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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 higher country-specific uncertainty on cross-border banking flows using data from the Bank for International Settlements Locational Banking Statistics. The bilateral structure of this data allows to disentangle supply factors from demand factors, thereby helping identify the effect of higher uncertainty on cross-border banking flows from other confounding factors. The results of this analysis suggest that: (i) uncertainty in a source country (domestic economy) is both a lender-specific push and pull factor that robustly predicts a decrease in outflows (cross-border lending) and inflows (cross-border borrowing); (ii) a decline in cross-border borrowing is larger than a decline in cross-border lending so that the net cross-border position of the banking sector increases; (iii) despite a decline in cross-border bank lending in the absolute sense, the share of cross-border bank lending in total bank lending increases, suggesting a portfolio rebalancing; (iv) this rebalancing occurs only when banks are lending to borrowers in advanced economies, not those in 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, henceforth), 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. Given that these flows were also most severely affected by the GFC (Milesi-Ferretti and Tille, 2011 and Broner et al., 2013), it is 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, 2015a; Cerutti et al., 2015; Cerutti et al., 2017; Correa et al., 2017; Choi et al., 2018).

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. On the other hand, if they are largely driven by non-fundamental factors, such as investor sentiment or herding behavior, policy interventions to dampen volatile international capital flows may have strong appeal (Ahmed and Zlate, 2014; Benhima and Cordonier, 2017). 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.

Although the 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 global 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). Moreover, their analyses are limited to analyzing capital flows at the aggregate level, which confound the identification of country-specific uncertainty shocks.[2]

Under the integrated international financial market, higher uncertainty in one country has important consequences on other countries through adjustments in capital flows (Fogli and Perri, 2015; Kollmann, 2016; Benhima and Cordonier, 2017). However, this question has not been properely addressed empirically because of the difficulty in separating the effect of uncertainty from other demand and supply factors affecting capital flows when relying on the aggregate-level data often taken 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 bilateral structure of this data

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

[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.

allows us to control for the recipient country-time fixed effect—that is, any global and country-level shocks affecting bank loan demand from a common recipient country—and thereby helps identify the impact of higher uncertainty on these flows. With the recipient country-time fixed effect, any time-varying regressors of source countries are interpreted as difference between each country pair. Thus our empirical strategy mitigates a criticism that countries are often subject to heightened global uncertainty at the same time,[4] 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 from the (time-varying) global mean, thereby serving as an appropriate measure of country-specific uncertainty.

We first study how global banks adjust their cross-border lending in response to higher uncertainty in the source economy where they operate. Then, by looking at the adjustment in cross-border borrowing in the same source country, we investigate how lenders in recipient (i.e., foreign) countries react to this uncertainty in a source country. After controlling for various macroeconomic factors affecting cross-border banking flows, we find that an increase in uncertainty in a source country reduces both cross-border lending (i.e., retrenchment) and borrowing (i.e., stops), and this effect is economically and statistically significant.[5] We also find robust evidence of an increase in net foreign asset position of the

[4] For example, Choi (2017) finds a high cross-country correlation in stock market volatility due to the contagion in international financial markets. Bloom (2017) also 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. from the sample and find quantitatively similar results.

[5] 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

banking sector, suggesting that a decline in cross-border borrowing tends to be larger than that in cross-border lending.

We perform an extensive set of robustness checks of the main findings. For example, 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 source and recipient 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. Our results are also robust to an instrument variable (IV) approach using the exogenous historical events identified by Baker and Bloom (2013).

We further contribute to the literature by analyzing a potential portfolio rebalancing behavior of global banks in response to higher uncertainty. Although our analysis relies on somewhat imperfect proxies due to the limited data availability, the estimation results suggest that the relative share of cross-border bank lending in total bank lending increases when uncertainty in the source country is higher. Our finding implies that banks reallocate their lending towards foreign borrowers, who are perceived as relatively safer *ceteris paribus* due to a rise in idiosyncratic uncertainty at home. Interestingly, this portfolio rebalancing behavior hinges on the perceived riskiness of the recipient countries based on their income

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decrease in global banks' cross-border claims corresponds to retrenchment, while a decrease in cross-border liabilities corresponds to stops.

status. The rebalancing appears only when banks are lending to borrowers in advanced economies, but not in emerging market economies.

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 capital flow demand sectors from supply factors. Section IV presents the main results and a battery of robustness exercises. Section V concludes.

II. DATA

Most empirical studies on capital flows have relied on net flows, as they are a counterpart to the current account. However, the rapid increase in gross capital flows, followed by the sharp decline during the GFC, has questioned the relevance of a traditional approach based on net capital flows where financial flows are seen only as the counterpart to the current account and emphasized gross capital flows as a new determinant of global financial stability (Obstfeld, 2012; Broner et al., 2013). Thus we use data on cross-border claims and liabilities from the Bank for International Settlements (BIS)' Locational Banking Statistics (LBS) as our main source to contribute to this emerging literature. The data is compiled following the residency principle, consistent with BoP statistics.[6] Unlike BoP statistics, however, the data also provide information on the geographical breakdown of their counterparties (i.e., recipient countries), which we exploit in our empirical analysis to

[6] As we follow the residency principle, we use source (recipient) and domestic (foreign) countries interchangeably throughout the paper. For example, for the British banks operating in Mexico, higher uncertainty in a source country means uncertainty in Mexico, not in the U.K. Whereas one might argue that the nationality is a more meaningful indicator than the residence of global banks given that ultimate economic decisions are often made in a country where the headquarters of these banks locate, the Consolidated Banking Statistics (CBS) based on the nationality principle neither have information on currency breakdown nor on the liability side of bank balance sheets.

disentangle changes in the supply factors of cross-border lending in source countries from changes in credit demand in recipient countries.

The LBS capture outstanding claims and liabilities of internationally active banks located in source countries against their cross-country counterparties. Banks record their positions on an unconsolidated basis, including intragroup positions between offices of the same banking group. 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).[7] The bulk of cross-border bank claims and liabilities takes a form of loans and deposits of the domestic banking sector vis-à-vis all counterparty sectors (including banks and non-banks, and the private and public sector). To the extent that claims and liabilities in the BIS LBS largely consist of loans and deposits rather than a bank's holding and issuance of debt securities, our analysis remains largely silent about other types of capital flows such as international bond flows with the increasing importance in shaping global liquidity recently (Avdjiev et al., 2017).

Another main advantage of the BIS LBS is that the currency composition of cross-border claims and liabilities is available so that cross-border banking flows expressed in the USD are adjusted for movements in exchange rates. To the extent that heightened uncertainty episodes coincide with significant fluctuations in the exchange rate and cross-border banking flows, ignoring the valuation effect could bias the findings of our analysis. The availability of a currency breakdown enables the BIS to calculate break- and exchange rate- adjusted

[7] Although there is no similar estimate for the share of cross-border bank lending to non-banks in the LBS, the recent work by Avdjiev et al. (2017) estimates that it is likely to exceed 90 percent of all cross-border bank to non-bank business. In Table A.1 in the online appendix, we summarize the data availability in the BIS International Banking Statistics. This summary highlights the available information of each statistics, together with their limitations, thereby helps our understanding of the data structure.

changes in amounts outstanding. Such adjusted changes approximate underlying flows during each quarter. 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).

As the BIS LBS only report the exchange rate-adjusted flows, we construct the exchange rate-adjusted stock of the cross-border claims ($L_{i,j,t}$) from a country *i* to a country *j* by adding the exchange rate-adjusted flows to the exchange rate-unadjusted claims—directly available from the BIS LBS—in the initial period (1985Q1 or the first available data point) and take the log difference ($\Delta L_{i,j,t}$) to ensure the stationarity of the dependent variable used in our main analysis. We construct the exchange rate-adjusted stock of the cross-border liabilities in the same manner.

Throughout the analysis, we drop offshore financial countries from our sample using the IMF classification because their behavior might differ substantially from the rest of the sample.[8] In our benchmark analysis—after dropping offshore financial centers—we focus on the 25 source 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 recipient countries in our analysis. Following Correa et al. (2017), we drop observations with the size of cross-border positions less than $5 million,

[8] While we have dropped offshore financial centers to obtain robust results, we confirm 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.

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.2 in the online appendix lists the final sample of source countries and their counterparties used in the analysis.

Following much of the recent literature on the link between uncertainty and economic activity, we use stock market volatility as a benchmark measure of 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 forward-looking information, but the difference is minor in practice.[10] For each country, annualized realized volatility RV_t at a quarterly frequency is calculated by using daily stock prices as follows: $RV_{i,t} = \sqrt{252/T_i \sum_{s=1}^{T_i} r_{i,s}^2} \times 100$, 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.

We present the size of total cross-border claims and liabilities as a share of the GDP in 2010Q4 for the 25 source countries in Table 1. Table 1 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.

[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, 2015b; Rey, 2015). We further contribute to the literature by examining the effect of economic policy uncertainty on international capital flows.

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

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 once the size of the economy is considered. While global banks in advanced economies tend to have larger 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 aggregate exchange rate-adjusted cross-border claims and liabilities for four countries (the U.S., Germany, Canada, and Brazil) in Figure A.1 in the online appendix.[11] However, our analysis expolits the bilateral structure of the LBS to disentangle supply and demand factors of cross-border banking flows. To visualize the variables used in our estimation framework, Figure 1 plots the examples of growth of exchange rate-adjusted cross-border claims and liabilities between the U.S. and three recipient countries—the main dependent variables—, together with stock market volatility—the main independent variable—in the U.S. The median unconditional correlation between stock market volatility and the growth of cross-border claims (liabilities) at the bilateral level is -0.09 (-0.06), suggesting only a moderate contemporaneous correlation between uncertainty and cross-border bank lending and borrowing.[12]

[11] In addition to the U.S., we include Germany to represent European countries, Canada to represent small open economies, and Brazil to represent emerging market economies. 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.

