

[16] Forbes et al. (2012) find a similar effect of the VIX on the probability of sudden stop and retrenchment episodes of emerging.

recipient country level (Gauvin et al., 2014), which do not provide information on a source of capital inflows to emerging market economies. Our approach improves the identification by exploiting the dyadic structure of the BIS LBS.

We compare briefly whether our finding is consistent with these previous studies focusing on emerging market economies using different data on international capital flows. First, Gourio et al. (2015) analyze total capital flows including direct investment, portfolio investment, and other investment from emerging market economies, while we focus mainly on the cross-border banking flows from advanced economies (column (I) to (III) in Table 4). Nevertheless, when we restrict our analysis to emerging market economies similarly to the sample of Gourio et al. (2015), we still find an adverse effect of local uncertainty on cross-border bank claims (shown in column (I) to (III) in Table 5).[17] The size of coefficients on the uncertainty variable tends to be larger than that in column (I) to (III) in Table 4, implying that global banks operating in emerging market economies are more vulnerable to higher local uncertainty.

Second, to compare our results with those of Gauvin et al. (2014), we restrict the counterparty countries to emerging market economies and the source countries to advanced economies, such as the U.S. or countries in the euro area. The results in column (IV) to (VI) of Table 5 show that cross-border banking flows into emerging market economies decrease in response to higher uncertainty in advanced economies, confirming the spillover effect of uncertainty shocks from advanced economies on portfolio inflows to emerging market economies. The size of coefficients found in Table 5 tends to be larger than that in column (I) to (III) in Table 4, implying that the adverse effect of higher uncertainty on the cross-border banking flows into emerging market economies is larger than that into advanced economies. This finding is consistent with a large body of empirical literature that capital flows into emerging market economies are more procyclical than advanced economies.

Given that the estimation results from column (III) and (VI) are not different from column (II) and (V) from both Table 4 and 5, we present the results controlling for the seven variables, together with the baseline results controlling for five variables only throughout the rest of the paper.

B. Robustness checks

Standard errors in the baseline analysis are clustered at the reporter-counterparty levels to account for possible serial correlation in the error term. In Table A.2 in the appendix, we confirm that our results are similar when clustering standard errors at the counterparty country-time levels. While we have dropped offshore financial centers to obtain robust

[17] Note that the sample size is reduced substantially because most reporting countries in the BIS LBS are advanced economies.

results, we also estimate equation (1) and (2) using the full sample including offshore financial centers to check whether their behaviors can outturn our findings. Table A.2 further shows that the inclusion of the offshore financial centers, such as Cyprus, Hong Kong, Ireland, Luxembourg, Malta, Singapore, and Switzerland, does not affect the main findings of the paper in a meaningful way, although it reduces both the economic and statistical significance of the uncertainty coefficient.

Moreover, we have treated each observation equally so far, which might have distorted the aggregate implication of our finding by exaggerating the importance of volatile but small cross-border flows. Thus, we re-estimate equation (1) and (2) by using the Weighted Least-Squares approach where the weight is defined as the share of bilateral flows between *i* and *j* in time *t* to the total cross-border flows in time *t*.[18] Table A.3 in the appendix demonstrates that weighting each observation by its relative importance does not affect our conclusion.

Alternative measure of uncertainty

We have used stock market volatility as a benchmark measure of uncertainty because it is widely used and available at a high frequency, it has the longest time-series, and it allows for straightforward international comparisons.[19] However, stock market volatility also captures investor's risk aversion (Bekaert et al., 2013) other than macroeconomic uncertainty. Moreover, high cross-country correlation in stock market volatility due to the contagion in international financial markets (Choi, 2017) makes identification of the shocks difficult.[20] Thus we use the economic policy uncertainty (EPU) index constructed by Baker et al. (2016) to complement the measure of uncertainty based on financial market data (Bordo et al., 2016; Choi, 2017; Ozturk and Sheng, 2017; Choi et al., forthcoming).[21] Given that the two indices measure uncertainty about different aspects of the economy, this sensitivity test complements the baseline analysis using stock market volatility.

The EPU index is based on the national newspaper coverage frequency of policy-related economic uncertainty, thereby mitigating the concerns mentioned above. Baker et al. (2016) conduct comprehensive searches of newspapers for relevant terms, such as "uncertain"

[18] We also define the weight as the share of bilateral flows between a country *i* and a country *j* in time *t* to the cross-border flows between a country *i* and its all counterparties in time *t* and find similar results.

[19] For example, other uncertainty measures based on consumer or firm survey data are not necessarily comparable between countries. Cross-sectional measures such as the dispersion of firm-level sales, employment, and productivity are often available for a much shorter period.

[20] For example, Bloom (2017) claims that the U.S economy exports its uncertainty to the rest of the world. Due to such a strong dominance of the U.S. in shaping global uncertainty, we repeat our analysis by dropping the U.S. and find quantitatively similar results.

[21] We download the historical version of the EPU index (Baker et al., 2016) from www.policyuncertainty.com.

or "uncertainty"; "economic", "economy" or commerce"; and policy-relevant terms, such as "central bank", "deficit", "trade policy", or "ministry of finance". For countries other than Australia, Canada, the UK, and the US, they conduct searches in the native language of the newspaper for relevant terms. However, this index is available for only 15 countries (Australia, Brazil, Canada, Chile, France, Germany, India, Italy, Japan, Korea, Netherlands, Spain, Sweden, the U.K., and the U.S.) in our sample.

Figure A.1 in the appendix presents quarterly stock market volatility for 25 countries together with the economic policy uncertainty index for 15 countries. The correlation between stock market volatility and economic policy uncertainty is far from perfect. The average correlation of the 15 countries is only 0.38, and the correlations range from 0.03 (Sweden) to 0.76 (Brazil). The results obtained re-estimating equation (1) and (2) using the EPU index are reported in Table 6. The adverse effect of uncertainty on the growth of cross-border bank claims and liabilities is still significant and quantitatively similar to the baseline analysis.

Controlling for the dominance of the global financial crisis

As demonstrated in Figure 1 and 2, during the GFC, the stock market volatility indices rose to the unprecedented level in most countries, which might have exaggerated the effect of uncertainty on cross-border banking flows. It is also possible that quantitative easing (QE) in advanced economies after the GFC might have altered the way uncertainty affects international capital flows. For example, Ahmed and Zlate (2014) and Fratzscher et al. (2016) find a positive effect of the U.S. unconventional monetary policy on capital flows into emerging market economies.

We check whether our results are robust to the inclusion of the GFC by employing two sensitivity tests. First, for each country, we winsorize the level of stock market volatility to mitigate the effect of the outlier event. To be more specific, we compute the standard deviation of country-specific stock market volatility during the GFC and non-GFC periods. Overall, the cross-country median of the standard deviation of annualized stock market volatility during the GFC (36.6) is about at the top five percentile of the distribution during the non-GFC period (35.7), reflecting the dominance of the GFC in shaping the fluctuations of uncertainty. Thus we winsorize the value of stock market volatility of each reporting country not to exceed the value at the top five percentile of its distribution during the non-GFC period.[22] Table 7 shows that our findings are robust to this sensitivity test although the size of the coefficients on the uncertainty term reduced slightly.

[22] In other words, $RV_{i,t}^{GFC} = min\{RV_{i,t}, RV_i^{5\%\, non-GFC}\}$ if $t \in GFC$ where $RV_i^{5\%\, non-GFC}$ is the value of the stock market volatility at the top five percentile of the distribution during the non-GFC period.

Second, we split the sample into the pre-(1995Q1-2007Q2) and the post-(2007Q3-2012Q4) GFC, and re-estimate equation (1) and (2) using both measures of uncertainty (stock market volatility and economic policy uncertainty). To maintain the sample size of the first sub-sample, we exclude the additional control variables of private credit growth and external debt to GDP in this exercise.[23] Table 8 summarizes the results from the sub-sample analysis using stock market volatility as a measure of uncertainty. The results using the EPU index are shown in Table A.4 in the appendix. One interesting observation is the decrease in the size and the significance of the policy rate after the GFC. It is likely an outcome of the constrained conventional monetary policy in most advanced economies and the emerging role of QE (Fratzscher et al., 2016). An increase in uncertainty in a local economy—whether it is measured by stock market volatility or EPU—predicts a slowdown in cross-border bank claims and liabilities before and after the GFC.

The role of the euro area in driving cross-border banking flows

Given the central role of the European banks in global banking flows (Cetorelli and Goldberg, 2011; Shin, 2012; Ivashina et al., 2015) and severe financial distress during the recent crisis in the region, an interesting question is whether the behaviors of global banks residing in the euro area differ from those of global banks outside the euro area. Due to a common monetary policy, member countries cannot use monetary policy instruments or the exchange rate to adjust to external shocks, which might amplify the effect of higher uncertainty on capital flows. On the other hand, various policy interventions in the region and the support from the IMF/EU program further complicates the channel through which uncertainty affects cross-border banking flows in the region.

To answer this question, we split the 25 reporting countries into euro and non-euro area countries and repeat the analysis. Table 9 shows that the adverse effect of domestic uncertainty on cross-border banking flows exists in both euro area and non-euro area countries, confirming that the countries in the euro area do not drive our finding. However, the adverse effect on cross-border banking flows is larger and more precisely estimated in euro area economies. If anything, the effect on cross-border claims is larger and more precisely estimated than cross-border liabilities, which is consistent with the particular concern about the retrenchment by European banks during the GFC driven by their fragile financial conditions and a significant share of the market for foreign lending.

Controlling for Gravity factors

The inclusion of counterparty-time fixed effect in the baseline estimation does not account for costs of international asset trade specific to a country-pair of interest, as those

[23] Our results hardly change when we move the exact split date between 2007Q3 and 2008Q3.

commonly used in the Gravity model of international finance (Okawa and van Wincoop, 2012). To the extent to which we investigate the effect of higher uncertainty on the growth rather than the holding of cross-border bank claims and liabilities, these factors are unlikely to drive our results. Nevertheless, we test the robustness of our finding by adding $Z_{i,j}$ vector for each pair of country. Following much of the literature, $Z_{i,j}$ includes distance between the two countries *i* and *j* and dummy variables whether they share a common border and use common language. We take the bilateral geography dataset from Mayer and Zignago (2011).

Table 10 shows the estimation results after controlling for common gravity factors. While we use the logarithm of population-weighted distance between two countries to account for the geographic distribution of population inside each nation (Mayer and Zignago, 2011), using the level of population-weighted distance or simple distance delivers similar results. As shown in Table 10, the inclusion of the gravity factors hardly affects the estimates in Table 4, including the uncertainty variable.

