How does the interaction of macroprudential and monetary policies affect cross-border bank lending?[1]

Előd Takáts[2]

Bank for International Settlements

Judit Temesvary[3]

Federal Reserve Board

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Abstract: We combine a rarely accessed BIS database on bilateral cross-border lending flows with cross-country data on macroprudential regulations. We study interactions between the monetary policy of major international currency issuers (USD, EUR and JPY) and macroprudential policies enacted in source (home) lending banking systems. We find significant policy interactions. Tighter macroprudential policy in a home country mitigates the effect of the monetary policy of a currency issuer on lending. For instance, macroprudential tightening in the UK mitigates the negative impact of US monetary policy tightening on USD cross-border bank lending outflows from UK banks. Vice-versa, easier macroprudential policy amplifies effects.

Keywords: Monetary policy; macroprudential policy; cross-border claims; diff-in-diff

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[2] Bank for International Settlements and London School of Economics, elod.takats@bis.org
[3] Federal Reserve Board, 1801 K Street, Washington, DC 20006 USA. judit.temesvary@frb.gov

1. Introduction

Central banks and financial regulators use macroprudential tools increasingly frequently after the global financial crisis to promote financial stability (IMF-FSB-BIS, 2016). At the same time, policy makers continue to use monetary policy tools to address inflation and employment goals. Even though macroprudential and monetary policies have been employed frequently side by side for nearly a decade, there are serious gaps in our understanding of how they work together (Yellen, 2014; Quarles, 2019). This lack of understanding is problematic in that such interaction matters for economic policy: both policies affect availability and the price of credit to the wider economy (Yellen, 2010; Claessens, 2013; Praet, 2018).

Yet, identifying the interaction between macroprudential and monetary policies is wrought with difficulties: within a country, these policies respond to similar variables, such as credit growth, and often operate through similar channels, such as the cost of bank credit. This, together with the lack of available data, has hindered efforts in identifying interaction effects in cross-border lending.

For the first time, we are uniquely able to tackle this identification issue and shed light on the interaction between macroprudential and monetary policies. We do so by applying a novel identification strategy to a unique and rarely accessed dataset on a network of cross-border bank claims by currency denomination (from the Stage 1 Enhancements to the Bank for International Settlements' International Banking Statistics (BIS IBS)). We combine this data with two distinct databases on country-specific measures of macroprudential policy actions (from the International Banking Research Network (IBRN) and the International Monetary Fund Integrated Macroprudential Policy Database (iMaPP).

Our identification strategy focuses on the interaction of a monetary policy that is exogenous to the macroprudential policy, yet affects the same lending flows. We build on the currency dimension of the international bank lending channel: monetary policy changes by the

issuer of the currency of lending impacts cross-border lending flows in that currency, even when neither the lending banking system nor the borrower country uses that currency as its own. For instance, tightening by the Federal Reserve reduces all US dollar-denominated cross-border bank lending flows around the world, even if the US is neither the lender nor the borrower. Invoking this currency dimension of the bank lending channel (Takats and Temesvary, 2016), we focus on foreign currency-denominated lending of banks across borders, and examine how changes in monetary policy by the *issuers of the top three reserve currencies* (the US dollar (USD), euro (EUR) and Japanese Yen (JPY)) interact with macroprudential policies enacted by policy makers in the *domestic* jurisdictions of global banks, in driving cross-border bank lending. By focusing on a network of cross-border bank lending flows in reserve currencies, we are able to separate monetary policy (enacted by the currency issuer rather than domestic policy makers) from macroprudential policy (enacted by domestic policy makers). To isolate confounding effects on credit demand, we apply a generalization of the Khwaja and Mian (2008) identification method and include extensive sets of fixed effects, including country-time fixed effects.