[12] The minimum and maximum correlations are -0.32 (-0.31) and 0.18 (0.17), respectively.

To the extent that the bilateral data structure allows us to control for time-variant unobserved factors in recipient countries through the recipient country-time fixed effect, 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 vis-à-vis USD,[13] private bank credit growth, and the external debt to GDP ratio.

We include the policy rate to capture a standard bank lending channel of monetary policy in the global context (Bruno and Shin, 2015a; Rey, 2015; Correa et al., 2017).[14] If monetary policy stance and uncertainty are systematically related, as argued by Bekaert et al. (2013), controlling for the policy rate 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 2 presents the summary statistics of the variables used in the analysis. Notably, the average quarter-over-quarter growth rate of cross-border claims and liabilities is about three percent, while its standard deviation exceeds 40 percent, suggesting that cross-border banking flows are highly volatile.

III. METHODOLOGY

Any empirical investigation of capital flows must note that variations in the volume of flows reflect not only the supply condition in a source country, but also the demand condition in a recipient country. Thus ignoring demand-side factors would bias the

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

[14] We use interbank rates when policy rates are not available.

estimation results to the extent to which uncertainty in a source country affects those fators. We exploit the bilateral structure of the LBS to control for unobserved time-variant factors in a recipient country, thereby controlling for any demand-side factors effectively.

To gauge the effect of higher uncertainty in a source country on determining cross-border bank lending (i.e., a lender-specific push factor of cross-border bank 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 our main dependent variable $\Delta L_{i,j,t}$ denotes the quarterly growth in cross-border bank claims of a source country *i* to a recipient country *j* in time *t*; $X_{i,t}$ is the set of macroeconomic controls in a source country described earlier. $\alpha_{j,t}$ is the recipient country-time fixed effect, incorporated to control for any macroeconomic shocks affecting a recipient country, including both external and recipient country-specific shocks as well as indirect impact of uncertainty through other recipient countries. The inclusion of the recipient-time fixed effect also maximizes the sample coverage of our analysis to the extent to which many recipient countries do not have data on every control variable.[15]

γ is the coefficient of our interest: A negative (positive) γ indicates that global banks decrease (increase) cross-border lending when the source country faces higher uncertainty. Following Bruno and Shin (2015a), all explanatory variables are lagged by one-quarter to mitigate reverse causality issues stemming from feedback effects of, for example, cross-

[15] In principle, we could replace the recipient country-time fixed effect with the source country-time fixed effect and investigate the role of higher uncertainty in recipient countries. However, a half of the recipient countries in our sample are emerging market economies where various macroeconomic variables are not necessarily available at a quarterly frequency, which constraints the sample size significantly.

border bank lending on economic growth, monetary policy stance, or uncertainty. We adopt the most conservative clustering setup by clustering standard errors at the source and recipient-pair levels.

Similarly, we also analyze the effect of higher uncertainty in the source country on cross-border bank borrowing by replacing the growth of cross-border claims ($\Delta L_{i,j,t}$) in equation (1) with the growth of similarly constructed cross-border liabilities ($\Delta B_{i,j,t}$) and use the same set of control variables and the fixed effects. Again, we focus on a source country only due to the asymmetric nature the LBS so that a sign of γ tells us how cross-border bank borrowing changes in response to higher uncertainty in a source country:

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

IV. EMPIRICAL FINDINGS

A. Baseline results

Table 3 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 857 source-recipient country pairs from 1990Q1 to 2012Q4. We discuss the results of estimating equation (1) first, and then present the results of estimating equation (2). Due to the limited availability of some control variables, we start presenting the results from a specification which controls for real GDP growth, stock market growth, the inflation rate, the policy rate, and the nominal exchange rate growth. Those variables have a greater coverage than other control variables.

The signs of control variables are largely consistent with the previous findings regarding the determinants of international capital flows. For example, once demand factors are controlled for, global banks increase their cross-border lending when domestic economic growth is higher, which is the robust finding in the related literature. A higher policy rate in a source economy has a positive effect on cross-border bank lending. Although this finding is consistent with the robust conclusion of Correa et al. (2017), it requires some caution when interpreting the result.[16] The depreciation of domestic currencies vis-à-vis USD is associated with a slowdown in cross-border bank lending, consistent with the risk-taking channel of Bruno and Shin (2015b). Nevertheless, the effect is not necessarily significant.

Importantly, higher uncertainty in a source 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 1.1-2.2 percentage points. In column (II), we include additional control variables such as private credit growth and external debt to GDP. While an increase in private bank 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. Despite the reduced sample size due to the limited availability of these variables, the effect of uncertainty on cross-border

[16] This finding does not necessarily imply that exogenous monetary tightening in a source country encourages lending to foreign borrowers, which seemingly contradicts to a traditional bank lending channel of monetary policy. For example, Avdjiev and Hale (2018) decompose an increase in the U.S. policy rate into the endogenous response to the strong domestic economic condition and the exogenous shocks to monetary policy stance. They find that the former increases cross-border bank lending, whereas the latter reduces cross-border bank lending. Choi et al. (2018) also find that exogenous shocks to U.S. monetary policy—identified by a narrative approach—reduce, not increases cross-border bank lending. However, identifying the effect of monetary policy shocks on cross-border lending is beyond the scope of this paper.

bank lending remains broadly unchanged. We use the specification in Column (I) as a baseline for the rest of the paper to preserve the sample size for various robustness tests.

In column (III) to (IV), we summarize the same set of results for cross-border borrowing of a source country after controlling for time-variant factors in its recipient countries. In column (III), higher real GDP growth and policy rates in a source country are associated with an increase in cross-border borrowing, although the latter is no longer statistically significant. The depreciation of domestic currency and higher external debt to GDP also decrease inflows to the banking sector in a source country. Importantly, the sign of uncertainty is negative and statistically significant, suggesting that higher uncertainty in a source country reduces gross inflows to its banking sector (stops).

Our finding that an idiosyncratic rise of uncertainty in a country *i* reduces both banking outflows and inflows requires further investigation, as an emerging theoretical literature analyzes the role of idiosyncratic uncertainty shocks in explaining international business cycles, asset prices, and capital flows, with a particular attention to the net foreign asset position. For example, Kollmann (2016) builds a two-country model with recursive preferences and complete markets in which uncertainty in a home country—measured by output volatility—increases its net foreign asset position through a risk-sharing mechanism. Fogli and Perri (2015) also find 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. Thus another interesting exercise is to investigate changes in the net foreign asset position of the banking sector in response to higher uncertainty.[17]

[17] We thank to the anonymous referee for this suggestion.

The idiosyncratic nature of uncertainty measures embedded in our empirical model via the fixed effects allows us to test directly the implication of risk sharing and precautionary saving mechanism in response to higher uncertainty. To measure how the net foreign asset position of the banking sector responds to higher uncertainty, we replace the dependent variable with the net cross-border bank claims (cross-border claims net of cross-border liabilities) normalized to the size of a source country's GDP:[18]

$$NFA_{i,j,t} = \alpha_{j,t} + \beta X_{i,t-1} + \gamma UNC_{i,t-1} + \varepsilon_{i,j,t}. \quad (3)$$

In column (V) and (VI), we find a significant increase in the cross-border net position, suggesting that a decline in inflows is larger than a decline in outflows in response to heightened country-specific uncertainty, which is consistent with the findings of Ahmed and Zlate (2014), Fogli and Perri (2015), and Gourio et al. (2015).

B. Robustness checks

In this section, we conduct several robustness tests of our main empirical findings. To conserve space, we only discuss the results from main robustness tests here. The online appendix includes the rest of the robustness checks, including an alternative standard error clustering, alternative estimation method, accounting for non-linearity in the effect of uncertainty, the role of the valuation effect, and an additional subsample analysis. To enhance readability, each Table 4, 5, and 6 contains the various sensitivity test results for cross-border claims, liabilities, and net claims, respectively.

[18] We obtain qualitatively similar results by normalizing net cross-border claims by a recipient country's GDP. Instead of net foreign asset position, we also use net outflows (gross outflows net of gross inflows) and find qualitatively similar results. These results are available upon request.

Alternative measure of uncertainty. We have used stock market volatility as a benchmark measure of uncertainty mainly because it is widely used in the literature and also available at a high frequency.[19] However, stock market volatility mostly captures uncertainty in financial markets, whereas uncertainty regarding other dimensions of the economy could be relevant. Thus we use the economic policy uncertainty (EPU) index constructed by Baker et al. (2016) to complement the baseline analysis.[20]

The EPU index measures uncertainty about "who will make economic policy decisions, what economic policy actions will be undertaken and when they will be enacted, the economic effects of past, present and future policy actions, and uncertainty induced by policy inaction." (pp. 1598) 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, which somewhat reduces the sample coverage.

Figure A.2 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 between the 15 countries is only 0.38, and the correlations range from 0.03 (Sweden) to 0.76 (Brazil). The estimation results using the EPU index are reported in

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

column (I) in Table 4-6, which confirm the adverse effect on cross-border bank claims and liabilities and the positive effect on cross-border net claims of uncertainty.

Controlling for the dominance of the global financial crisis. As demonstrated in Figure 1, stock market volatility rose to the unprecedented level in most countries during the GFC, 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.

We check the robustness of our findings 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. We first compute the standard deviation of country-specific stock market volatility during the GFC and non-GFC periods. We then compute the cross-country median of the standard deviation during the GFC (36.6), which is at the top five percentile of the distribution during the non-GFC period (35.7). Given the dominance of the GFC in shaping the fluctuations of the uncertainty measure, we winsorize the value of stock market volatility of each source country not to exceed the value at the top five percentile of its distribution during the non-GFC period.[21] Column (II) in Table 4-6 shows that our findings are robust to this sensitivity test.