Controlling for bilateral trade flows

So far, we have used the counterparty-time fixed effect $\alpha_{j,t}$ to control for any global or macroeconomic shocks in the recipient country. The use of this fixed effect is more flexible than controlling for any set of common time-varying regressors. However, this fixed effect alone cannot control for potential factors affecting cross-border banking flows at the bilateral level. One obvious candidate of such factors is bilateral trade flows between country pairs in our sample. The recent literature also attributed the so called "Great Trade Collapse" to heightened global uncertainty and investigated the role of uncertainty in explaining the pattern of international trade (Taglioni and Zavacka, 2013; Novy and Taylor, 2014). This variable is particularly important for the study of bilateral capital flows, as the current account and the financial account are tightly related by the accounting identity, and trade balance is a major determinant of the size of current account (Kleimeier et al., 2013). Of course, our use of the variable corresponding to only a subset of total capital flows—the sum of direct investment, portfolio equity and debt, and other investment flows— guards against this criticism.[24]

Nevertheless, we test the robustness of our findings by adding extra control variables capturing bilateral trade flows. We take bilateral trade flow data from the IMF Directions of Trade Statistics. Note that our dependent variables are gross flows, not net inflows. Thus, for conceptual consistency, we add the lagged growth of exports from a country *i* to a country *j*, $EXP_{i,j,t-1}$ and the lagged growth of imports of a country *i* from a country *j*, $IMP_{i,j,t-1}$ to equation (1) and (2) respectively.

[24] The category "other investment" is the residual in the BOP statistics and includes in particular loans, currency and deposits, and trade credits.

Table 11 presents the results of this additional exercise. Although an increase in bilateral exports (imports) is associated with an increase in cross-border claims (liabilities), this relationship is not only statistically, but also economically insignificant given that the size of bilateral trade flows is similar to that of cross-border banking flows (Table 3). When the exports from a source country *i* to a counterparty country *j* grow by 10 percent, the cross-border claims from a country *i* to a country *j* increase, on average, by 0.3 percent at most. This result suggests that cross-border activity of global banks is mostly independent of traditional trade activity between countries. As a result, our main findings still hold, and the coefficients on the (lagged) uncertainty term are very similar to those in Table 4. Our conclusions hardly change when we use (1) current bilateral trade flows instead of the lagged trade flows or (2) bilateral trade balance (as a share of the GDP) instead. These results are available upon request to conserve space.

Non-linearity in uncertainty

While we have used stock market volatility series as a baseline proxy for uncertainty, thereby have obtained the linear-effect of uncertainty on cross-border banking flows, it is also possible that economic agents respond only to an exceptional level of uncertainty and ignore minor fluctuations in uncertainty. Such non-linear effects of uncertainty shocks on output or productivity are documented in the literature (Jones and Enders, 2016; Choi et al., forthcoming). Bloom (2009) also advocates the use of the binary indicator taking a value of one when stock market volatility rises significantly over the mean and zero otherwise, because this indicator function ensures that identification comes only from these large, and arguably exogenous, volatility shocks rather than from the smaller ongoing fluctuations.[25]

Following Bloom (2009), we define the binary uncertainty shock taking a value of one when country-specific stock market volatility is above the country-specific threshold. The threshold was 1.65 standard deviations above the mean of the HP-filtered series, selected as the 5% one-tailed significance level treating each reporting country-time as an independent observation. We re-estimate equation (1) using this binary uncertainty shock. Table 12 presents interesting results regarding the non-linearity in the effect of uncertainty shocks. Whereas cross-border claims continue to decline significantly after exceptional uncertainty shocks, cross-border liabilities, if anything, increases insignificantly though.

[25] Despite these advantages of using the binary indicator, we use the original stock market volatility series throughout the paper due to our shorter sample than Bloom (2009)'s. First, we identify only two to four events for most countries compared to the Bloom's 17 identified events in his analysis, which lowers the statistical power of the test substantially. Second, the shorter sample exacerbates the dominance of the GFC by driving up the sample mean and standard deviation of the stock market volatility series. Nevertheless, we still identify some (at most two) high-uncertainty events during the non-GFC period.

How do we reconcile such asymmetric effects of the exceptionally uncertain events? Note that most (19 out of 25) of the reporting countries in our sample are advanced economies. During the period of unusually high uncertainty, these countries could be a destination of international capital flows from the rest of the world, although the volume of overall international capital flows shrinks dramatically ("flight-to-safety"). In this case, one should find qualitatively different patterns in cross-border depositing between advanced and emerging market economies. To test this possibility, we separately estimate equation (2) for advanced and emerging market economies. Indeed, we find the negative and statistically significant uncertainty coefficients from a group of emerging market economies despite the small sample used in the estimation and the positive but statistically insignificant uncertainty coefficients from a group of advanced economies. We investigate further this flight-to-safety channel of cross-border banking flows in the following section.

Valuation effect

So far, we have used the growth rate of exchange rate-adjusted stock of cross-border claims and liabilities to separate actual changes in asset holding from the valuation effect. However, if the nominal (dollar) value of their portfolios is what global banks are concerned about, they must consider the valuation effect as well. Although modeling a global bank's optimization problem is beyond the scope of this paper, we can still infer the direction and size of the valuation effect by comparing our baseline results with those using cross-border claims and liabilities that are not adjusted by the valuation effect. In our baseline sample, the correlation between the growth rate of cross-border claims (liabilities) using two measures is only 0.54 (0.63), suggesting a non-negligible role of the valuation effect.

We apply the same standard to treat outliers and missing observations here. Table 13 presents the results from re-estimating equation (1) and (2) using the growth rate of unadjusted stock of cross-border claims and liabilities, respectively. The use of non-adjusted cross-border claims and liabilities delivers quite different results regarding the size and statistical significance of variables. Importantly, the effect of uncertainty decreases and loses their statistical significance across most specifications, suggesting that the valuation effect has brought a downward bias in the effect of uncertainty on cross-border banking flows through the appreciation of the dollar.

C. Mechanism at play: Rebalancing channel of global banks

We have found robust evidence that higher uncertainty in a country whereby global banks operate reduces their cross-border lending (outflows) and deposit they receive from foreign countries (inflows). Givn that banks do not have much incentive to refuse deposits, a decrease in cross-border banking inflows should be mostly explained by behaviors of foreign lenders. Moreover, we control for other macroeconomic variables in a local economy potentially affecting asset supply. Higher uncertainty in a local economy is likely to induce a

risk-averse behavior of foreign lenders through several channels. First, information and expectations about local assets beome more dispersed between domestic and foreign investors as uncertainty about the local economy increases. (Broner et al., 2013; Tille and van Wincoop, 2014; Benhima and Cordonier, 2017). Second, to the extent to which higher uncertainty increases expropriation risks (Broner et al., 2010; Gourio et al., 2015), foreign investors will also hold less deposits in this country. All else equal—a maintained assumption in the paper using the costellation of control variables and the fixed effects—, these mechanisms will decrease the foreign holding of local deposits.

Then what explains a decrease in outflows (retrenchment)—after accounting for the valuation effect—in response to higher uncertainty in a local economy? Is it a mere reflection of the weakness in the banking sector hit by a negative shock? As long as global banks operate across different markets, it is possible that they find foreign borrowers more attractive when facing higher uncertainty about the local economy via the so called "flight-to-quality" mechanism. To the extent that banks also reduce their lending to domestic borrowers when facing higher uncertainty at home (Bordo et al., 2016; Raunig et al., 2016), perhaps one should answer this question by analyzing whether global banks rebalance the composition of their lending between local and foreign borrowers in response to higher uncertainty.

An emerging theoretical literature studies the role of idiosyncratic uncertainty shocks in explaining international business cycles, asset prices, and capital flows. For example, Kollmann (2016) builds a two-country model with recursive preferences and complete markets in which uncertainty in home plays an important role in shaping international business cycles and capital flows via risk sharing. Fogli and Perri (2015) also find some evidence that an increase in relative volatility in home output is associated with an increase in net foreign assets and explain this phenomenon with precautionary saving motives. The relative measure of uncertainty (between a local and foreign country) embedded in our empirical model allows us to test the implication of risk sharing and precautionary saving mechanisms on the reallocation of global banks in response to higher uncertainty.

We test the reallocation channel by creating a new dependent variable to proxy the relative share of cross-border and local lending. Unfortunately, the BIS LBS do not provide historical data on total domestic claims of the global banks in a reporting country.[26] This data limitation does not allow us to calculate the relative size of cross-border claims to domestic claims by the same set of global banks in a reporting country directly. We still aim to provide the first set of evidence on the reallocation behavior by employing two proxies to gauge the relative share of cross-border lending in total bank lending.

[26] The BIS LBS provides the data on domestic claims of the global banks in local currencies in a reporting countries ("Q:S:C:A:TO1:D:5J:A:Country:A:5J:R" in BIS statistics code) only after 2012 (Bank for International Settlements, 2017).

First, we use domestic claims of the banking system in a reporting country to capture the reallocation of lending by global banks between local and foreign borrowers. While domestic claims of the banking system cover credit extended to domestic private and public borrowers, they also include domestic banks that do not report any cross-border claims to the BIS. To the extent to which the global banks in the BIS LBS account for a bulk of the domestic banking system, this new variable provides a reasonable proxy to study banks' reallocation behaviors. Since 2012Q3, the BIS LBS started reporting the value of local claims in local currencies. Although the short coverage of the data prevents us from using them in our analysis, we compare this value with domestic bank claims reported to the IMF IFS. For most cases, the reported values are very close to each other, suggesting that the global banks studied in this paper are representative of the domestic banking system.

We obtain domestic bank claims (line 32) from the IMF International Financial Statistics Depository Corporations Survey. Because the BIS LBS includes bank claims on the private and public sectors, we also use total domestic claims rather than domestic claims on the private sector (line 22d). Because domestic claims are measured in a local currency, we convert them into U.S. dollar using the end-of-the-period nominal exchange rate. The share of cross-border claims to total domestic claims is computed as:

$$s_{i,j,t} = \frac{cross\ border\ claims_{i,j,t}}{total\ domestic\ claims_{i,t}/nominal\ exchange\ rate_{i,t}+cross\ border\ claims_{i,t}} \times 100, \quad (3)$$

where $cross\ border\ claims_{i,t} = \sum_j cross\ border\ claims_{i,j,t}$. For most countries in the sample, total domestic claims at a quarterly frequency in a consistent manner are available from the IMF IFS since 2001. To confirm that our results are not driven by the analysis of a shorter sample period, we repeat the baseline analysis using the data since 2001 and find that our main findings hardly change.[27]

$$s_{i,j,t} = \alpha_{j,t} + \beta X_{i,t-1} + \gamma UNC_{i,t-1} + \varepsilon_{i,j,t}, \quad (4)$$

with a positive (negative) sign of γ suggesting that global banks increase (decrease) the share of their lending to foreign borrowers when they face higher uncertainty in a local economy. Note that an increase in the share does not mean that global banks increase the amount of cross-border lending. Although global banks reduce cross-border lending in response to higher uncertainty—as we have seen in the previous section—, they may reduce domestic lending even more, thereby shifting towards cross-border lending effectively.[28]

[27] For example, the coefficient on the lagged uncertainty term is still negative and significant at 5% level. The results are available upon request.