To see how we identify the macroprudential-monetary policy interaction, consider an example of USD-denominated cross-border bank lending from UK banks. The currency dimension of the international bank lending channel posits that US monetary policy affects cross-border bank lending denominated in USD, even if the US is neither the source bank lending system nor the borrowers' country (Takats and Temesvary, 2016). As an example of this channel, US monetary policy tightening would reduce UK-headquartered banks' USD-denominated lending to Malaysia. At the same time UK macroprudential policies also affect this cross-border bank lending. For instance, macroprudential tightening, by making domestic bank lending relatively more expensive, may drive UK banks' lending outward and thereby increase cross-border bank lending also to Malaysia. In this context, an example of what we do

in this paper is to investigate how UK macroprudential tools interact with US monetary policy in affecting USD-denominated cross-border bank lending outflows from the UK banking system. The fact that US monetary policy is exogenous to UK macroprudential policy provides an identification which would be impossible to obtain in a single-country setup. In addition, the fact that we have bilateral lending data in several currencies, that is, we also have information on EUR and JPY denominated cross-border bank lending by UK banks to Malaysia, allows us to apply country-time fixed effects to control for confounding changes in credit demand by Malaysian borrowers. The unique quarterly breakdown of the BIS IBS Stage 1 Enhancements by (1) lending banking system, (2) borrower country, and (3) currency is essential for our analysis.

We find consistent evidence that macroprudential measures enacted in source (lending) banking systems significantly interact with changes in the monetary policy associated with the currency of lending. We show that tighter macroprudential policy *mitigates* the lending impact of monetary policy (irrespective of whether monetary policy tightens or eases). Referring back to our example, our results imply that macroprudential policy tightening in the UK mitigates the negative impact of US monetary policy tightening on USD cross-border lending outflows from the UK banking system (say, to Malaysia). Symmetrically, we also find that macroprudential policy easing in the source banking system *amplifies* the lending impact of monetary policy on cross-border outflows.

We construct a unique dataset from three sources. First, the "Stage 1 Enhancements" to the BIS IBS, available starting in 2012 Q2, lists cross-border lending flows by currency (USD, EUR and JPY) from 27 lending banking systems to 50 borrowers' countries. This database uniquely allows us to identify the currency dimension of the (international) bank lending channel, that is, monetary policy transmission through the currency denomination of cross-border bank lending (Takats and Temesvary, 2016). We combine this data with two distinct

macroprudential databases from the IBRN and the IMF iMaPP). Both databases contain country-specific measures of macroprudential policy actions. Having two distinct sources for macroprudential policies is critical to ensure robustness, because measuring macroprudential policies is still in its infancy.

We conduct our analysis as follows. In the first step, we focus on the period of the effective (zero) lower bound on monetary policy rates, starting with 2012 Q2 and ending in 2014 Q4, the eve of the year of US monetary policy liftoff (Lhuissier et al, 2019). Given the binding effective lower bound, we use shadow interest rates from Krippner (2016) to capture the stance of post-crisis unconventional monetary policy. For this period, we examine the macroprudential-monetary policy interaction using regulatory measures from both the IBRN and IMF iMaPP databases. In the second step, we extend our analysis up until 2016 Q4 to study the policy interaction during and after US monetary policy liftoff. For this extended analysis, we have the IMF iMaPP database available.

Our main findings that tighter macroprudential policy *mitigates* the lending impact of monetary policy and easier macroprudential policy *amplifies* the lending impact of monetary policy, are not only statistically but also economically significant. Given the nature of interactions, quantifying the economic impact requires considering both policies simultaneously. As an example, following a 25 basis point monetary tightening over four quarters, cross-border lending outflows decline by around 2.5 percentage points (p.p.) more in a source banking system that relatively eases macroprudential tools (i.e. India in 2014 Q1) than from a source that relatively tightens such tools (i.e. the Netherlands in 2014 Q1). This impact is substantial in magnitude, given that the average quarterly growth in bilateral cross-border bank claims is 1.2 percent. Importantly, the impact we highlight here is merely due to the interaction, i.e. the effect that we describe here is *in addition* to the level effects of each policy.

Our findings are robust to a range of alternative specifications. We find significant results in both our short and long sample, and both using the IBRN and iMaPP databases. The results are robust to a wide range of changes in the specification. We examine possibly non-linearities, and see no evidence that the policy interactions would be different depending on whether we look at easing vs. tightening. For completeness, we also examine the potential interactions with macroprudential tools applied in borrowers' countries, and here we do not find consistently significant interaction effects.