Second, we split the sample into the pre-(1995Q1-2007Q2) and the post-GFC (2007Q3-2012Q4).[22] Column (III) and (IV) in Table 4-6 summarize the results from the sub-

[21] 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 stock market volatility at the top five percentile of the distribution during the non-GFC period.

[22] Our results hardly change when choosing any break date between 2007Q3 and 2008Q3.

sample analysis. One interesting observation is the decrease in the size and the significance of the policy rate after the GFC for the case of cross-border bank lending. It is likely an outcome of the constrained conventional monetary policy in most advanced economies and the emerging role of unconventional monetary policy. Overall the effects of uncertainty are still significant in both periods, while the effects become larger after the GFC.

Controlling for Gravity factors. The inclusion of recipient country-time fixed effect in the baseline estimation does not account for costs of international asset trade specific to a country-pair of interest, so-called the "Gravity factors." To the extent to which we investigate the effect of higher uncertainty on the growth rather than the level 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 a vector of gravity variables (the distance between the two countries and dummy variables indicating whether they share a common border and a common language).[23] We take the bilateral geography dataset from Mayer and Zignago (2011). Column (V) in Table 4-6 shows the estimation results after controlling for the gravity factors. The inclusion of the gravity factors hardly affects the baseline estimates in Table 3, including those regarding the uncertainty variable.

Controlling for bilateral trade flows The use of the recipient country-time fixed effect is more flexible than controlling for any set of time-varying regressors in recipient countries. 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

[23] While we use the logarithm of population-weighted distance between two countries to account for the geographic distribution of population inside each nation, using the level of population-weighted distance or simple distance delivers similar results.

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 (for example, Novy and Taylor, 2014). This variable is particularly important for the analysis of bilateral capital flows, as the current account and the financial account are tightly related by the accounting identity.

Although our use of banking flows—corresponding to only a subset of total capital flows—mitigates this concern, we still test the robustness of our findings by adding bilateral trade flows between source and recipient countries, taken from the IMF Directions of Trade Statistics. For conceptual consistency, we add the lagged growth of exports from a country *i* to a country *j*, the lagged growth of imports of a country *i* from a country *j*, and trade balance between a country *i* and *j* to equation (1), (2), and (3) correspondingly.[24]

Column (VI) in Table 4-6 presents the results of this additional exercise. The coefficients on bilateral exports, imports, and trade balance are not statistically significant. Moreover, this effect seems quantitatively unimportant: when the exports from a source country *i* to a recipient country *j* grow by 10 percent, the cross-border claims from the country *i* to the country *j* increase, on average, by 0.3 percent at best. This finding suggests that cross-border banking flows are laregely independent of trade flows. As a result, the estimation coefficients are nearly identical to those in Table 3.

Instrumental variable approach. Despite our extensive efforts to address the potential enodogeneity issues—including controlling for GDP growth and stock market growth in a

[24] Our findings hardly change when we use (1) current bilateral trade flows instead of the lagged trade flows or (2) bilateral trade balance for all three specification instead. These results are available upon request to conserve space.

source country—, it is still possible that unobserved factors might drive uncertainty in a source country and its cross-border banking flows simultaneously, especially given the countercylical nature of our uncertainty measures. Thus we use an instrument variable (IV) approach in the same spirit of Baker and Bloom (2013) to account for the possibility that uncertainty could increase as an endogenous response to certain economic fluctuations, which would affect cross-border banking flows simultaneously. Baker and Bloom (2013) use natural disasters, terrorist attacks, and political shocks as an instrument, which is typically exogenous to economic fluctuations at least in the short run, to identify the causal impact of uncertainty shocks on GDP growth.[25]

We use the two kinds of exogenous disasters as instruments: (i) natural disasters—extreme weather and geological events as defined by the Center for Research on the Epidemiology of Disasters (CRED); (ii) terrorist attacks—high casualty terrorist bombing as defined by the Center for Systemic Peace (CPS).[26] 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. Following Baker and Bloom (2013), we jointly instrument the volatility (the second moment) and the returns (the first moment) of stock markets.

We proceed with a two-stage least squares (2SLS) approach. In the first step, we regress stock market volatility and returns on the two instruments. The results of the first

[25] 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.

[26] 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 natural disasters and terrorist attacks 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.

stage 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 two instrument variables). In the second step, we re-estimate the baseline equations using the exogenous part of the volatility and returns driven by the instruments—that is, the fitted value of the first step. While the results reported in Column (VII) in Table 4-6 confirm our OLS results in Table 3, the size of the coefficient on uncertainty increases except for the case of cross-border borrowing, implying that the OLS estimates are biased downwards.

Level specification of cross-border positions. Lastly, we check whether our findings are robust to the level specification of cross-border positions. We have expressed the model in stationary variables (i.e., the growth rate)—except for few variables, such as the interest rate, the exchange rate, and the uncertainty measures that are already stationary—to avoid problems of spurious correlation, as in standard in the literature (for example, Portes and Rey, 2005 and Bruno and Shin, 2015a). However, a class of portfolio theories predicts the holding of optimal portfolio (i.e., level) instead of the growth of stock (i.e., flows). Thus we re-estimate equation (1) and (2) by replacing $\Delta L_{i,j,t}$ and $\Delta B_{i,j,t}$ with $L_{i,j,t}$ and $B_{i,j,t}$, respectively. To capture the persistence in bilateral positions, we add the source-recipient country-pair fixed effect to this specification. We report the results using the level specification in column (VIII) in Table 4-5, which confirm the negative effect of uncertainty on both directions of cross-border banking activity.

C. Portfolio rebalancing channel of higher uncertainty

We have found robust evidence that higher uncertainty in a source country reduces its cross-border lending (retrenchment) and borrowing (stops) simultaneously, and the effect on cross-border lending is larger so that the net cross-border claims of the banking sector increases. However, one might expect that both domestic and foreign lenders would seek to reduce their exposure to a source country subject to higher uncertainty, resulting in flight, not retrenchment of capital flows. Regarding the mechanism generating retrenchment of cross-border banking flows, one should note that the reduced exposure on domestic assets of domestic lenders does not necessarily translate into the increased exposure on foreign assets of domestic lenders, as higher uncertainty is a negative shock to the banking sector. It is well known that the banking sector reduces their lending to domestic borrowers in response to higher domestic uncertainty as well (Bordo et al., 2016; Raunig et al., 2016). Thus one should analyze whether global banks rebalance the composition of their lending from domestic to foreign borrowers despite a overall reduction in lending in response to higher uncertainty.

We test the portfolio rebalancing channel empirically by regressing a new dependent variable capturing the share of cross-border bank lending in total bank lending on the same set of regressors from the previous analysis. This additional analysis can shed light on the relative shift of bank portfolio from domestic to foreign borrowers in response to higher uncertainty in a source country. Currently, the BIS LBS do not provide historical data on total domestic claims of the banking sector,[27] so we use various proxies to measure the share

[27] The BIS LBS provide the data on domestic claims of the global banks in local currencies in a source countries ("Q:S:C:A:TO1:D:5J:A:countrycode:A:5J:R" in BIS statistics code) only after 2012 (Bank for International Settlements, 2017). Together with the data on international bank claims (the sum of cross-border bank claims and domestic bank claims in foreign currencies), domestic bank claims in local currencies offer the comprehensive picture of bank lending from a given source country. Although the short coverage of the data prevents us from using them in our analysis, we compare this data with total domestic bank claims reported to

of cross-border bank lending in total bank lending. While we still provide the first evidence on the rebalancing behavior of global banks, one should bear in mind that we rely on imperfect proxies when interpreting the results of the following analysis.

Our baseline proxy utilizes the data on bank credit to the private non-financial sector, available from the BIS ("Q:countrycode:P:B:M:USD:A"). Whereas our measure of cross-border claims includes credit extended to both bank and non-bank borrowers, this data only includes credit to the private non-financial sector so that the sector of domestic borrowers is not fully consistent with the sector of foreign borrowers. Moreover, the dollar value of domestic claims denominated in local currencies will be affected by changes of the exchange rate vis-à-vis the USD.[28] Nevertheless, we use bank credit to the private non-financial sector to construct a benchmark proxy due to its long time-series availability and wide application in the existing studies. Thus the share of cross-border lending in total lending is computed as:

$$s_{i,j,t} = \frac{cross-border\ bank\ claims_{i,j,t}}{bank\ claims\ on\ the\ private\ non-financial\ sector_{i,t}+cross-border\ bank\ claims_{i,t}} \times 100, \quad (4)$$

where $cross - border\ bank\ claims_{i,t} = \sum_j cross - border\ bank\ claims_{i,j,t}$. To provide a look of the relative size of cross-border lending to domestic lending across countries, Figure A.3 plots the share of cross-border bank claims in total bank claims when bank credit to the private non-financial sector is used to proxy domestic bank claims. We then estimate

the IMF IFS in the recent period. 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.

[28] The BIS provides data on the dollar value of bank credit to the private non-financial sector by converting the local currency value of bank credit to the private non-financial sector using the end-of-period exchange rate vis-à-vis USD.

the following equation using the same set of control variables and fixed effects from equation (1):

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

with a positive (negative) sign of γ suggesting that global banks increase (decrease) the relative share of their cross-border lending when they face higher uncertainty in a source economy. Note that an increase in the share does not mean that global banks increase the amount of cross-border lending. Instead, they reduce domestic lending more than cross-border lending in response to higher uncertainty in a source country.

Column I in Table 7 shows the results from estimating equation (5). The coefficients on some control variables, such as real GDP growth and the policy rate switch their sign from Table 3. For example, higher GDP growth and the policy rate in a source country reduce the relative share of cross-border lending, while they increase cross-border lending in an absolute term. It is likely because the relative profitability of lending to domestic borrowers improves during the expansions accompanied by monetary policy tightening compared to their foreign counterparts. Most importantly, the sign of the uncertainty coefficient turns into positive, a novel finding implying that global banks reduce their cross-border lending less than domestic lending despite overall retrenchment when uncertainty regarding the source economy increases.[29]

[29] 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 banks' domestic claims only, 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.