[28] Correa et al. (2017) also test a similar rebalancing channel in response to monetary policy tightening by asking whether domestic credit is less sensitive to the monetary policy compared to foreign credit. However, our methodology of computing the share of cross-border claims directly differs from that of Correa et al. (2017).

Table 14 shows the results from estimating equation (4). The signs of coefficients on some control variables, such as real GDP growth and the policy rate switch their sign in this analysis, suggesting that behaviors of gross cross-border claims do not necessarily coincide with those of local claims in foreign currencies. For example, an increase in growth in a reporting country reduces the share of cross-border claims, while it increases cross-border claims in an absolute term. Global banks expand their lending to both local and foreign borrowers during economic expansions and monetary policy tightening in a local economy, but they lend more to local borrowers. It is likely because the relative profitability of investment made by domestic firms improves during expansions compared to their foreign counterparts.[29]

Interestingly, the uncertainty variable switches its sign as well, implying that global banks shift the composition of their lending toward foreign borrowers when uncertainty regarding the local economy increases, suggesting the existence of a rebalancing mechanism of global banks in response to higher uncertainty. One might argue that our finding of rebalancing toward foreign borrowers contradicts to the previous finding of the increased home bias during the period of financial distress found in the literature (Milesi-Ferretti and Tille, 2011 and Broner et al., 2013). However, this is not necessarily the case. While our measure includes only banks' domestic claims, the previous studies use total capital flows from BOP data, which include official flows as well. The home bias might be an outcome of the changes in the portfolio structure in favor of domestic assets by monetary financial institutions due to deleveraging processes. To the extent that we focus only on the subset of the BOP data, our finding cannot be generalized to the case of total capital flows.

Instrumental variable approach

Our analysis could still be subject to endogeneity since unobserved factors might drive uncertainty and macroeconomic conditions in a local economy simultaneously. While controlling for GDP growth and stock market growth in a reporting country mitigates this concern,[30] we use an IV approach in the same spirit of Baker and Bloom (2013). To obtain the causal impact of uncertainty shocks on GDP growth, Baker and Bloom (2013) use natural

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Correa et al. (2017) interact the policy rate with a dummy variable that takes the value one for observations where the dependent variable measures domestic lending and zero for foreign lending.

[29] The negative sign on domestic policy rate may seem counterintuitive since it contradicts to the conventional bank lending channel of monetary policy. However, one should note that our focus is on the global banks engaging in cross-border lending and borrowing. To the extent that these global banks tap U.S. dollar money market funds in financial centers to finance their lending activity (Bruno and Shin, 2015), tighter monetary policy in a local economy implies a higher lending rate not necessarily with an increase in funding costs. Global banks can benefit from such a high-interest rate environment in a local economy by lending relatively more to local borrowers.

[30] However, a decline in economic activity associated with heightened uncertainty and the synchronization in business cycles across the world should bias our estimates downward in any case.

disasters, terrorist attacks, and political shocks as an instrument, which is typically exogenous at least in the short-run.[31]

Specifically, we use the disaster shock data—extreme weather and geological events as defined by the Center for Research on the Epidemiology of Disasters (CRED)—as instruments.[32] These instruments are also scaled by the increase in media mentions of the country in the 15-days after the shock compared to the 15-days before the shock. We proceed with a two-stage least squares (2SLS) approach. In the first step, we regress our measures of uncertainty on the instruments. The results of the first stage in Table 10 confirm that this instrument can be considered as "strong instruments"—that is, the Cragg-Donald Wald F-statistics are far above the Stock and Yogo (2005) critical values for weak instruments in all cases. Hansen's J statistics for valid instruments are not reported since the equation is exactly identified (we only have one instrument variable).

In the second step, we re-estimate equation (4) using the exogenous part of stock market volatility driven by the instrument—that is, the fitted value of the first step. While the results reported in Table 15 confirm our OLS results in Table 14, the size of the coefficient on uncertainty increases substantially, implying that the OLS estimates are biased downwards.

Safe vs. risky borrowers

If the higher uncertainty in a local economy encourages global banks to switch their lending toward relatively safer foreign borrowers, we expect that this mechanism could be weaker when banks lend to borrowers who are genuinely conceived risky. In other words, despite higher uncertainty, global banks may be reluctant to lend to borrowers in a risky economy, regardless of its economic conditions (flight-to-safety). To test this hypothesis, we interact our main independent variable of uncertainty with the income-level status of counterparty countries. In other words, we interact $UNC_{i,t-1}$ with a dummy variable EM_j taking a value of one if a counterparty country j is an emerging market economy and zero otherwise.

$$s_{i,j,t} = \alpha_{j,t} + \beta X_{i,t-1} + \gamma UNC_{i,t-1} + \delta EM_j UNC_{i,t-1} + \varepsilon_{i,j,t}, \quad (5)$$

[31] To sort out major exogenous events, Baker and Bloom include a shock only if it fulfills at least one of the following conditions: 1. More than .001% of a country's population dead. 2. More than .01% of a country's GDP in damage 3. A successful coup or regime change.

[32] While Baker and Bloom (2013) include other events such as Coup d'état, a revolutionary war or violent uprising as an instrument of uncertainty, our sample of advanced economies rarely contains these events during the last two decades. Thus, we include only the natural disasters in our instrument. See Baker and Bloom (2013) for details on the constructions of these instruments and on the tests regarding the exogeneity of these measures.

Table 16 shows that the interaction term is indeed negative and statistically significant, suggesting that while global banks switch their lending toward relatively safer foreign borrowers when they face higher uncertainty in a local economy, this rebalancing occurs only lending towards advanced economies, not emerging market economies. This finding is consistent with the flight-to-safety behavior observed during the episodes of heightened uncertainty, such as the Asian Financial Crisis, 9/11, the collapse of Lehman Brothers, and Taper Tantrum (Beber et al., 2008; Caballero and Krishnamurthy, 2008; De Bock and Filho, 2015) and the existence of the international credit channel of uncertainty shocks suggested in the recent literature to explain much larger effects of uncertainty shocks in emerging markets than in advanced economies (Carrière-Swallow and Céspedes, 2013; Choi, 2018).

Alternative measure of the share of cross-border claims

We have used domestic claims by the whole banking system when constructing $s_{i,j,t}$ in equation (3) in creating a new variable. However, the global banks reporting to the BIS may still not necessarily span the whole domestic banking system. Moreover, potential cross-country differences in the definition or coverage of the banking system may create some measurement errors in constructing the share of cross-border bank lending to the total bank lending. To the extent to which such data issues are systematic, our finding in the previous section is likely to be biased.

To complement this analysis, we use local claims in foreign currencies of the same set of global banks in a reporting country to capture the reallocation of lending by global banks between local and foreign borrowers, which is free of the valuation effect. The BIS LBS provides the historical data on local claims in foreign currencies of the global banks in a reporting country ("Q:S:C:A:TO1:F:5J:A:Country:A:5J:R"), with an exception of the U.S. In the BIS international banking statistics, the sum of cross-border claims and local claims in foreign currencies is labeled "international" claims. Figure 3 shows the absolute size of international claims across the 25 reporting countries in the sample and Figure 4 shows the relative size of cross-border claims to international claims. In Figure 4, it is apparent that the relative size of cross-border claims is lower in emerging market economies than advanced economies, suggesting that local lending in foreign currencies is prevalent phenomenon in these countries.

Apparently, using this alternative proxy has its own limitation because we cannot draw a full picture regarding the rebalancing behavior in response to higher uncertainty. The lower the relative size of international claims to total domestic claims by the banking sector, the smaller is the aggregate implication of the identified portfolio reallocation channel in response to higher uncertainty. Figure 5 compares the relative size of international claims with total domestic claims used to construct a share of cross-border lending in equation (3),

suggesting that the size of international claims are not negligible when compared to total domestic claims for most countries in the sample. We compute the share of cross-border claims to international claims as:

$$\tilde{s}_{i,j,t} = \frac{cross\ border\ claims_{i,j,t}}{cross\ border\ claims_{i,t} + local\ claims\ in\ foreign\ currencies_{i,t}} \times 100. \quad (6)$$

Because every variable in equation (3) is in the U.S. dollar after the exchange-rate adjustment from the BIS LBS, we do not need to worry about the valuation effect. We estimate the effect of higher uncertainty on the share of cross-border claims using a specification similar to equation (4):

$$\tilde{s}_{i,j,t} = \alpha_{j,t} + \beta X_{i,t-1} + \gamma UNC_{i,t-1} + \varepsilon_{i,j,t}. \quad (7)$$

Table 17 shows the results from estimating equation (7) by using both measures of uncertainty, as well as using an IV approach described in the main text and adding the interaction term to denote the recipient country status (advanced vs. emerging). When using an alternative measure of the share of cross-border lending free of the valuation effect and measurement errors, we still reach a qualitatively similar finding regarding the effect of higher uncertainty and the role of counterparty-country status.

V. CONCLUSION

This paper contributes to the growing literature on the link between uncertainty and international capital flows. Unlike most prior studies focusing on uncertainty as a global push factor of international capital flows into emerging market economies, we use the dyadic structure of the BIS LBS data to control for any shocks affecting economic conditions in counterparty countries, and thereby identify better the role of country-specific uncertainty in explaining cross-border banking flows among a large group of countries with a different level of financial market development.

The results suggest that higher uncertainty in a local economy—measured by country-specific stock market volatility—reduces cross-border lending from (and cross-border deposits into) this economy, and the decline is more substantial if the flows are related to emerging market economies. Our findings are robust to using alternative measures of uncertainty, such as economic policy uncertainty, controlling for gravity factors and bilateral trade flows, and various sample split exercises.