The results are policy relevant. They show that the interaction between monetary policy of a currency issuer and the macroprudential policy of major lending baking system jurisdictions materially affects the supply of cross-border bank lending. First, this interaction matters for central banks in the countries of borrowers to assess credit supply. Relating back to our earlier example, Malaysian (and other emerging market) policy makers would benefit from understanding early how the interaction of US monetary policy and UK macroprudential policy affects cross-border USD loan supply to their economies. An early recognition could help calibrate the appropriate domestic policy response in time for reserve currency-issuer monetary policy transmission into cross-border lending inflows to take effect. Second, these interactions also matter for regulators of major international banks, when they calibrate macroprudential policies. In our example, understanding the policy interaction enables UK regulators to consider the effect on cross-border bank lending when fine-tuning their macroprudential policies. This might also matter for externalities to emerging market borrowers – and for potential spillbacks as well. Furthermore, understanding this interaction also matters for the central banks associated with the major international currencies. In our example, understanding policy interactions may provide information to the Federal Reserve to more precisely assess spillbacks to the US.

Last, but not least, the recognition of such positive interaction is also important when thinking about domestic application of monetary and macroprudential policies. While our quantitative results do not necessarily translate to domestic lending, the qualitative results suggest that the interaction might matter for domestic policies as well. Therefore, central banks and financial regulators might want to assess the potential domestic interactions between domestic monetary and macroprudential policies in more detail – and, if necessary, coordinate these policies more closely.

The paper proceeds as follows. In Section 2 we link our work to the related literature. In Section 3 we describe our data. We present the methodology in Section 4 and detail the results in Section 5. We discuss robustness in Section 6 and conclude in Section 7.

2. Related literature

Our research focuses on the interaction between macroprudential policies and monetary policies in an international bank lending setup. Hence, we aim to fill a gap at the intersection of three strands of literature studying the drivers of international bank lending flows: (1) research on the impact of macroprudential policies (2) research on monetary policy spillovers, and (3) the relatively new research focusing specifically on the interaction between monetary and macroprudential policies.

First, the research on macroprudential policies dates back to Crockett (2000) and Borio (2003) and is recently reviewed in detail by Claessens (2015) and Galati and Moessner (2018). Elliott et al (2013) provide of historical overview of such policies in the United States. The policy discussion, as shown for instance in the IMF-FSB-BIS (2016) publication, suggests that macroprudential policies might have an international dimension. From the perspective of borrowers' countries, Houston et al (2012) shows that more strictly regulated jurisdictions

receive less cross-border bank credit. Temesvary (2018) and Frame et al (2019) show that banks not only lend less to locations with stricter regulations, but they are also less likely to set up operations there. The body of research in the context of the IBRN's 2016 project (summarized in Buch and Goldberg (2017)) also shows a wide range of evidence on regulatory impact on cross-border bank lending flows. Takats and Temesvary (2019) provide evidence that macroprudential rules can stabilize cross-border lending flows during times of severe financial stress, such as the taper tantrum.

Second, there is also a fast-growing literature showing evidence for international monetary policy spillovers through cross-border bank lending (Cetorelli and Goldberg, 2012; Miranda-Agrippino and Rey, 2012; Forbes and Warnock, 2012; Temesvary et al, 2018). There are several papers showing, in line with our identification approach, that the monetary policy of a currency issuer can transmit into lending in that currency in foreign countries as well (Alper et al, 2016; Ongena et al, 2015; Avdjiev and Takats, 2018; Avdjiev et al, 2016; Takats and Temesvary, 2016). In addition, our work also builds on research which argues that national borders and economically relevant decision-making units often diverge (see, for instance, Takats and Temesvary (2016) for a review). The discussion dates back to Fender and McGuire (2010) and Cecchetti et al (2010), who argue that the lending bank's nationality tends to be more relevant than its residence in identifying the decision-making unit. Building on these findings, Avdjiev et al (2015) coin the term of the (absence of) triple coincidence in international finance. This term refers to the phenomenon that national borders, the conventional units of international economic analysis, often do not coincide with the economically relevant decision-making unit. Following these lessons, we focus on "lending banking systems" as opposed to "lending countries", so that we can follow the decision-making unit as precisely as possible.