Safe vs. risky borrowers If higher uncertainty in a source economy encourages global banks to switch their lending toward relatively safer foreign borrowers, we expect that this mechanism should be weaker when banks lend to borrowers who are genuinely conceived risky. In other words, despite the relative attractiveness of cross-border lending due to higher uncertainty in a source country, global banks may be reluctant to lend to borrowers in a risky economy. To test this hypothesis, we run a subsample analysis by dividing the sample into two groups according to the income status of recipient countries where borrowers reside (advanced vs. emerging market economies using the IMF definition), regardless of their contemporaneous economic conditions.[30]

Column (II) and (III) in Table 7 show the estimation results for the subsample of advanced and emerging market recipient countries, respectively. Interestingly, the portfolio rebalancing channel we found in Column (I) only exists when banks are lending to borrowers in advanced economies. When lending to emerging market economies, we find no evidence of rebalancing toward foreign borrowers, consistent with the "flight-to-safety" behavior observed during the episodes of heightened uncertainty. Given that this flight-to-safety occurs in the relative sense not the absolute sense, we call this behavior *relative* flight-to-safety throughout the paper.

Robustness checks An important concern here is the validity of our empirical proxy for domestic lending in constructing the share of cross-border bank lending in total bank lending. To check the robustness of our finding, we further employ two additional measures of

[30] In the earlier version of the paper, we interacted the uncertainty variable with the income status of recipient countries and found similar results. However, we found that the interaction with the uncertainty variable only is too restrictive, so we adopt a less restrictive specification here.

domestic lending by the banking sector. First, we use total domestic bank claims (line 32) from the IMF International Financial Statistics Depository Corporations Survey which include not only bank credit to the private sector, but also to the public sector. Because cross-border bank claims in the LBS include bank credit extended to both sectors, the IFS data on total domestic bank claims reduces discrepancy regarding the sector of borrowers used in the baseline analysis.[31] Because domestic bank claims are measured in a local currency, we convert them into the USD using the end-of-the-period nominal exchange rate vis-à-vis USD, indicating that this alternative proxy is still subject to the valuation effect. Similar to Figure A.3, Figure A.4 in the online appendix shows the share of cross-border bank lending in total bank lending when this alternative proxy for domestic bank lending is used.

Lastly, we use the stock of local claims in foreign currencies from the BIS LBS as a second alternative proxy for domestic bank lending to address the potential bias from the valuation effect. The BIS LBS provide the historical data on the dollar value of local claims in foreign currencies of the global banks in a source country ("Q:S:C:A:TO1:F:5J:A:countrycode:A:5J:R"), with an exception of the U.S.[32] While this proxy eliminates the concerns regarding the valuation effect and the consistency of counterparty sectors, the size of local claims in foreign currencies is typically small compared to that of domestic bank claims, thereby limiting the aggregate implication of the identified portfolio rebalancing behavior in response to higher uncertainty. Figure A.5 in the online appendix shows the share of cross-border lending in total lending when the third proxy

[31] However, this data is available in a consistent manner only after 2000 for most countries in the sample.

[32] In the BIS international banking statistics, the sum of cross-border claims and local claims in foreign currencies is labeled "international" claims.

is used. It is apparent that domestic lending in foreign currencies is relatively more important than cross-border lending in a group of emerging market economies, implying the limited ability of banks to lend in own currencies in countries with less developed financial markets. Column (4) to (9) in Table 7 show the estimation results of equation (5) using these alternative proxies, resulting in qualitatively similar findings regarding the portfolio rebalancing channel and the relative flight-to-safety channel.

We also perform similar sensitivity tests to those in the previous section, such as including more control variables, an IV approach, and a subsample analysis before and after the GFC. The results from the sensitivity tests are presented in able B.4-B.5 in the online appendix to conserve space, which largely confirm the portfolio rebalancing channel (the coefficient on the uncertainty variable is positive and statistically significant) and the relative flight-to-safety channel (the positive effect only exists when lending to borrowers in advanced economies).

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 bilateral structure of the BIS LBS data to control for any shocks affecting economic conditions in recipient 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 source country—measured by country-specific stock market volatility—reduces both cross-border lending and borrowing of this economy. Moreover, cross-border net bank claims increase, suggesting that a decline in cross-border borrowing is larger than that in lending. Our findings are robust to using alternative measures of uncertainty, such as economic policy uncertainty, controlling for gravity factors and bilateral trade flows, an IV approach, and various sample split exercises.

To further shed light on the behavior of global banks in response to higher uncertainty, we study portfolio reallocation of global banks between domestic and cross-border lending. Global banks switch the composition of their lending toward foreign borrowers from domestic borrowers when uncertainty in the source country increases. Interestingly, this rebalancing occurs only when banks are lending towards borrowers in advanced economies, not in emerging market economies. One important caveat applies to the results regarding the rebalancing behavior. As we rely on imperfect proxies for domestic bank lending, we take our results rather suggestive than clear-cut evidence. A future study with the data on domestic bank lending that is fully consistent with cross-border bank lending will provide a definite answer to the question of interest.

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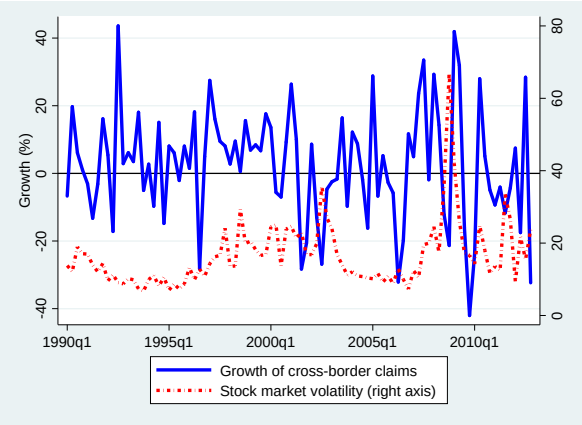
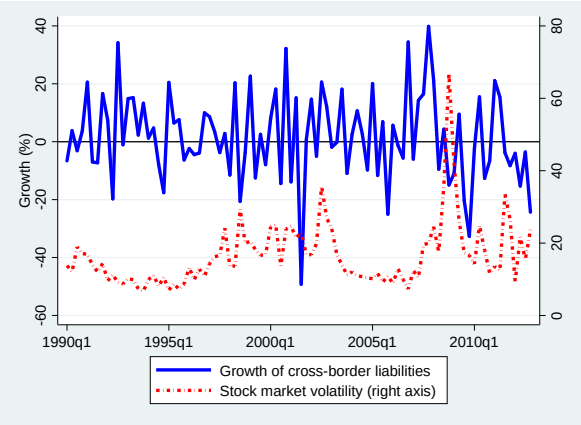
Figures and Tables

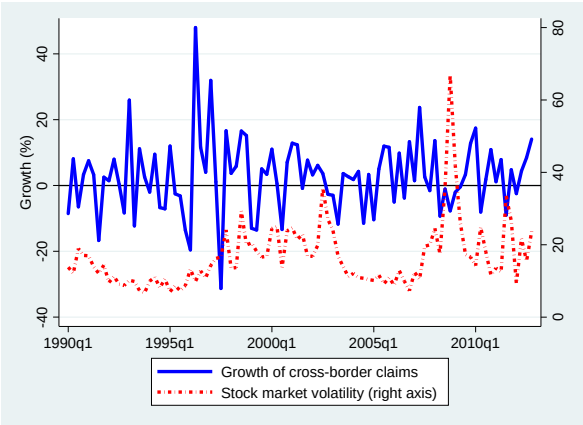
Figure 1. The main bilateral data and the uncertainty measure used for the baseline analysis

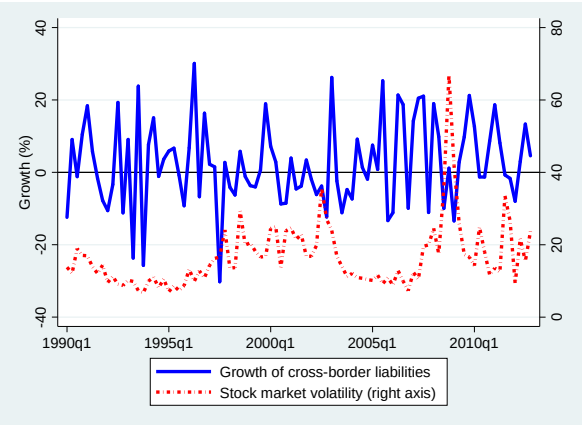
a) U.S. and Germany



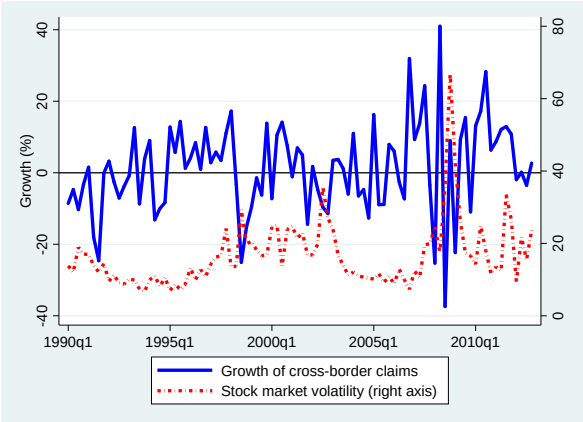


b) U.S. and Canada





c) U.S. and Brazil



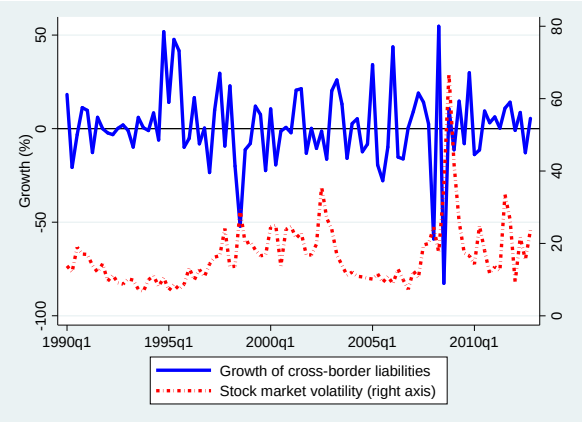


Table 1. Total cross-border claims and liabilities as a share of GDP

	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 under the LBS with the residency principle as a share of the domestic GDP in the USD in 2010Q4.