To further shed light on the behaviors of global banks in response to higher uncertainty, we study portfolio reallocation of global banks between local and cross-border lending. Global banks switch the composition of their lending toward foreign borrowers

when uncertainty regarding the local economy increases. Interestingly, this reallocation occurs only on lending towards advanced economies, not emerging market economies, suggesting the flight-to-safety behavior of the global banks. One important caveat applies to the results regarding the reallocation channel. As we rely on imperfect proxies, we take our results rather suggestive than clear cut evidence. A future study with the complete data including historical domestic claims by global banks will provide a definite answer to the question of interest.

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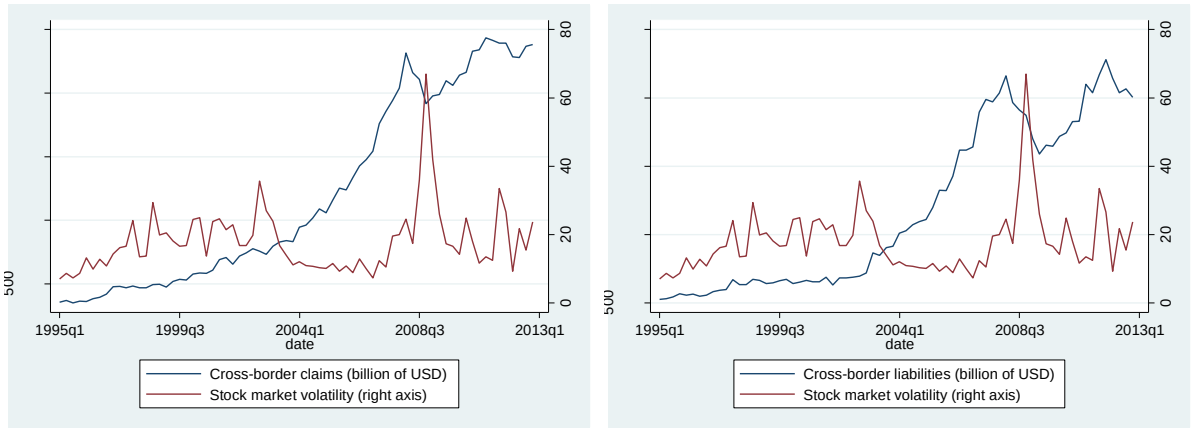
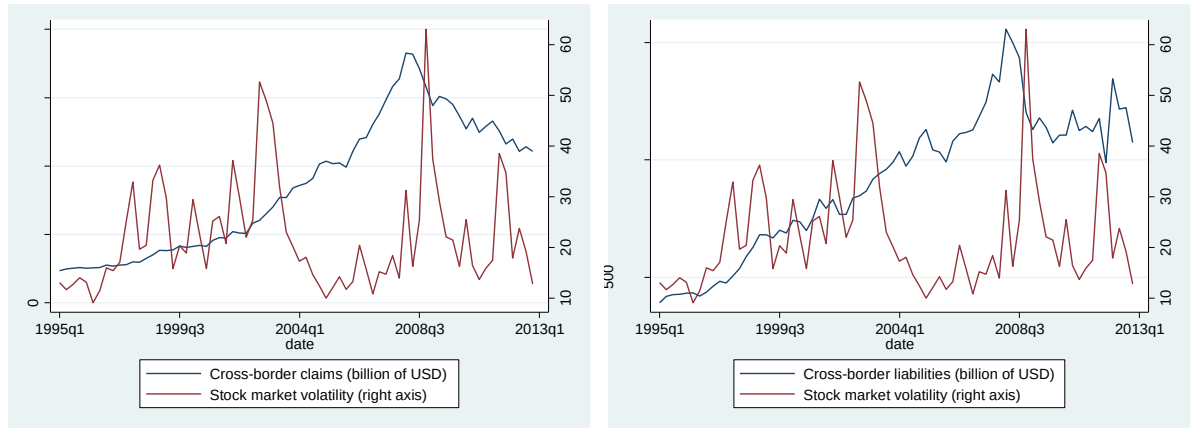
Figures and Tables

Figure 1. Total cross-border bank claims and liabilities

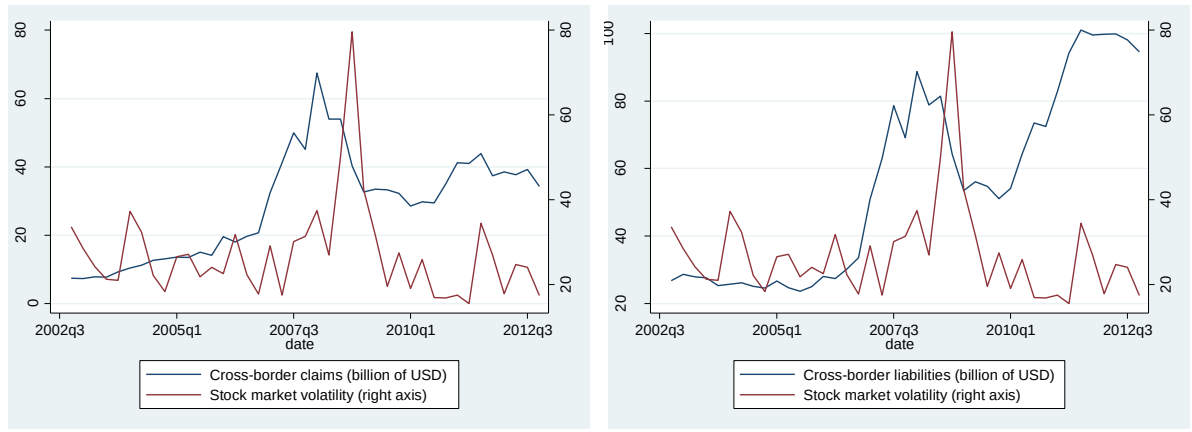
a) U.S.



b) Germany



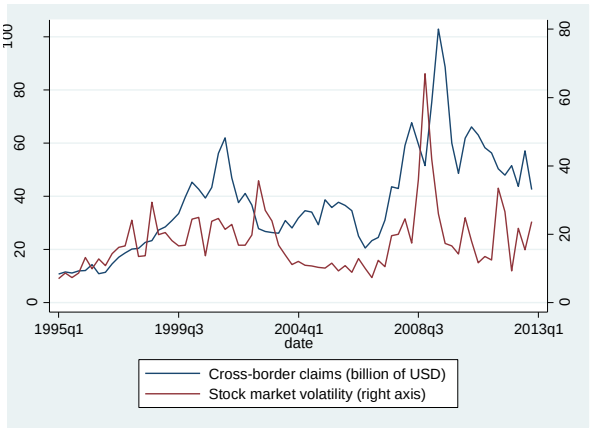
c) Brazil

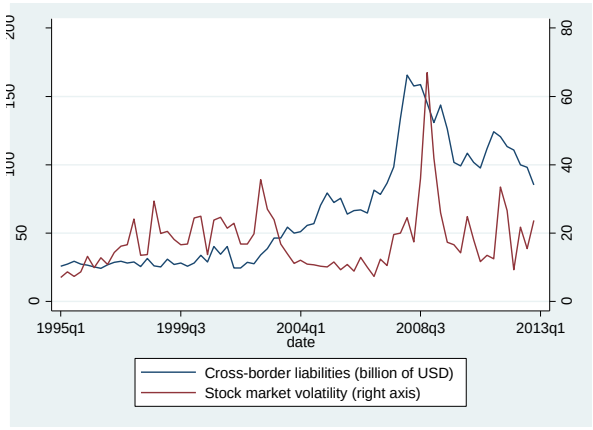


Note: Uncertainty is measured by stock market volatility in a reporter (source) country.

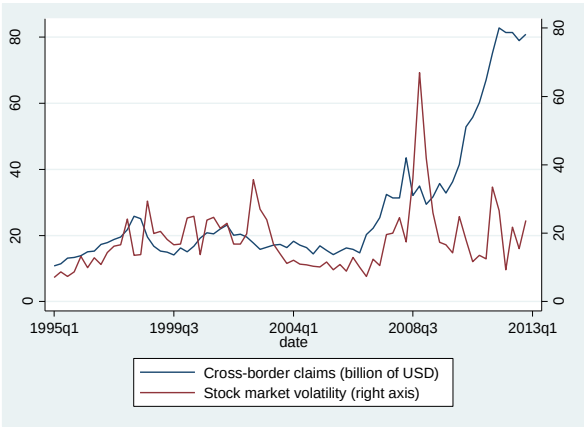
Figure 2. Examples of the bilateral cross-border bank claims and liabilities: a reporter—counterparty pair