Third, the interaction of monetary and macroprudential policies became one critical focus for policymakers (Yellen, 2010; Claessens, 2013; Claessens and Valencia, 2013; Praet, 2018; Cecchetti et al, 2018) and therefore for economic research. Although earlier literature has addressed such interactions in the domestic context, to the best of our knowledge ours is the first paper to investigate such interaction in the global and cross-border bank lending context. Various models were proposed on how macroprudential policies could interact with monetary policy (Beau et al, 2011, 2012; De Paoli and Paustian, 2013; Brunnermeier and Sannikov, 2014; Smets, 2014; Darracq Paries et al, 2019, Coman and Lloyd, 2019). Broadly, macroprudential and monetary policies aim at different goals: financial stability and stable inflation (or business cycle), respectively. Following the Tinbergen principle the two tools may suffice to reach these two separate goals, but policymakers need to understand their interaction to fine-tune the combined policy effects. Yet, the related empirical evidence remains scarce. Based on confidential credit registry data from Latin America, Gambacorta and Murcia (2017) argue that macroprudential tools have a greater effect on credit growth when reinforced by the use of monetary policy moving in the same direction. Similarly, Bruno et al (2017) find evidence in the Asian context for the two policies reinforcing each other. Hills et al (2019) investigate this interaction through the external lending of UK banks.

3. Data description

3.1 Data on macroprudential measures

Our data on country-level regulatory measures come from two sources: the macroprudential database employed by the 2016 IBRN project, also incorporating the 2013 Global Macro Prudential Instruments (GMPI) survey (Cerrutti et al, 2015; Correa et al, 2016; Avdjiev et al, 2017; Berrospide et al, 2017); and the IMF's Integrated Macroprudential Policy

Database (iMap). The IBRN database extends on a quarterly frequency up until 2014 Q4, and the IMF iMaPP database is available up to 2016 Q4. The panels in Table A1 summarize and describe these indices.

Importantly, we focus on the overall impact of macroprudential rules, rather than formulating hypotheses around specific tools and their impact on cross-border bank lending in our main analysis. Therefore, we construct macroprudential policy indices from both databases. In the construction, we follow similar steps as those taken in the IBRN database. The IBRN and IMF iMaPP regulatory databases describe quarterly changes in the stance of individual macroprudential tools, coded as 1 for tightening and -1 for easing. Our macroprudential index in each database is a country index by time *t* and country *i*, which equals 1 if the sum of changes in the individual policy tools listed in Table A1 is greater than or equal to 1, equals -1 if the sum of the changes is less than or equal to -1, and is 0 otherwise.

In our investigation, we focus on strictly macroprudential tools. This distinction matters because both the IBRN and IMF iMaPP databases contain a mix of macroprudential and (micro)prudential measures. Most importantly, both databases contain information on minimum capital requirements. These capital requirements reflect more (micro)prudential considerations – in fact, they often reflect the adoption of Basel III regulatory reforms. In other words, the changes in capital requirements, though they might affect cross-border bank lending, are not macroprudential tools and are outside the scope of our analysis. Therefore, we exclude changes in minimum capital requirements, when we create our index of macroprudential tools.[4]

The two macroprudential databases show a similar, but not identical picture. The correlation across the macroprudential indexes constructed from the two databases is near 0.7. This underlines the importance of investigating interactions using both measures.

[4] We include capital requirements in our robustness checks to show that this exclusion does not drive our results.

3.2 Data on bilateral cross-border bank claims

Cross-border bank claims total around 30 trillion USD globally. These claims include cross-border bank lending and other claims (such as securities holding). The Bank for International Settlement's International Banking Statistics (BIS IBS) provides detailed data about these cross-border claims along several dimensions.

In order to study the interaction between home macroprudential tools and the monetary policy of the currency issuer, we need to identify three dimensions of the cross-border bank claims data: (A) the currency composition of cross-border claims; (B) the residence of the borrower, and (C) the nationality of the lending banking system. The currency composition (A) is necessary to study the currency-specific monetary policy. The borrowers' residence (B) is necessary to control for credit demand of the borrowers' countries. The nationality of the lending banking system (C) is necessary to identify the home macroprudential agency whose policy we aim to follow. Using our leading example, these three dimensions enable us to investigate how USD-denominated cross-border bank claims from UK-headquartered banks to Malaysia are affected by the interaction of (A) US monetary policy and (B) UK macroprudential policy while controlling for credit demand in Malaysia (C).

In our analysis, we use the Stage 1 enhancements of the BIS IBS, because this dataset uniquely allows us to have all three necessary dimensions of the underlying cross-border bank claims data (Table A2). In comparison, two main BIS IBS datasets cover cross-border claims: the consolidated and the locational data. The first, consolidated dataset groups claims according to the nationality of banks. It covers residence of borrower (B) and the nationality of the lending banking system (C), but not the currency composition (A). In our case, the consolidated dataset

would not allow us to use the currency-specific monetary policy, i.e. to identify the currency dimension of the international bank lending channel.