Table 2. Summary statistics

Variable	Mean	Median	Standard deviation	Obs.
Growth of cross-border claims	2.913	1.047	42.437	40,164
Growth of cross-border liabilities	2.974	1.266	53.315	38,589
Cross-border net positions	0.276	0.026	2.724	37,124
Stock market volatility	18.698	16.218	9.801	40,164
Economic policy uncertainty	106.751	98.704	42.904	27,182
Real GDP growth	0.580	0.637	1.034	40,164
Stock market returns	1.216	1.884	9.605	40,164
Inflation rate	0.634	0.584	0.619	40,164
Policy rate	4.377	3.820	3.061	40,003
Nominal exchange rate growth	-0.122	-0.093	4.301	40,164
Private credit growth	1.517	1.482	2.137	17,907
External debt to GDP ratio	81.806	74.953	53.761	19,610
Growth of bilateral exports	1.716	2.284	21.334	38,931
Growth of bilateral imports	1.868	2.085	23.436	38,925

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

Table 3. Baseline analysis

	Growth of claims (outflows)		Growth of liabilities (inflows)		Net cross-border asset positions	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	-1.536**	-2.961**	-2.435***	-2.291*	0.502***	0.994***
	(0.665)	(1.306)	(0.807)	(1.312)	(0.180)	(0.286)
Real GDP growth	0.767***	0.419	0.970***	-0.086	-0.043	0.048
	(0.271)	(0.461)	(0.330)	(0.649)	(0.037)	(0.059)
Stock market returns	0.016	-0.061	0.006	0.135	0.002	0.006
	(0.029)	(0.040)	(0.039)	(0.074)	(0.002)	(0.005)
Inflation rate	-0.183	-0.228	1.620***	1.201	-0.243***	-0.279***
	(0.453)	(1.001)	(0.567)	(1.369)	(0.048)	(0.097)
Policy rate	0.592***	0.633***	0.065	0.160	-0.090***	-0.043
	(0.089)	(0.162)	(0.104)	(0.182)	(0.021)	(0.030)
Exchange rate growth	-0.086	-0.127	-0.199*	-0.477***	0.001	0.007
	(0.080)	(0.113)	(0.103)	(0.155)	(0.005)	(0.006)
Private credit growth		0.076		-0.242		-0.121***
		(0.188)		(0.234)		(0.030)
External debt to GDP		-0.017***		-0.024***		0.005**
		(0.005)		(0.007)		(0.003)
Observations	40,027	16,549	38,403	15,653	36,933	15,215
R-squared	0.128	0.142	0.141	0.157	0.151	0.137

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

Table 4. Robustness checks: Growth of cross-border claims

	EPU	Winsorized shock	Before GFC	After GFC	Gravity factors	Trade channel	IV regression	Level
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Uncertainty	-1.574*	-1.470**	-1.825**	-2.676**	-1.474**	-1.593**	-2.338**	-2.174**
	(0.887)	(0.691)	(0.762)	(1.258)	(0.678)	(0.701)	(1.077)	(1.081)
Real GDP growth	1.130***	0.766***	0.711**	0.939***	0.749***	0.826***	0.132	-0.091
	(0.403)	(0.271)	(0.384)	(0.292)	(0.272)	(0.274)	(0.189)	(0.116)
Stock market returns	0.073	0.017	0.035	-0.004	0.016	0.016	0.761***	-0.008
	(0.037)	(0.029)	(0.039)	(0.032)	(0.029)	(0.029)	(0.271)	(0.014)
Inflation rate	-0.333	-0.188	-0.481	-0.202	-0.193	-0.145	-0.184	-0.716**
	(0.603)	(0.453)	(0.645)	(0.547)	(0.453)	(0.458)	(0.453)	(0.333)
Policy rate	0.557***	0.590***	0.739***	0.114	0.585***	0.572***	0.603***	0.914***
	(0.107)	(0.089)	(0.111)	(0.177)	(0.089)	(0.090)	(0.094)	(0.303)
Exchange rate growth	-0.032	-0.084	0.011	0.002	-0.085	-0.094	-0.134	0.057
	(0.096)	(0.080)	(0.122)	(0.082)	(0.080)	(0.081)	(0.109)	(0.041)
Distance					0.210			
					(0.247)			
Common border					0.320			
					(0.679)			
Common language					0.074			
					(0.636)			
Export growth						0.022		
						(0.016)		
Observations	23,167	40,027	28,085	11,740	40,027	38,794	40,027	40,027
R-squared	0.181	0.128	0.131	0.118	0.128	0.129	0.127	0.848

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border claims in Column (I) to (VII) and the level of exchange rate-adjusted cross-border claims in Column (VIII). The Cragg-Donald Wald F-statistic for Column (VII) is 31.626, while the Stock-Yogo weak identification test 5% critical value is 20.65. The source-recipient country pair-fixed effect is included in Column (VIII). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the source-recipient levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 5. Robustness checks: Growth of cross-border liabilities

	EPU	Winsorized shock	Before GFC	After GFC	Gravity factors	Trade channel	IV regression	Level
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Uncertainty	-2.555**	-2.334***	-1.865**	-4.458**	-2.253***	-2.571***	-1.277*	-1.090*
	(1.212)	(0.832)	(0.879)	(1.912)	(0.826)	(0.841)	(0.745)	(0.629)
Real GDP growth	0.815	0.970***	1.071**	0.972	0.917***	1.093***	0.225	-0.241**
	(0.468)	(0.330)	(0.431)	(0.560)	(0.332)	(0.337)	(0.149)	(0.123)
Stock market returns	0.061	0.009	-0.098	0.122	0.005	0.007	0.838***	-0.025**
	(0.052)	(0.039)	(0.053)	(0.067)	(0.039)	(0.039)	(0.307)	(0.012)
Inflation rate	0.496	1.613***	2.564***	0.880	1.607***	1.546***	1.149***	-0.476
	(0.603)	(0.567)	(0.837)	(0.756)	(0.570)	(0.574)	(0.547)	(0.274)
Policy rate	0.194	0.062	0.002	0.152	0.035	0.076	-0.052	0.486
	(0.117)	(0.105)	(0.114)	(0.223)	(0.105)	(0.106)	(0.099)	(0.260)
Exchange rate growth	-0.128	-0.195	-0.061	-0.303**	-0.195	-0.219**	-0.242***	0.048
	(0.127)	(0.103)	(0.141)	(0.148)	(0.103)	(0.103)	(0.110)	(0.045)
Distance					0.957***			
					(0.295)			
Common border					1.923**			
					(0.757)			
Common language					-0.897			
					(0.619)			
Import growth						-0.002		
						(0.019)		
Observations	22,914	38,403	27,340	11,063	38,403	37,163	42,419	38,403
R-squared	0.183	0.141	0.149	0.123	0.141	0.142	0.122	0.872

Note: The dependent variables are the growth rate of exchange rate-adjusted cross-border liabilities in Column (I) to (VII) and the level of exchange rate-adjusted cross-border liabilities in Column (VIII). The Cragg-Donald Wald F-statistic for Column (VII) is 30.455, while the Stock-Yogo weak identification test 5% critical value is 20.65. The source-recipient country pair-fixed effect is included in Column (VIII). All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the source-recipient levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 6. Robustness checks: Net cross-border positions

	EPU	Winsorized shock	Before GFC	After GFC	Gravity factors	Trade channel	IV regression
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
Uncertainty	0.252	0.490***	0.448**	0.614*	0.316*	0.564***	1.178***
	(0.168)	(0.183)	(0.190)	(0.322)	(0.171)	(0.178)	(0.476)
Real GDP growth	-0.138***	-0.043	-0.063	0.004	-0.004	-0.047	-0.038
	(0.052)	(0.037)	(0.041)	(0.052)	(0.033)	(0.038)	(0.053)
Stock market returns	-0.002	0.002	0.008**	-0.004	0.003	0.003	-0.037
	(0.003)	(0.002)	(0.003)	(0.004)	(0.002)	(0.002)	(0.036)
Inflation rate	-0.268***	-0.242***	-0.223***	-0.264***	-0.218***	-0.233***	-0.247***
	(0.060)	(0.048)	(0.064)	(0.061)	(0.047)	(0.047)	(0.048)
Policy rate	-0.079**	-0.089***	-0.079***	-0.119***	-0.072***	-0.092***	-0.105***
	(0.024)	(0.021)	(0.022)	(0.034)	(0.020)	(0.021)	(0.026)
Exchange rate growth	0.004	-0.001	-0.017**	0.018**	-0.002	0.001	0.016
	(0.005)	(0.005)	(0.007)	(0.007)	(0.005)	(0.005)	(0.018)
Distance					-0.560***		
					(0.154)		
Common border					-0.36		
					(0.570)		
Common language					-0.026		
					(0.245)		
Trade balance						0.242	
						(0.185)	
Observations	25,037	36,933	26,195	10,738	36,933	35,777	36,933
R-squared	0.192	0.15	0.179	0.095	0.169	0.152	0.137