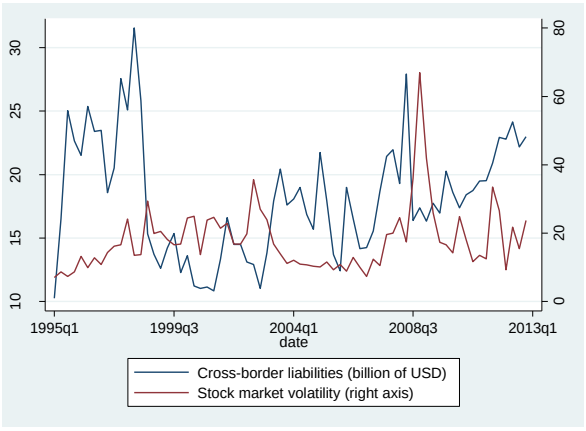
a) U.S.—Germany



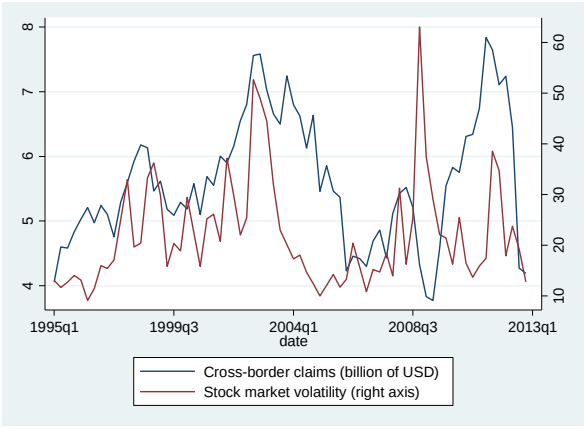


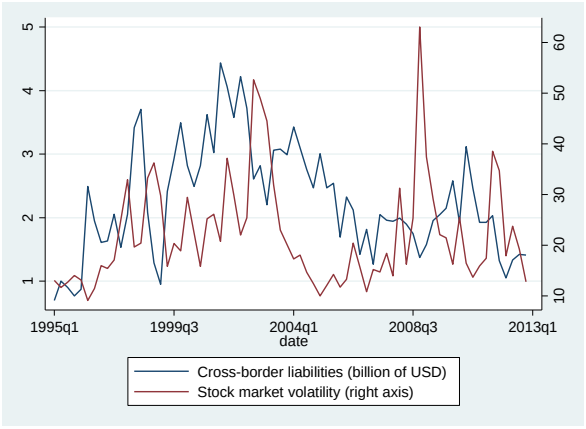
b) U.S. —Brazil





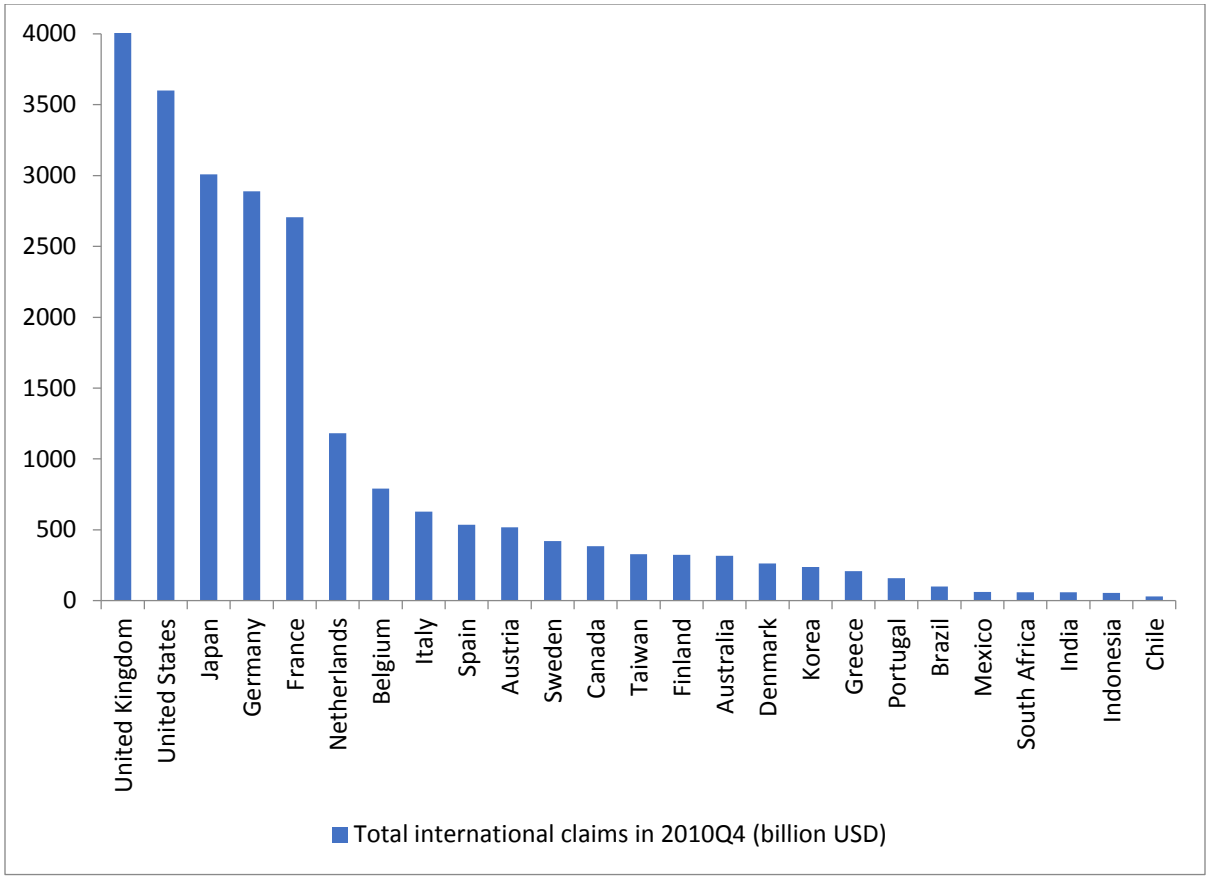
c) Germany—Brazil





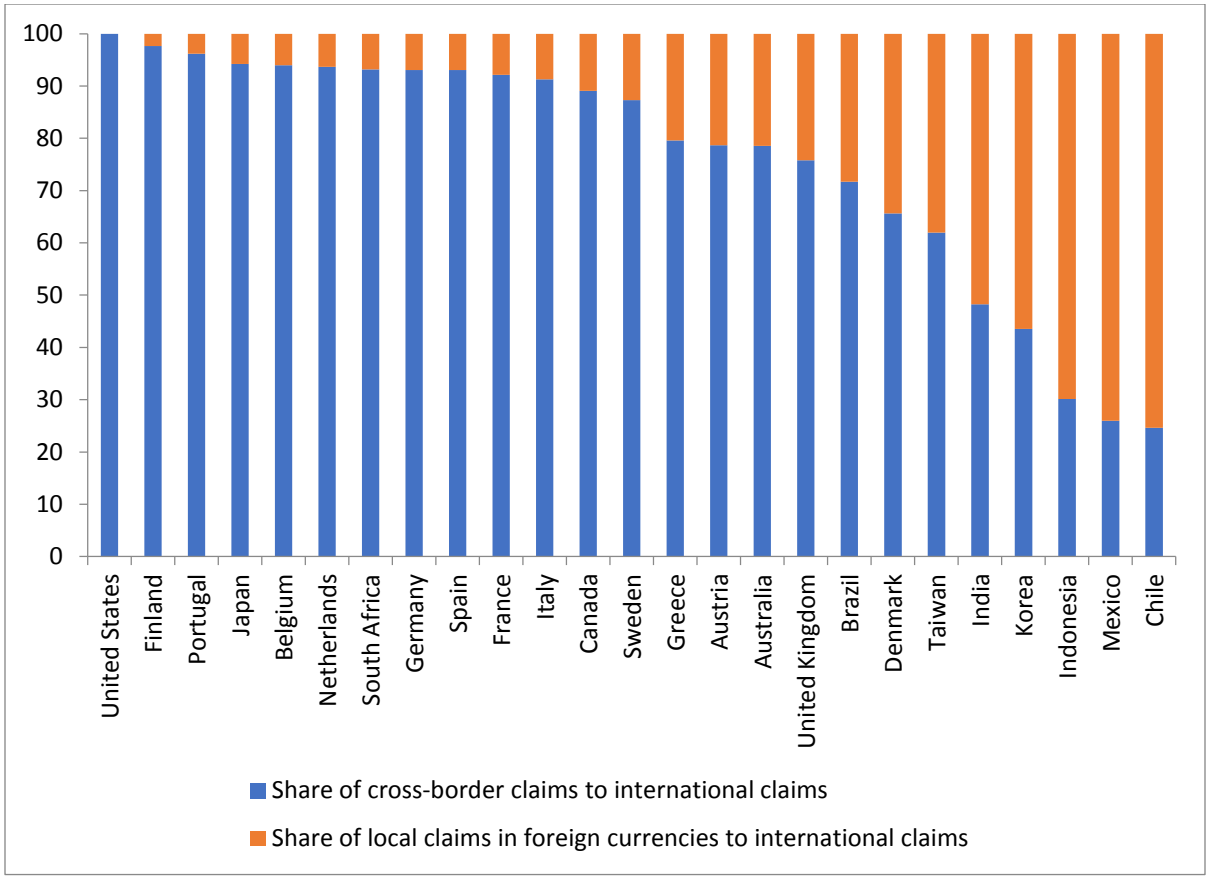
Note: Uncertainty is measured by stock market volatility in a reporter (source) country.

Figure 3. Total international claims in 2010Q4 (billion USD)



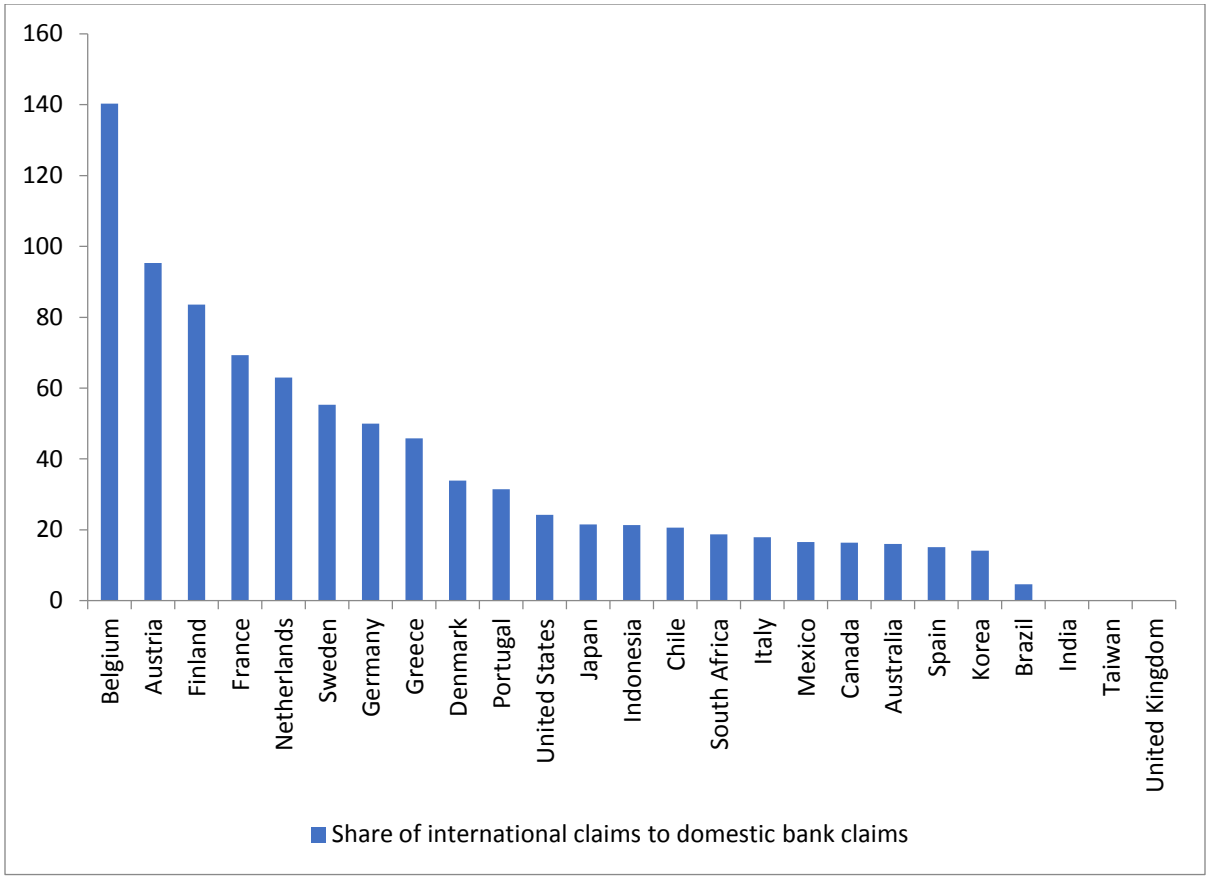
Note: International claims are defined by the sum of cross-border claims and local claims in foreign currencies. The U.S. does not report local claims in foreign currencies to the BIS, so this value captures only cross-border claims for the U.S. To enhance visualization, the upper limit of 4000 billion USD is imposed. Total international claims of the U.K. in 2010Q4 are 6,972 billion dollars.