The second dataset, the locational banking statistics defines creditors and debtors according to their residence, consistently with national accounts and balance of payments principles. It has three main subsets: the residence-based, the nationality-based and the Enhanced Stage 1 data. The residence based data has information on the currency composition (A) and the residence of borrower (B), but not on the nationality of the lending banking system (C). This can be an issue with financial centers. For instance, a UK bank's lending through its Hong Kong subsidiary to Malaysia, would be identified as two separate lending relationships in residence-based approach: one loan from the UK to Hong Kong and another one from Hong Kong to Malaysia. In our case, that would mask the impact of the home (i.e. the UK) macroprudential regulator's macroprudential policies on lending to Malaysia. In contrast, the nationality-based data observes nationality of the lending bank (C) along with the currency denomination (A) – but not the residence of the borrower (B). In our case, not having access to the residence of borrower would preclude controlling for credit demand.

The Stage 1 Enhancement to the BIS IBS is available by quarterly frequency starting from 2012 Q2 onward both in stocks (levels) and in currency adjusted flows.[5] The stocks and flows are also available by currency denomination, across the major international currencies.[6] We focus on the three main currencies (USD, EUR and JPY) that are the most prevalent in cross-border lending. More precisely, we use quarterly changes in the natural logarithm of bilateral cross-border bank claim stocks denominated in these three currencies. When analyzing the

[5] The start of our sample is determined by data availability. However, 2012 Q2 is also the period that marks the start of the effective lower bound (ZLB) in the euro-area – thus allowing us to focus on a more uniform time frame during which each of our reserve currencies experienced a binding ZLB.
[6] The flow is also adjusted for breaks in the series.

Stage 1 enhanced dataset, we use a large cross section that covers 27 lending banking systems and 50 borrowers' countries.[7]

The Stage 1 enhanced IBS data is fairly representative, though not yet fully complete. On aggregate, information on the nationality of lending banks is available for more than 90 percent of global cross-border claims (Avdjiev and Takats, 2018). However, this ratio varies and tends to be higher for larger counterparty countries.

Since smaller-scale lending flows can be very volatile, we winsorize the observations at the 5th and 95th percentile as is common in related work (Avdjiev and Takats, 2014; Takats and Temesvary, 2016; Avdjiev and Takats, 2018; Takats and Temesvary, 2019).[8]

3.3 Data on monetary policy stance

Our benchmark sample focuses on the period of the binding effective zero lower bound (2012 Q2 – 2014 Q4), preceding the liftoff of US monetary policy. During this period, the major central banks, the Federal Reserve, the European Central Bank and the Bank of Japan relied on "unconventional" expansionary monetary policies. As a result, the short-term policy target interest rates set by these three central banks hit the effective lower bound in early 2009 – and therefore became uninformative of the stance of expansionary monetary policy thereon (Figure 1, left panel). Hence, we use the currency-specific short-term shadow interest rates (as described in Krippner (2013, 2015 and 2016)) to measure the change in monetary policy stance

[7] The 27 lending banking systems are Austria; Australia; Belgium; Brazil; Canada; Chinese Taipei; Denmark; Finland; France; Germany; Greece; India; Ireland; Italy; Japan; Korea; Luxembourg; Mexico; the Netherlands; Norway; Portugal; Spain; Sweden; Switzerland; Turkey; United Kingdom; United States. The 50 borrowing countries are Angola; Austria; Australia; Belgium; Brazil; Bulgaria; Canada; Chile; China; Chinese Taipei; Croatia; Cyprus; Czech Republic; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Israel; Italy; Japan; Korea; Liberia; Lithuania; Luxembourg; Malta; Marshall; Island; Mexico; Morocco; the Netherlands; New Zealand; Nigeria; Norway; Poland; Portugal; Romania; Russia; Slovakia; Slovenia; South Africa; Spain; Sweden; Switzerland; Turkey; Ukraine; United Kingdom; United States; Vietnam.

[8] It is not unprecedented to observe several hundred percentage point changes across some very small bilateral claims even in response to small idiosyncratic shocks, such as a new FDI project.

of the three major reserve currencies (Figure 1, right panel). By construction, the short-term shadow interest rates are not subject to the zero lower bound, and are thus able to capture expansionary monetary policy actions by dipping into the negative range.