Note: The dependent variables are exchange rate-adjusted cross-border net claims normalized by the source country's GDP. The Cragg-Donald Wald F-statistic for Column (VII) is 32.747, while the Stock-Yogo weak identification test 5% critical value is 20.65. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the source-recipient levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table 7. Rebalancing between domestic and cross-border bank lending

	Using domestic bank credit to the private non-financial sector			Using domestic bank credit to the private and public sector			Using local claims in foreign currencies		
	Full sample	AE recipients	EM recipients	Full sample	AE recipients	EM recipients	Full sample	AE recipients	EM recipients
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
Uncertainty	0.113**	0.210**	-0.013	0.174**	0.204**	-0.001	0.258*	0.593**	-0.156
	(0.049)	(0.084)	(0.015)	(0.082)	(0.100)	(0.019)	(0.148)	(0.240)	(0.112)
Real GDP growth	-0.033***	-0.058***	0.001	-0.029*	-0.046**	0.006*	-0.058***	-0.113***	0.003
	(0.009)	(0.015)	(0.003)	(0.017)	(0.019)	(0.003)	(0.021)	(0.036)	(0.012)
Stock market returns	0.000	0.001	0.000	0.000	0.000	0.000	-0.002	-0.004	0.001
	(0.001)	(0.001)	0.000	(0.001)	(0.001)	0.000	(0.001)	(0.003)	(0.001)
Inflation rate	-0.035**	-0.070***	-0.003	-0.069**	-0.049	0.004	-0.071*	-0.114*	-0.047**
	(0.016)	(0.027)	(0.004)	(0.031)	(0.035)	(0.006)	(0.036)	(0.062)	(0.019)
Policy rate	-0.043***	-0.060***	-0.008***	-0.044***	-0.049***	0.000	-0.058**	-0.090**	0.011
	(0.007)	(0.010)	(0.002)	(0.012)	(0.011)	(0.002)	(0.020)	(0.028)	(0.011)
Exchange rate growth	0.000	-0.001	0.001	0.001	-0.003	0.000	-0.007*	-0.018***	0.004
	(0.001)	(0.002)	0.000	(0.002)	(0.002)	0.000	(0.004)	(0.007)	(0.003)
Observations	36,954	20,368	16,586	17,787	9,839	7,735	26,355	14,536	11,819
R-squared	0.460	0.413	0.300	0.417	0.378	0.328	0.493	0.448	0.261

Note: The dependent variables are the ratio of cross-border claims to the sum of cross-border claims and domestic claims, measured by domestic bank credit to the private non-financial sector in Column (I) to (III), domestic bank credit to the private and public sector in Column (IV) to (VI), and local claims in foreign currencies in Column (VII) to (IX), respectively. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the source-recipient levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Online Appendix for "Uncertainty and Cross-Border Banking Flows"*

July 2018

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* This is an online appendix of "Uncertainty and cross-border banking flows," which includes additional figures and tables, and the results from additional robustness checks.

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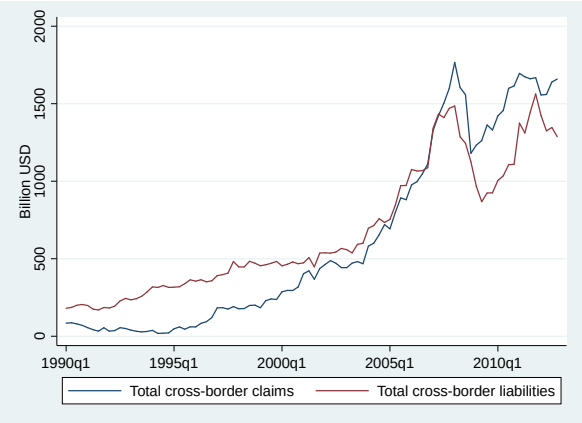
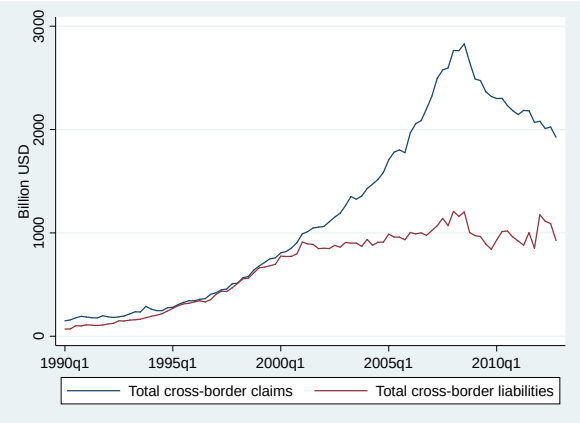
A. Additional Figures and Tables

Figure A.1. Total cross-border bank claims and liabilities

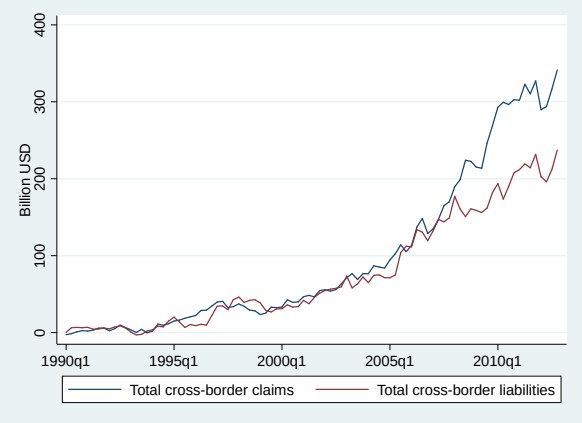
a) U.S.