Figure 4. Share of cross-border claims to total international claims in 2010Q4



Note: The U.S. does not report local claims in foreign currencies to the BIS.

Figure 5. The relative size of international claims to domestic bank claims in 2010Q4



Note: International claims are defined by the sum of cross-border claims and local claims in foreign currencies. Their values are shown in Figure 3. The U.S. does not report local claims in foreign currencies to the BIS, so this value captures only cross-border claims for the U.S. Domestic bank claims (line 32) are taken from IMF International Financial Statistics Depository Corporations Survey. These data are not available for India, Taiwan, and the U.K. in the IMF IFS.

Table 1. Data availability on cross-border flows in the BIS International Banking Statistics

	Nationality of lending bank	Residence of borrowers	Currency composition
Consolidated banking statistics	Yes	Yes	No
Locational banking statistics			
by residence	No	Yes	Yes
by nationality	Yes	No	Yes
stage 1 data	Yes	Yes	Yes

Note: This table is reproduced from Table 1 in Avdjiev and Elod Takáts (2014). In addition to exchange rate fluctuations, the quarterly flows in the locational datasets are corrected for breaks in the reporting population. The BIS consolidated banking statistics group claims according to the nationality of banks (i.e., according to the location of banks' headquarters), netting out inter-office positions. The BIS locational banking statistics define creditors and debtors according to their residence, consistently with national accounts and balance of payments principles. The Stage 1 enhanced data are the first consistent data set to provide all three dimensions at the same time, but the construction of comprehensive time series data is still in progress.

Table 2. Total cross-border claims and liabilities as a share of GDP

	Total cross-border claims as a share of GDP	Total cross-border liabilities as a share of GDP
Australia	65.20	165.13
Austria	382.88	227.47
Belgium	571.81	441.18
Brazil	5.97	12.36
Canada	88.99	66.26
Chile	12.39	21.65
Denmark	197.52	229.40
Finland	502.87	595.53
France	337.02	327.53
Germany	289.92	130.79
Greece	199.62	133.61
India	6.03	18.08
Indonesia	7.53	7.34
Italy	101.95	127.21
Japan	162.92	72.29
Korea	31.03	71.46
Mexico	5.44	7.32
Netherlands	524.19	469.70
Portugal	224.71	184.77
South Africa	52.65	37.30
Spain	135.20	171.35
Sweden	278.91	169.49
Taiwan	155.67	62.37
United Kingdom	643.95	379.29
United States	63.55	49.65

Note: Total cross-border claims and liabilities as a share of the domestic GDP in 2010Q4 under locational banking statistics with the residency principle.

Table 3. Summary statistics

Variable	Obs.	Mean	Median	Standard deviation
Growth of cross-border claims from a country *i* to a country *j*	30,608	3.136	1.225	40.751
Growth of cross-border liabilities of a country *i* from a country *j*	29,889	2.998	1.359	50.930
Stock market volatility	30,608	19.943	17.211	10.238
Economic policy uncertainty	24,901	105.921	97.412	44.417
Real GDP growth	30,608	0.600	0.645	1.059
Growth of stock market	30,608	1.254	2.214	9.826
Inflation rate	30,608	0.609	0.573	0.626
Policy rate	30,608	3.666	3.370	2.653
Growth of nominal exchange rate with respect to USD	30,608	-0.127	0.000	4.243
Growth of private credit	19,605	1.506	1.372	2.143
External debt to GDP ratio	17,973	80.704	74.052	53.674
Growth of bilateral exports from a country *i* to a country *j*	30,608	1.644	2.277	20.434
Growth of bilateral imports of a country *i* from a country *j*	30,608	1.993	2.242	21.967

Note: Growth rates are calculated quarter-over-quarter. All variables are in percentage points.

Table 4. Baseline analysis

	Growth of claims (outflows)			Growth of liabilities (inflows)		
Explanatory variables	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	-1.670**	-2.845**	-2.716**	-2.369**	-2.734**	-2.302*
	(0.824)	(1.150)	(1.211)	(0.957)	(1.328)	(1.289)
Real GDP growth	0.852***	0.782**	0.391	0.856**	0.207	-0.598
	(0.290)	(0.402)	(0.422)	(0.393)	(0.629)	(0.604)
Stock market growth	0.002	-0.067*	-0.062	-0.017	0.063	0.029
	(0.031)	(0.039)	(0.040)	(0.041)	(0.070)	(0.065)
CPI inflation	-0.349	-1.331	-0.995	0.782	0.587	0.477
	(0.508)	(0.879)	(0.922)	(0.615)	(1.270)	(1.017)
Policy rate	0.557***	0.718***	0.669***	0.147	0.244	0.062
	(0.107)	(0.136)	(0.133)	(0.114)	(0.166)	(0.150)
Nominal exchange rate growth	-0.094	-0.123	-0.153*	0.003	-0.093	-0.217**
	(0.078)	(0.088)	(0.089)	(0.110)	(0.138)	(0.109)
Private credit growth		0.109	0.029		0.035	0.035
		(0.183)	(0.194)		(0.211)	(0.200)
External debt to GDP			-0.022***			-0.018***
			(0.004)			(0.006)
Obs	30,608	17,462	16,431	29,889	16,725	14,784
R-squared	0.13	0.14	0.15	0.14	0.15	0.16

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (III) and the growth rate of exchange rate-adjusted cross-border liabilities in column (IV) to (VI). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors in parentheses. Standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 5. Link to the previous studies focusing on emerging market economies

	Reporter: emerging market economies only			Counterparty: emerging market economies only		
Explanatory variables	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	-8.126*	-14.287*	-16.928**	-2.177*	-3.695**	-4.016**
	(4.114)	(7.727)	(7.821)	(1.223)	(1.792)	(1.797)
Real GDP growth	1.588	-1.234	-1.381	1.512***	1.667***	1.073*
	(1.241)	(1.666)	(1.745)	(0.448)	(0.550)	(0.561)
Stock market growth	0.296**	0.138	0.097	-0.028	-0.137**	-0.126**
	(0.114)	(0.472)	(0.491)	(0.043)	(0.053)	(0.053)
CPI inflation	1.046	-2.872	0.711	-1.462*	-3.397***	-2.517**
	(1.257)	(2.309)	(3.019)	(0.764)	(1.246)	(1.253)
Policy rate	0.726**	1.429**	1.648**	0.920***	1.371***	1.188***
	(0.327)	(0.626)	(0.698)	(0.215)	(0.310)	(0.304)
Nominal exchange rate growth	0.273	0.101)	0.189	0.095	0.148)	0.133
	(0.194)	(0.287	(0.293)	(0.113)	(0.133)	(0.122)
Private credit growth		0.687	0.753		0.297	0.132
		(0.651)	(0.794)		(0.273)	(0.278)
External debt to GDP			0.054			-0.029***
			(0.128)			(0.007)
Obs	2,671	1,400	1,358	13,685	7,694	7,249
R-squared	0.37	0.41	0.42	0.15	0.17	0.18

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 6. Robustness check: Alternative measure of uncertainty

	Growth of claims (outflows)		Growth of liabilities (inflows)	
	Economic policy uncertainty		Economic policy uncertainty	
Explanatory variables	(I)	(II)	(V)	(VI)
Uncertainty	-1.923**	-3.574***	-2.621**	-2.832*
	(0.930)	(1.239)	(1.207)	(1.681)
Real GDP growth	1.446***	0.920**	0.888*	-0.052
	(0.380)	(0.430)	(0.468)	(0.705)
Stock market growth	0.049	-0.056	0.035	0.080
	(0.037)	(0.042)	(0.051)	(0.074)
CPI inflation	-0.492	-0.807	0.121	0.436
	(0.587)	(1.005)	(0.608)	(1.233)
Policy rate	0.479***	0.540***	0.212*	0.167
	(0.114)	(0.140)	(0.120)	(0.145)
Nominal exchange rate growth	-0.034	-0.085	0.123	0.027
	(0.084)	(0.090)	(0.116)	(0.134)
Private credit growth		-0.031		-0.060
		(0.193)		(0.227)
External debt to GDP		-0.022***		-0.028***
		(0.005)		(0.007)
Obs	21,564	13,715	21,212	14,784
R-squared	0.15	0.17	0.17	0.16

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 7. Robustness check: Winsorizing the uncertainty shock

	Growth of claims (outflows)		Growth of liabilities (inflows)	
Explanatory variables	(I)	(III)	(IV)	(VI)
Uncertainty	-1.630*	-2.598**	-2.307**	-2.106*
	(0.872)	(1.301)	(1.016)	(1.285)
Real GDP growth	0.852***	0.500	0.856**	-0.686
	(0.289)	(0.426)	(0.393)	(0.610)
Stock market growth	0.004	-0.059	-0.014	0.025
	(0.031)	(0.040)	(0.041)	(0.067)
CPI inflation	-0.353	-0.773	0.779	0.299
	(0.508)	(0.935)	(0.616)	(1.026)
Policy rate	0.555***	0.606***	0.144	0.014
	(0.107)	(0.152)	(0.115)	(0.147)
Nominal exchange rate growth	-0.094	-0.127	0.003	-0.186*
	(0.078)	(0.090)	(0.110)	(0.112)
Private credit growth		0.010		-0.042
		(0.195)		(0.207)
External debt to GDP		-0.022***		-0.016***
		(0.005)		(0.006)
Obs	30,608	16,431	29,889	14,784
R-squared	0.13	0.15	0.14	0.16

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 8. Robustness check: Before and after the Global Financial Crisis