Our larger sample extends through end-2016, including the post-liftoff period of conventional monetary policy actions. However, for consistency and comparability, we continue to use the Krippner shadow rates also in this extended sample. This is appropriate, as by construction the Krippner shadow short-term rates are identical with policy interest rates during conventional monetary policy periods. We define the change in the monetary policy stance as the quarterly change (from t–1 to t, in p.p.) in the short-term shadow interest rate that corresponds to the monetary conditions determined by the central bank that issues currency *c*.

3.4 Additional macro controls

Whenever we do not rely on (borrowers') country*time fixed effects, we control for macroeconomic and financial effects on credit demand in borrowers' countries and credit supply in source bank lending systems. To do so, we add (real) GDP growth and changes in domestic interest rates as controls in specifications where country*time fixed effects are not included. We also add quarterly changes in the exchange rate between the currencies of the source (home) and the borrowers' country, to capture any additional valuation effects which may influence banks' cross-border lending flows. We describe our model variables in detail in Table 1.

4. Estimation methodology

4.1 Identification

The main identification issue is that the use of macroprudential tools can be endogenous to the use of monetary policy. In a domestic context, policy makers might observe overheating credit markets and react with either macroprudential or monetary tightening – or a combination of the two. In short, the use of the two policies are typically endogenous in a domestic context. Consequently, when we investigate interactions with source macroprudential tools, we need to focus on the effects of a monetary policy that is not linked to the source bank lending system. Similarly, when we extend the analysis to policy interactions with borrowers' country macroprudential tools, then we need to examine a monetary policy that is unrelated to borrowers' country regulatory policies.

4.2 Panel regression setup

Our dependent variable, $\Delta claims$ is the quarterly change in the log of bilateral claims between the source lending banking system *i* and borrowers' country *j*, denominated in currency *c*. Our two main explanatory variables are (1) our IBRN and IMF iMaPP indices of applied macroprudential measures (*macroprudential*) in source bank lending system *i* as defined in Section 3.1 above, and (2) the change in monetary policy stance (*monetary*) associated with the major international currencies (USD, EUR, JPY) as measured by the Krippner (2016) shadow rates. Following the standards of the bank lending literature (Kashyap and Stein, 2000; Cetorelli and Goldberg, 2012) in accounting for potential persistence in lending flows, we consistently add the lagged dependent variable to the right-hand side.

To strengthen identification, we restrict all our estimations to exclude both same country lending and own currency lending (in the terminology of Takats and Temesvary (2016)). These two sets of lender-borrower pairs could potentially confound identification. First, same country lending (e.g. US-owned bank subsidiaries lending back to US-based borrowers) suffer from a

more severe endogeneity of monetary and macroprudential policies. Second, own currency lending (e.g. German bank lending in EUR or US banks' lending in USD) might confound the country and currency-specific impact of monetary policy.

We use six equations throughout the paper. The first regression explains lending flows as a function of macroprudential policies in source bank lending system *i* ($\Delta macroprudential_{it}$). In addition, we control for macroeconomic variables both in source bank lending system *i* ($\Delta macro_{it}$) and borrowers' country *j* ($\Delta macro_{jt}$). Furthermore we apply fixed effects for each source bank lending system (FE_i), borrowers' country (FE_j) and currency (FE_c) to capture any time-invariant level differences. Finally, we apply time fixed effects for each quarter (FE_t) to control for unobserved global factors. Equation (1) is formally written as:

1. $$\Delta claims_{ijct} = \sum_{k=1}^{4}(\alpha_{1k}\Delta macroprudential_{it-k} + \alpha_{2k}\Delta macro_{it-k} + \alpha_{3k}\Delta macro_{jt-k}) + FE_i + FE_j + FE_c + FE_t + \varepsilon_{ijct}$$

In the second regression, we add monetary policy by currency issuer *c* ($\Delta monetary_{ct}$):

2. $$\Delta claims_{ijct} = \sum_{k=1}^{4}(\beta_{1k}\Delta macroprudential_{it-k} + \beta_{2k}\Delta monetary_{ct-k} + \beta_{3k}\Delta macro_{it-k} + \beta_{4k}\Delta macro_{jt-k}) + FE_i + FE_j + FE_c + FE_t + \varepsilon_{ijct}$$

In the third regression, we add our main interest: the interaction between macroprudential and monetary policy ($\Delta macroprudential_{it} * \Delta monetary_{ct}$):