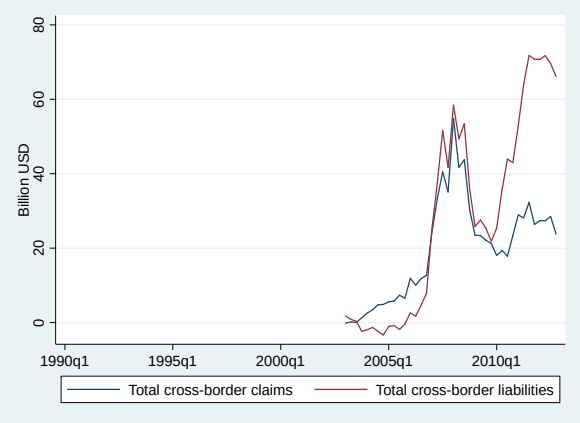
b) Germany



c) Canada

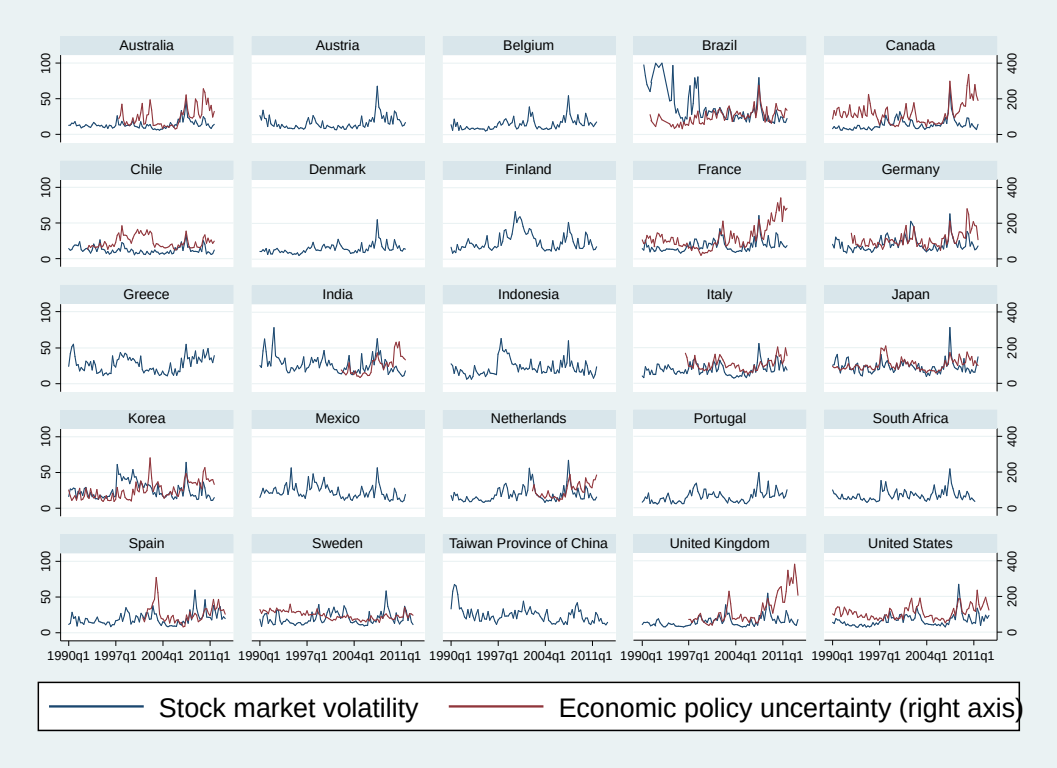


d) Brazil



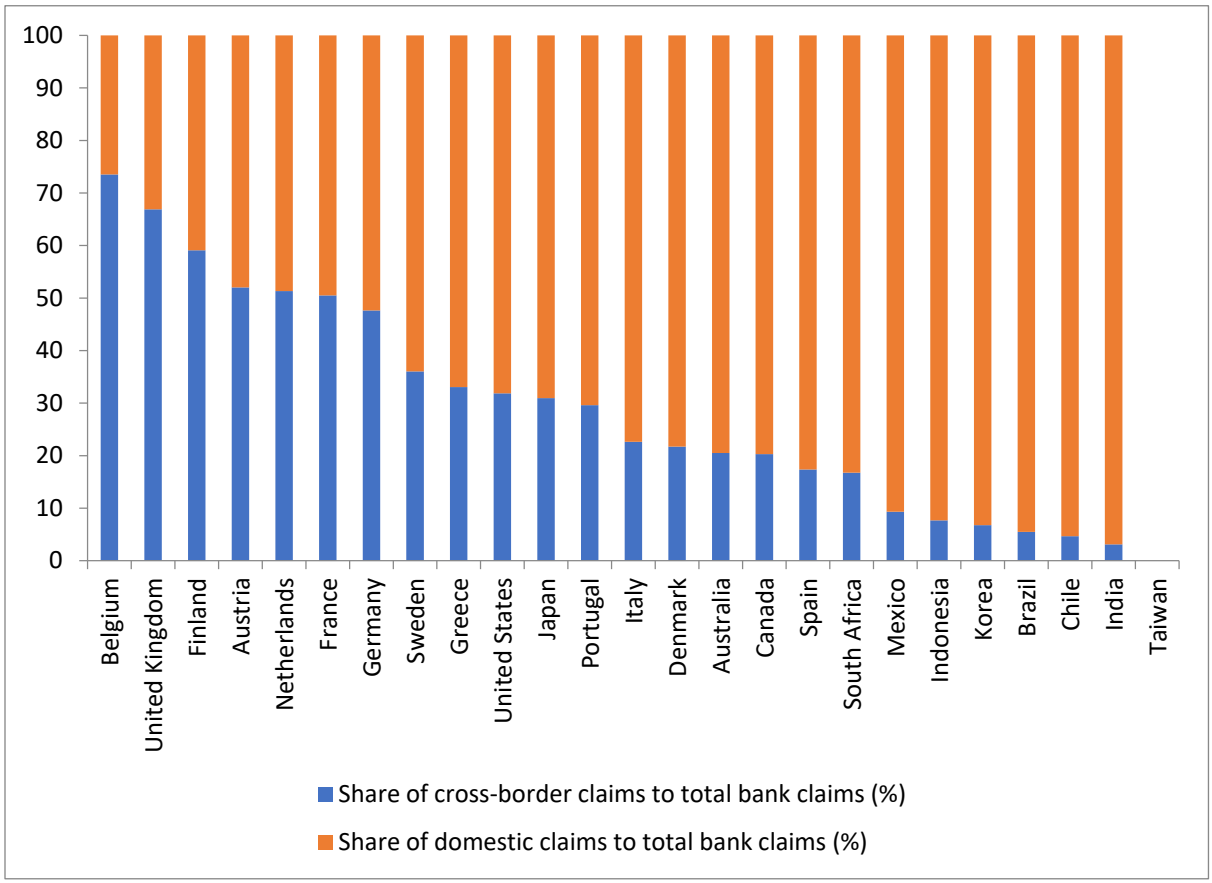
Note: Blue (red) lines denote aggregate cross-border claims (liabilities) in billion USD, which are adjusted by changes in the exchange rate.

Figure A.2. Country-specific uncertainty index



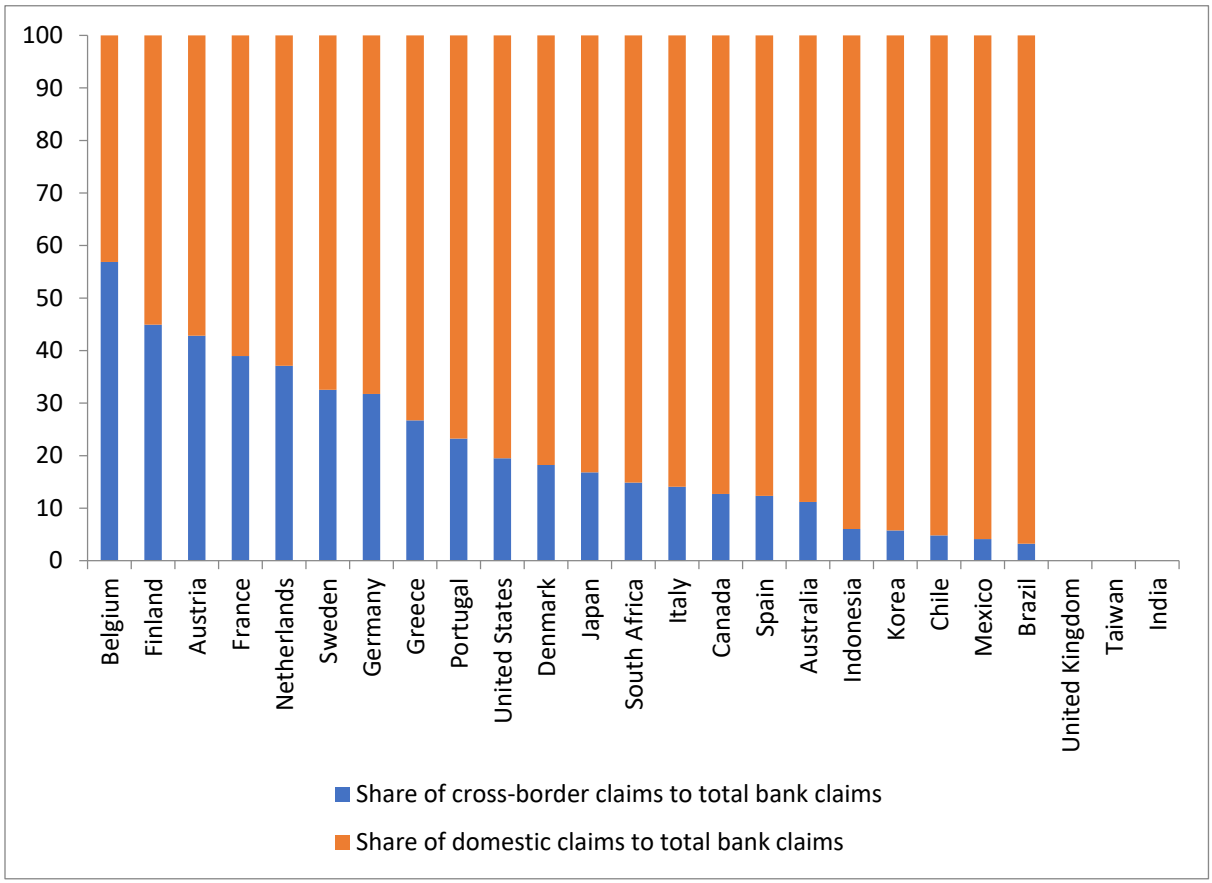
Note: Blue (red) lines denote baseline uncertainty measured by stock market volatility (alternative uncertainty measured by economic policy uncertainty).

Figure A.3. The share of cross-border bank claims in total bank claims in 2010Q4: using bank credit to the private non-financial sector



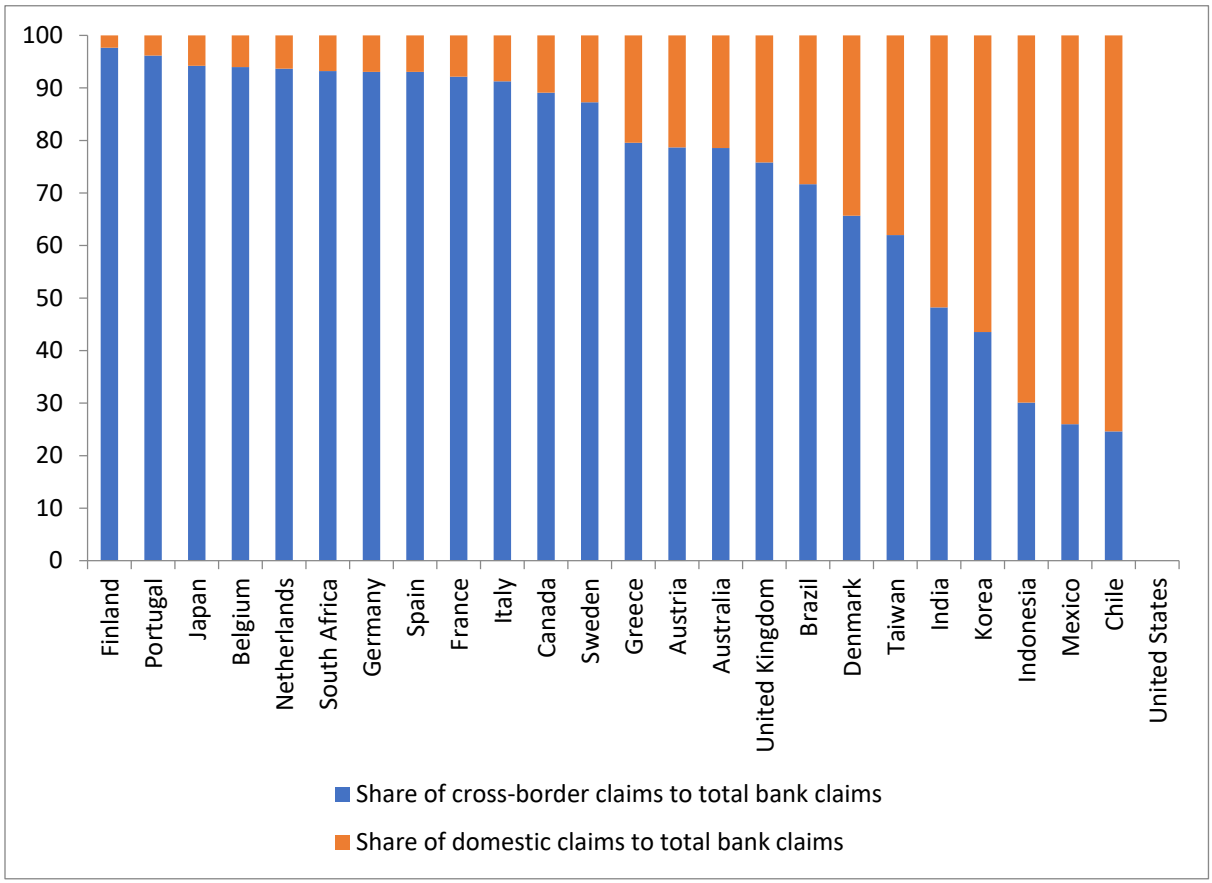
Note: Domestic bank claims denote bank credit to the private non-financial sector taken from the BIS. This data is not available for Taiwan.