	Growth of claims (outflows)		Growth of liabilities (inflows)	
	Before the GFC (1995Q1-2007Q2)	After the GFC (2007Q3-2012Q4)	Before the GFC (1995Q1-2007Q2)	After the GFC (2007Q3-2012Q4)
Explanatory variables	(I)	(II)	(III)	(IV)
Uncertainty	-1.983**	-2.841**	-2.111**	-3.550*
	(1.026)	(1.289)	(1.052)	(1.910)
Real GDP growth	0.757*	0.909***	0.973*	0.672
	(0.453)	(0.297)	(0.550)	(0.554)
Stock market growth	0.006	0.008	-0.169***	0.106
	(0.048)	(0.033)	(0.060)	(0.065)
CPI inflation	-0.878	-0.183	0.778	0.916
	(0.843)	(0.536)	(0.986)	(0.759)
Policy rate	0.691***	0.177	0.135	0.152
	(0.143)	(0.179)	(0.124)	(0.222)
Nominal exchange rate growth	-0.058	0.003	0.011	-0.003
	(0.141)	(0.079)	(0.158)	(0.142)
Obs	18,846	11,578	18,808	1,1081
R-squared	0.143	0.119	0.16	0.13

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 9. Robustness check: Euro area vs. non-euro area countries

	Growth of claims (outflows)		Growth of liabilities (inflows)	
	Euro area	Non-euro area	Euro area	Non-euro area
Explanatory variables	(I)	(II)	(III)	(IV)
Uncertainty	-5.136**	-2.827*	-4.167	-1.503
	(2.444)	(1.511)	(2.523)	(2.078)
Real GDP growth	0.352	0.351	0.025	-1.120
	(0.840)	(0.587)	(1.173)	(0.827)
Stock market growth	-0.186*	-0.023	0.005	0.064
	(0.104)	(0.048)	(0.161)	(0.084)
CPI inflation	1.646	-1.672	-0.294	2.051
	(1.494)	(1.190)	(2.164)	(1.611)
Policy rate		0.621***		-0.151
		(0.191)		(0.219)
Nominal exchange rate growth		0.003		-0.098
		(0.079)		(0.160)
Private credit growth	-0.247	0.225		0.029
	(0.208)	(0.312)		(0.370)
External debt to GDP	-0.013	-0.033**		-0.055***
	(0.009)	(0.014)		(0.020)
Obs	6,559	9,508	6,253	8,856
R-squared	0.32	0.22	0.32	0.23

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 10. Robustness check: Controlling for gravity factors

	Growth of claims (outflows)		Growth of liabilities (inflows)	
Explanatory variables	(I)	(III)	(IV)	(VI)
Uncertainty	-1.601*	-2.920**	-2.179**	-2.093*
	(0.824)	(1.230)	(0.987)	(1.221)
Real GDP growth	0.831***	0.463	0.803**	-0.745
	(0.291)	(0.430)	(0.396)	(0.612)
Stock market growth	0.004	-0.061	-0.010	0.032
	(0.031)	(0.039)	(0.041)	(0.067)
CPI inflation	-0.285	-0.632	0.942	0.604
	(0.517)	(0.964)	(0.622)	(1.051)
Policy rate	0.538***	0.609***	0.074	-0.027
	(0.108)	(0.151)	(0.115)	(0.149)
Nominal exchange rate growth	-0.124	-0.138	-0.141	-0.277**
	(0.088)	(0.111)	(0.112)	(0.139)
Private credit growth		0.026		-0.007
		(0.194)		(0.207)
External debt to GDP		-0.023***		-0.013**
		(0.005)		(0.007)
Distance	0.244	-0.169	1.043***	0.609
	(0.283)	(0.322)	(0.311)	(0.331)
Common border	0.546	-0.001	2.201***	2.262**
	(0.809)	(1.168)	(0.765)	(0.978)
Common language	0.040	-0.293	-1.038	-0.491
	(0.739)	(0.827)	(0.703)	(0.962)
Obs	30,608	16,431	29,889	14,784
R-squared	0.14	0.15	0.14	0.17

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors in parentheses. Standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 11. Robustness check: Controlling for bilateral trade flows

	Growth of claims (outflows)		Growth of liabilities (inflows)	
Explanatory variables	(I)	(III)	(IV)	(VI)
Uncertainty	-1.686**	-2.877**	-2.365**	-2.220*
	(0.827)	(1.217)	(0.959)	(1.318)
Real GDP growth	0.834***	0.464	0.837**	-0.744
	(0.290)	(0.426)	(0.393)	(0.614)
Stock market growth	0.002	-0.063	-0.017	0.020
	(0.032)	(0.040)	(0.041)	(0.067)
CPI inflation	-0.360	-0.804	0.782	0.271
	(0.508)	(0.937)	(0.615)	(1.029)
Policy rate	0.553***	0.615***	0.145	0.018
	(0.107)	(0.151)	(0.114)	(0.147)
Nominal exchange rate growth	-0.096	-0.127	0.006	-0.186*
	(0.078)	(0.090)	(0.110)	(0.112)
Private credit growth		0.010		-0.036
		(0.194)		(0.207)
External debt to GDP		-0.022***		-0.016***
		(0.005)		(0.006)
Export (import) growth	0.028	0.015	0.018	0.037
	(0.020)	(0.028)	(0.021)	(0.026)
Obs	30,608	16,431	29,889	14,784
R-squared	0.13	0.15	0.14	0.17

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors in parentheses. Standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 12. Robustness check: Using a binary indicator of the uncertainty events

	Growth of claims (outflows)		Growth of liabilities (inflows)	
Explanatory variables	(I)	(III)	(IV)	(VI)
Uncertainty	-5.563***	-3.553*	0.803	0.433
	(1.716)	(1.929)	(2.359)	(2.661)
Real GDP growth	0.801***	0.552	0.921*	-0.440
	(0.291)	(0.421)	(0.488)	(0.681)
Stock market growth	-0.006	-0.065	0.007	0.044
	(0.032)	(0.040)	(0.052)	(0.075)
CPI inflation	-0.309	-0.591	1.633	1.587
	(0.508)	(0.939)	(1.051)	(1.235)
Policy rate	0.507***	0.531***	-0.215	0.300
	(0.106)	(0.146)	(0.228)	(0.352)
Nominal exchange rate growth	-0.092	-0.115	-0.073	-0.288*
	(0.078)	(0.089)	(0.131)	(0.168)
Private credit growth		0.011		-0.346
		(0.194)		(0.232)
External debt to GDP		-0.024***		-0.012*
		(0.005)		(0.007)
Obs	30,608	16,431	29,889	14,784
R-squared	0.13	0.15	0.16	0.18

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors in parentheses. Standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 13. Robustness check: Testing for the valuation effect

	Growth of claims (outflows)		Growth of liabilities (inflows)	
Explanatory variables	(I)	(III)	(IV)	(VI)
Uncertainty	-0.401	-0.859	-1.394*	-0.256
	(0.633)	(0.948)	(0.721)	(1.150)
Real GDP growth	0.441**	0.378	0.905***	0.192
	(0.217)	(0.299)	(0.287)	(0.461)
Stock market growth	0.002	-0.053	-0.001	0.068
	(0.024)	(0.035)	(0.033)	(0.053)
CPI inflation	0.017	-0.514	1.309***	2.048**
	(0.403)	(0.766)	(0.481)	(0.910)
Policy rate	0.222**	0.168	-0.199**	-0.23
	(0.089)	(0.118)	(0.091)	(0.134)
Nominal exchange rate growth	0.035	0.092	-0.113	-0.316***
	(0.065)	(0.081)	(0.081)	(0.103)
Private credit growth		0.105		-0.350**
		(0.152)		(0.162)
External debt to GDP		-0.010***		-0.018***
		(0.004)		(0.005)
Obs	33,542	18,658	32,171	17,562
R-squared	0.14	0.15	0.14	0.15

Note: The dependent variables are the growth rate of unadjusted cross-border claims in column (I) to (II) and the growth rate of unadjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors in parentheses. Standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 14. Rebalancing between local and cross-border claims

	Share of cross-border claims		
Explanatory variables	(I)	(II)	(III)
Uncertainty	0.219**	0.187**	0.136*
	(0.086)	(0.085)	(0.079)
Real GDP growth	-0.035**	-0.031**	0.001
	(0.015)	(0.014)	(0.012)
Stock market growth	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)
CPI inflation	-0.056**	-0.060**	-0.072**
	(0.026)	(0.026)	(0.029)
Policy rate	-0.050***	-0.043***	-0.036**
	(0.014)	(0.013)	(0.014)
Nominal exchange rate growth	0.001	0.001	0.003
	(0.002)	(0.002)	(0.002)
Private credit growth		-0.024***	-0.014
		(0.009)	(0.008)
External debt to GDP			0.002***
			(0.001)
Obs	20,783	20,115	19,035
R-squared	0.46	0.47	0.47

Note: The dependent variables are the ratio of cross-border claims of global banks to the sum of cross-border claims of global banks and domestic claims of the banking system. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level

Table 15. Rebalancing between local and cross-border claims: IV approach

	Share of cross-border claims	
Explanatory variables	(I)	(II)
Log of uncertainty	0.815**	0.603*
	(0.373)	(0.299)
Real GDP growth	-0.007	0.015
	(0.017)	(0.012)
Stock market growth	0.002	0.002*
	(0.002)	(0.001)
CPI inflation	-0.024	-0.047
	(0.028)	(0.030)
Policy rate	-0.063***	-0.050***
	(0.016)	(0.019)
Nominal exchange rate growth	0.001	0.003*
	(0.002)	(0.002)
Private credit growth		-0.009
		(0.009)
External debt to GDP		0.002**
		(0.001)
Cragg-Donald Wald F-statistic	345.749	316.89
Stock-Yogo weak identification test 5% critical values	16.38	16.38
Obs	20,783	19,035
R-squared	0.45	0.46

Note: The dependent variables are the ratio of cross-border claims of global banks to the sum of cross-border claims of global banks and domestic claims of the banking system. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level

Table 16. Rebalancing between local and cross-border claims: Safe vs. risky borrowers

	Share of cross-border claims	
Explanatory variables	(I)	(II)
Log of uncertainty	0.380***	0.255*
	(0.145)	(0.137)
Log of uncertainty X counterparty EM dummy	-0.389**	-0.309**
	(0.154)	(0.151)
Real GDP growth	-0.035**	0.001
	(0.015)	(0.012)
Stock market growth	0.001	0.001
	(0.001)	(0.001)
CPI inflation	-0.054**	-0.071**
	(0.026)	(0.028)
Policy rate	-0.052***	-0.039***
	(0.014)	(0.015)
Nominal exchange rate growth	0.001	0.003*
	(0.002)	(0.001)
Private credit growth		-0.014
		(0.008)
External debt to GDP		0.002***
		(0.001)
Obs	20,783	19,035
R-squared	0.45	0.46

Note: The dependent variables are the ratio of cross-border claims of global banks to the sum of cross-border claims of global banks and domestic claims of the banking system. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level