3. $$\Delta claims_{ijct} = \sum_{k=1}^{4}(\boldsymbol{\gamma_{1k}\Delta macroprudential_{it-k} * \Delta monetary_{ct-k}} + \gamma_{2k}\Delta macroprudential_{it-k} + \gamma_{3k}\Delta monetary_{ct-k} +$$

$$+ \gamma_{4k}\Delta macro_{it-k} + \gamma_{5k}\Delta macro_{jt-k}) + FE_j + FE_i + FE_c + FE_t +$$

$$+ \varepsilon_{ijct}$$

While Equation (3) addresses the policy interaction, a potential identification question remains. Namely, the question is the extent to which the macro controls capture non-policy related changes in credit demand from the borrowers' countries and credit supply from the source bank lending systems. Less than fully controlling for such confounding factors might result in omitted variable bias, which may, in turn, affect our interaction estimates.

To address this potential omitted variable bias, we expand the logic outlined in Khwaja and Mian (2008) to a broader context by adding (1) country*time fixed effects for borrower's country *i* and (2) currency*time fixed effects for currency *c*. The borrowers' country-specific fixed effects allow us to control for any potential direct time-varying country-level credit demand shocks in the borrowers' country. Similarly, the currency specific currency*time fixed effect controls for any shocks related to the use of that currency. Consequently, we drop the stand-alone macroprudential and macro terms for borrowers' country *j* ($\Delta macroprudential_{it}$ and $\Delta macro_{it}$) and the monetary policy by currency issuer *c* ($\Delta monetary_{ct}$) that would be subsumed by our extensive fixed effects. The resulting Equation (4) is written as:

4. $$\Delta claims_{ijct} = \sum_{k=1}^{4}(\boldsymbol{\delta_{1k}\Delta macroprudential_{it-k}} * \boldsymbol{\Delta monetary_{ct-k}} +$$

$$+ \delta_{2k}\Delta macroprudential_{jt-k} + \delta_{3k}\Delta macro_{jt-k}) + FE_{i*t} + FE_i +$$

$$+ FE_{c*t} + FE_t + \varepsilon_{ijct}$$

Next, we add further fixed effects to address potential omitted variables on the credit supply side from source bank lending systems. In other words, we add country*time fixed effects for source bank lending system *i* so as to focus attention on the interaction of macroprudential and monetary policies. This fixed effect allows us to control for any potential direct time-varying source banking system-specific credit supply shocks. We drop the stand-

alone terms for lending system *i* both for macroprudential policy ($\Delta macroprudential_{it}$) and macro controls ($\Delta macro_{jt-k}$) that would now be subsumed. The resulting Equation (5) is written as:

5. $$\Delta claims_{ijct} = \sum_{k=1}^{4} \boldsymbol{\lambda_{1k}} \Delta \boldsymbol{macroprudential_{it-k}} * \Delta \boldsymbol{monetary_{ct-k}} + FE_{i*t} + \\ + FE_{j*t} + FE_{c*t} + \varepsilon_{ijct}$$

Finally, we address the potential concern that some unobserved structural drivers embedded in the global cross-border bank lending system may drive our result. Technically, we introduce a fixed effect for each lending-borrowing pair to assume such structural impact (FE_{i*j}). For instance, in our earlier example the UK-Malaysia link would receive a fixed effect. Given that our identification relies much more on cross-sectional than on time-series variation, this constitutes a demanding specification. In order to avoid overloading the regression with fixed effects, we drop the country*time fixed effects for lending banking systems and borrowers' countries here and reintroduce the macroeconomic controls ($\Delta macro_{it}$ and $\Delta macro_{jt}$). The resulting final Equation (6) is written as:

6. $$\Delta claims_{ijct} = \sum_{k=1}^{4} (\boldsymbol{\theta_{1k}} \Delta \boldsymbol{macroprudential_{it-k}} * \Delta \boldsymbol{monetary_{ct-k}} \\ + \theta_{2k} \Delta macro_{it-k} + \theta_{3k} \Delta macro_{jt-k}) + FE_{i*j} + FE_{c*t} + \varepsilon_{ijct}$$

Importantly, while the extensive use of time-country and time-currency specific fixed effects identifies the policy interaction precisely, it also precludes us from being able to observe the impact of source (home) and borrowers' country policy measures separetely. While Equation (1-3) and partly Equation (4) provide some estimates for such level effects, these results should be treated cautiously due to the identification challenge that the less saturated specifications mentioned above face.