Figure A.4. The share of cross-border bank claims in total bank claims in 2010Q4: using bank credit to the private and public sector



Note: Domestic bank claims denote bank claims on both the private and public sector (line 32) taken from IMF International Financial Statistics Depository Corporations Survey. This data is not available for India, Taiwan, and the U.K.

Figure A.5. The share of cross-border bank claims in total bank claims in 2010Q4: using local claims in foreign currencies



Note: Domestic bank claims denote bank claims on local borrowers in foreign currencies from the BIS LBS. This data is not available for the U.S.

Table A.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 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 A.2. 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

Note: The IMF classification is used to distinguish advanced and emerging market economies.

B. Additional Robustness Checks

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. Column (I) in Table B.1-B.3 present the results from re-estimating equation (1) and (2) using the growth rate of exchange rate-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.

Weighted Least Squares 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*.[33] Column (II) in Table B.1-B.3 demonstrate that weighting each observation by its relative importance does not affect our conclusion.

Non-linearity in uncertainty While we have used stock market volatility series as a baseline proxy for uncertainty, thereby obtaining 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.[34]

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

[33] 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.

[34] 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.

as the 5% one-tailed significance level treating each source country-time as an independent observation. Column (III) in Table B.1-B.3 present results using a binary uncertainty variable. The results are qualitatively similar to those in the baseline estimation, although the results on cross-border liabilities are no longer significant.

Standard error clustering Standard errors in the baseline analysis are clustered at the source-recipient levels to account for possible serial correlation in the error term. In Column (IV) in Table B.1-B.3, we confirm that our results are similar when clustering standard errors at the recipient country-time levels.

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 behavior of cross-border banking flows in the euro area differs from that outside the euro area. Due to a common monetary policy framework, member countries cannot use monetary policy instruments independently, which might amplify the effect of higher uncertainty on cross-border banking flows.

To answer this question, we conduct a subsample analysis for cross-border banking between (i) the euro area countries and (ii) the non-euro area countries. Column (V) and (VI) in Table B.1-B.3 show that the adverse effect of higher uncertainty on cross-border banking flows exists in both subsamples, 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 the euro area subsample.

Table B.1. Additional robustness check: Growth of cross-border claims

	Valuation effect	WLS	Binary shock	Standard error	Euro area only	Non-euro area only
	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	-0.971	-2.012**	-3.533**	-1.536*	-2.572*	-1.574
	(0.724)	(0.899)	(1.594)	(0.835)	(1.387)	(1.187)
Real GDP growth	0.640**	-0.574	0.537**	0.767***	-0.536	0.572
	(0.277)	(0.622)	(0.244)	(0.266)	(0.724)	(0.426)
Stock market returns	0.005	-0.062	0.021	0.016	0.022	0.018
	(0.028)	(0.081)	(0.026)	(0.030)	(0.117)	(0.044)
Inflation rate	0.427	-0.241	-0.249	-0.183	1.579	-0.645
	(0.511)	(0.842)	(0.377)	(0.489)	(1.727)	(0.676)
Policy rate	0.501***	0.589***	0.453***	0.592***	0.326	0.621***
	(0.110)	(0.164)	(0.084)	(0.131)	(0.243)	(0.154)
Exchange rate growth	0.001	-0.400**	-0.027	-0.086		-0.081
	(0.083)	(0.164)	(0.068)	(0.085)		(0.108)
Observations	40,027	40,027	40,027	40,027	4,673	15,126
R-squared	0.133	0.179	0.132	0.128	0.245	0.224

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 source-recipient levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table B.2. Additional robustness check: Growth of cross-border liabilities

	Valuation effect	WLS	Binary shock	Standard error	Euro area only	Non-euro area only
	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	-0.736	-2.472***	-3.273	-2.435*	-4.148**	-1.496
	(0.864)	(0.773)	(2.637)	(1.016)	(1.896)	(1.020)
Real GDP growth	1.234***	0.373	1.060***	0.970**	-1.947*	0.129
	(0.347)	(0.373)	(0.353)	(0.321)	(1.004)	(0.403)
Stock market returns	0.068*	-0.001	0.002	0.006	0.045	0.005
	(0.039)	(0.037)	(0.043)	(0.043)	(0.105)	(0.046)
Inflation rate	1.017*	1.196	1.549**	1.620**	1.707	0.965
	(0.561)	(0.772)	(0.603)	(0.546)	(1.643)	(0.611)
Policy rate	-0.040	0.114	0.053	0.065	-0.003	0.025
	(0.112)	(0.123)	(0.117)	(0.123)	(0.313)	(0.110)
Exchange rate growth	-0.125	-0.184	-0.160	-0.199*		-0.161
	(0.104)	(0.122)	(0.105)	(0.113)		(0.109)
Observations	37,894	37,894	37,894	38,403	4,487	14,460
R-squared	0.14	0.221	0.139	0.141	0.272	0.228

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

Table B.3. Additional robustness check: Net cross-border positions

	Valuation effect	WLS	Binary shock	Standard error	Euro area only	Non-euro area only
	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	0.735***	2.472**	0.136	0.502***	0.080	0.111*
	(0.205)	(1.114)	(0.112)	(0.053)	(0.294)	(0.065)
Real GDP growth	-0.087**	-0.194	-0.053	-0.043**	0.134	-0.074***
	(0.039)	(0.246)	(0.029)	(0.019)	(0.102)	(0.027)
Stock market returns	-0.001	0.046***	-0.001	0.002	0.036***	0.001
	(0.003)	(0.014)	(0.002)	(0.002)	(0.014)	(0.003)
Inflation rate	-0.190***	-1.342***	-0.218***	-0.243***	-0.824***	-0.223***
	(0.059)	(0.324)	(0.041)	(0.029)	(0.242)	(0.032)
Policy rate	-0.127***	-0.199**	-0.064***	-0.090***	0.046	-0.040***
	(0.026)	(0.099)	(0.016)	(0.006)	(0.041)	(0.008)
Exchange rate growth	0.000	-0.032	-0.002	0.000		0.003
	(0.005)	(0.040)	(0.004)	(0.005)		(0.007)
Observations	36,933	36,933	36,933	36,933	4,485	13,165
R-squared	0.129	0.301	0.154	0.151	0.357	0.329

Note: The dependent variables are exchange rate-adjusted cross-border net claims normalized by the source country's GDP. All independent variables are lagged by one period. Heteroskedasticity-robust standard errors are clustered at the source-recipient levels. *** denotes 1% significant level, ** denotes 5% significance level, and * denotes 10% significance level.

Table B.4. Additional robustness check for the relative share

	Additional controls			IV approach		
	Full sample	AE recipients	EM recipients	Full sample	AE recipients	EM recipients
	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	0.122*	0.218*	-0.009	0.282**	0.544**	-0.017
	(0.072)	(0.118)	(0.023)	(0.140)	(0.233)	(0.036)
Real GDP growth	0.006	0.001	0.007**	-0.019	-0.049**	0.001
	(0.012)	(0.019)	(0.003)	(0.014)	(0.024)	(0.006)
Stock market returns	0.001	0.001	0.000	-0.020	-0.012	-0.002
	(0.001)	(0.001)	0.000	(0.016)	(0.025)	(0.008)
Inflation rate	-0.051**	-0.087**	-0.003	-0.034**	-0.072**	-0.003
	(0.025)	(0.043)	(0.007)	(0.017)	(0.029)	(0.005)
Policy rate	-0.029***	-0.030**	-0.001	-0.047***	-0.069***	-0.008***
	(0.011)	(0.014)	(0.002)	(0.008)	(0.013)	(0.002)
Exchange rate growth	0.002*	0.002	0.001*	0.010	0.006	0.001
	(0.001)	(0.002)	0.000	(0.007)	(0.011)	(0.004)
Private credit growth	-0.015**	-0.022*	-0.002			
	(0.007)	(0.012)	(0.002)			
External debt to GDP	0.002***	0.004***	0.001			
	(0.001)	(0.001)	(0.001)			
Observations	15,911	8,877	7,034	36,954	20,368	16,586
R-squared	0.422	0.382	0.346	0.436	0.413	0.300

Table B.5. Additional robustness check for the relative share (continued)

	Before GFC			After GFC		
	Full sample	AE recipients	EM recipients	Full sample	AE recipients	EM recipients
	(I)	(II)	(III)	(IV)	(V)	(VI)
Uncertainty	0.110**	0.197**	-0.008	0.093	0.213*	-0.028
	(0.054)	(0.092)	(0.016)	(0.065)	(0.109)	(0.024)
Real GDP growth	-0.028***	-0.048***	0.000	-0.029***	-0.057***	-0.002
	(0.010)	(0.017)	(0.004)	(0.011)	(0.018)	(0.003)
Stock market returns	0.002**	0.005***	-0.001	-0.002***	-0.004***	0.000
	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	0.000
Inflation rate	-0.017	-0.038	0.004	-0.050**	-0.104***	-0.015***
	(0.019)	(0.033)	(0.006)	(0.020)	(0.032)	(0.005)
Policy rate	-0.041***	-0.059***	-0.010***	-0.048***	-0.064***	-0.004
	(0.007)	(0.011)	(0.002)	(0.010)	(0.013)	(0.003)
Exchange rate growth	-0.005**	-0.009***	-0.001	0.007***	0.009***	0.001***
	(0.002)	(0.003)	0.000	(0.001)	(0.003)	0.000
Observations	26,338	14,514	11,824	10,616	5,854	4,762
R-squared	0.496	0.447	0.296	0.368	0.328	0.320

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