Table 17. Rebalancing between domestic and cross-border lending: Using an alternative proxy for the share of cross-border claims

	Share of cross-border claims		
	OLS	IV	OLS interaction
Explanatory variables	(I)	(II)	(III)
Log of uncertainty	0.370*	0.628	0.775**
	(0.202)	(0.459)	(0.322)
Log of uncertainty X counterparty EM dummy			-0.974***
			(0.365)
Real GDP growth	0.006	0.018	0.002
	(0.038)	(0.042)	(0.038)
Stock market growth	(0.001)	(0.001)	(0.002)
	(0.002)	(0.002)	(0.002)
CPI inflation	(0.067)	(0.056)	(0.058)
	(0.057)	(0.058)	(0.057)
Policy rate	-0.027	-0.035	-0.035
	(0.024)	(0.035)	(0.026)
Nominal exchange rate growth	0.000	0.001	0.000
	(0.004)	(0.006)	(0.004)
Private credit growth	-0.026	-0.026	-0.026
	(0.019)	(0.019)	(0.019)
External debt to GDP	0.005***	0.005***	0.005***
	(0.001)	(0.002)	(0.001)
Obs	11,631	11,631	11,631
R-squared	0.50	0.50	0.50

Note: The dependent variables are the ratio of cross-border claims to the sum of cross-border claims and local claims in foreign currencies. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Appendix A. Additional Figures and Tables

Figure A.1. Country-specific uncertainty index

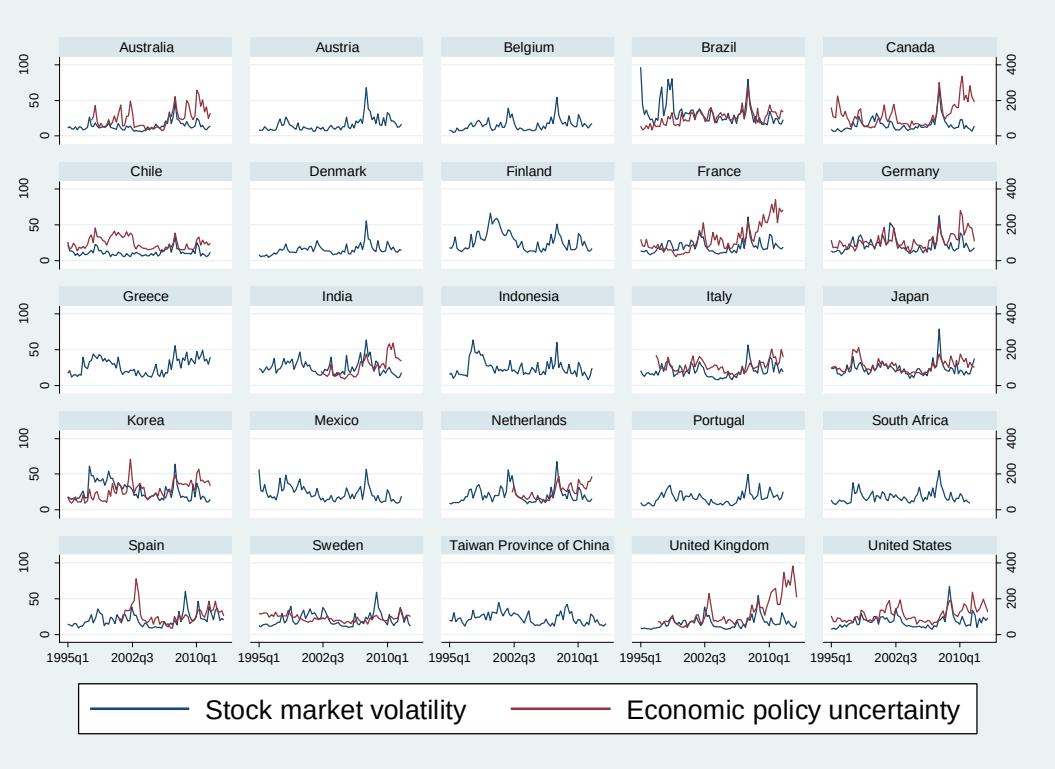


Table A.1. List of countries in the final sample

Source countries	= 1 if advanced economy	Recipient countries	= 1 if advanced economy
Australia	1	Argentina	0
Austria	1	Australia	1
Belgium	1	Austria	1
Brazil	0	Belgium	1
Canada	1	Brazil	0
Chile	0	Bulgaria	0
Denmark	1	Canada	1
Finland	1	Chile	0
France	1	China	0
Germany	1	Colombia	0
Greece	1	Czech Republic	1
India	0	Denmark	1
Indonesia	0	Estonia	1
Italy	1	Finland	1
Japan	1	France	1
Korea	1	Germany	1
Mexico	0	Greece	1
Netherlands	1	Hungary	0
Portugal	1	India	0
South Africa	0	Indonesia	0
Spain	1	Israel	1
Sweden	1	Italy	1
Taiwan	1	Japan	1
United Kingdom	1	Korea	1
United States	1	Latvia	0
		Lithuania	0
		Malaysia	0
		Mexico	0
		Netherlands	1
		New Zealand	1
		Norway	1
		Pakistan	0
		Peru	0
		Philippines	0
		Poland	0
		Portugal	1
		Romania	0
		Russia	0
		Slovak Republic	1
		Slovenia	1
		South Africa	0
		Spain	1
		Sweden	1
		Taiwan	1
		Thailand	0
		Turkey	0
		Ukraine	0
		United Kingdom	1
		United States	1
		Venezuela	0

Table A.2. Robustness check: Alternative standard error clustering and the inclusion of offshore financial centers

	Growth of claims (outflows)				Growth of liabilities (inflows)			
	Standard error clustered at the counterparty-time levels		Offshore financial centers included		Standard error clustered at the counterparty-time levels		Offshore financial centers included	
Explanatory variables	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Uncertainty	-1.672*	-2.829**	-1.367**	-2.035**	-2.400**	-2.199*	-2.062**	-1.714
	(0.999)	(1.391)	(0.741)	(1.112)	(1.173)	(1.337)	(0.873)	(1.240)
Real GDP growth	0.851***	0.464	0.742***	0.284	0.858**	-0.732	1.041***	-0.137
	(0.292)	(0.454)	(0.211)	(0.344)	(0.364)	(0.588)	(0.323)	(0.457)
Stock market growth	0.004	-0.061	-0.028	-0.075	-0.009	0.033	0.006	0.098
	(0.032)	(0.041)	(0.075)	(0.054)	(0.046)	(0.067)	(0.033)	(0.066)
CPI inflation	-0.282	-0.65	0.427	-1.226	0.923	0.626	0.998	1.336
	(0.561)	(0.953)	(0.834)	(0.688)	(0.595)	(1.086)	(0.801)	(1.166)
Policy rate	0.550***	0.605***	0.432***	0.429*	0.125	-0.005	0.06	0.057
	(0.155)	(0.214)	(0.162)	(0.176)	(0.138)	(0.181)	(0.136)	(0.149)
Nominal exchange rate growth	-0.125	-0.137	-0.307**	0.101	-0.147	-0.279*	-0.117	-0.269
	(0.092)	(0.119)	(0.135)	(0.073)	(0.126)	(0.153)	(0.125)	(0.195)
Private credit growth		0.027		0.272*		-0.018		0.512***
		(0.210)		(0.110)		(0.223)		(0.147)
External debt to GDP		-0.022***		-0.016***		-0.015*		-0.005
		(0.006)		(0.003)		(0.009)		(0.004)
Obs	30,608	16,431	37,583	20,255	29,889	14,784	36,056	18,339
R-squared	0.13	0.15	0.17	0.23	0.14	0.16	0.19	0.24

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (IV) and the growth rate of exchange rate-adjusted cross-border liabilities in column (V) to (VIII). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors in parentheses. Standard errors are clustered at the counterparty country-time levels in column (I), (II), (V), and (VI), while standard errors are clustered at the reporter-counterparty levels in column (III), (IV), (VII), and (VIII). *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table A.3. Robustness check: Weighted Least Squares

	Growth of claims (outflows)		Growth of liabilities (inflows)	
Explanatory variables	(I)	(II)	(III)	(IV)
Log of uncertainty	-2.310**	-2.100*	-2.344**	-2.317*
	(1.150)	(1.179)	(0.993)	(1.379)
Real GDP growth	-0.726	-0.362	0.138	-0.117
	(0.688)	(0.302)	(0.387)	(0.638)
Stock market growth	-0.039	-0.068	0.003	0.101
	(0.097)	(0.059)	(0.041)	(0.080)
CPI inflation	0.481	-1.277	1.142	1.191
	(1.011)	(0.842)	(0.953)	(1.332)
Policy rate	0.415**	0.368**	0.085	0.104
	(0.174)	(0.183)	(0.144)	(0.154)
Nominal exchange rate growth	-0.347**	0.104	-0.176	-0.269
	(0.154)	(0.078)	(0.140)	(0.213)
Private credit growth		0.186		0.405**
		(0.147)		(0.175)
External debt to GDP		-0.020***		-0.008
		(0.003)		(0.005)
Obs	30,608	16,431	29,511	14,784
R-squared	0.19	0.25	0.22	0.26

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table A.4. Robustness check: Before and after the Global Financial Crisis using economic policy uncertainty

	Growth of claims (outflows)		Growth of liabilities (inflows)	
	Before the GFC (1995Q1-2007Q2)	After the GFC (2007Q3-2012Q4)	Before the GFC (1995Q1-2007Q2)	After the GFC (2007Q3-2012Q4)
Explanatory variables	(I)	(II)	(III)	(IV)
Log of uncertainty	-2.841**	-2.616*	-0.827	-6.026***
	(1.289)	(1.521)	(1.348)	(2.225)
Real GDP growth	0.909***	1.080**	0.593	0.820
	(0.297)	(0.473)	(0.552)	(0.647)
Stock market growth	0.008	0.062	-0.142**	0.187***
	(0.033)	(0.045)	(0.068)	(0.072)
CPI inflation	-0.183	0.078	-0.202	0.311
	(0.536)	(0.694)	(1.056)	(0.748)
Policy rate	0.177	0.438**	0.213	0.057
	(0.179)	(0.214)	(0.141)	(0.226)
Nominal exchange rate growth	0.003	-0.063	0.259	0.057
	(0.079)	(0.105)	(0.167)	(0.147)
Obs	11,578	9,559	11,126	8,998
R-squared	0.11	0.13	0.12	0.14

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in column (I) to (II) and the growth rate of exchange rate-adjusted cross-border liabilities in column (III) to (IV). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the reporter-counterparty levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.