In all estimations we apply two-way clustering of the standard errors across the source (lending) banking system and borrowers' country dimensions.

5. Results

Our estimates show consistent evidence that the monetary policy of major currency issuers and the macroprudential policies in source bank lending systems interact in a statistically and economically significant way. In our analysis, we start from relatively simple models and gradually develop more sophisticated estimates as we move from Equation (1) to (6) outlined in Section 4.2. We estimate our benchmark set of specifications first over the unconventional monetary policy period of 2012 Q2 – 2014 Q4 using both the IBRN (Table 2) and IMF iMaPP (Table 3) regulatory databases. We then extend our sample through end-2016, using the IMF iMaPP regulatory data (Table 4). We discuss economic significance and interpretation in separate subsections.

5.1 IBRN data (2012-2014)

First, we investigate the policy interaction with the help of the IBRN macroprudential database for the 2012 Q2 – 2014 Q4 period (Table 2). Our first model estimates Equation (1), where only source bank lending system macroprudential policy is included – with the currency-specific monetary policy and its interaction omitted (Model 1). We see that the coefficient on macroprudential tightening has a positive and significant coefficient. This is consistent with the assertion that tighter macroprudential regulation increases the costs of lending at the home jurisdiction and thereby makes lending abroad, everything else being constant, more attractive.

We then estimate Equation (2), which also includes the impact of the cumulative shadow interest rates (Model 2). We find a negative, albeit insignificant coefficient for the level impact.

This is consistent with the observation that tighter monetary policy of a currency issuer implies lower cross-border bank lending in that currency. Importantly, the estimates on the macroprudential coefficient remains significant and of similar size as in Model 1.

Next, we turn to estimate our main interest by adding the interaction term between monetary and macroprudential policies to our regressions. Formally, we estimate Equation (3). The results show that the interaction is positive and statistically significant (Model 3). That is, macroprudential tightening in a source bank lending system significantly mitigates the negative impact of a monetary tightening of the currency issuer on cross-border bank lending. (We discuss the interpretation of this interaction in more detail in Section 5.5.)

As we discussed in the model setup, omitted variable bias might affect the results of Model (3). That is, there might be some uncontrolled demand or supply factors that could affect our interaction coefficient estimate. We address these concerns by applying a generalization of the Khwaja and Mian (2008)-style identification to address potential non-interaction related demand effects from borrowers' countries (Equation 4). The interaction results stemming from this estimation remain significant and materially unchanged from our earlier estimates (Model 4).

We then extend the set of fixed effects from the demand side to the supply side, i.e. to the source bank lending systems. Formally, we estimate Equation (5). The results show that the interaction term remains highly significant and positive (Model 5).

Finally, as a robustness check, we add *source*borrower* fixed effects to estimate Equation (6). That is, we add a time-invariant fixed effect for each pair of source bank lending system *i* and borrowers' country *j* in our specification. Though this is a very demanding control, the interaction coefficient estimate remains consistently significant (Model 6). Furthermore, its sign and size also remains in line with our earlier models.

5.2 IMF iMaPP data (2012-2014)

In the next step, we use the IMF iMaPP data for the 2012 Q2 – 2014 Q4 period (Table 3). This setup allows us to broadly compare the IMF iMaPP estimates to the IBRN estimates. This "broad" comparability means that the panel is not exactly the same: even though we made the time series consistent – the cross-section differs somewhat across the IBRN and IMF iMaPP databases due to variation in country coverage.[9]

We run regressions from Equation (1) to Equation (6) exactly as for the IBRN dataset. A similar picture emerges as before: the interaction term is significant with a positive sign for Models 3, 4 and 6. However, the interaction coefficient estimate becomes insignificant for Model 5. In evaluating the Model 5 results, it is important to emphasize that this specification, which includes the most complete fixed effects on both the source and borrower sides, is extremely demanding of the data.

5.3 IMF iMaPP data (2012-2016)

In the next step, we use the IMF iMaPP data for the 2012 Q2 – 2016 Q4 period (Table 4). This utilizes the most recent regulatory data available. We run regressions from Equation (1) to Equation (6) exactly as before. The results are very close to the earlier findings, in particular to the short sample iMaPP results: the interaction term is significant with a positive sign for Models 3, 4 and 6, while the coefficient estimate remains insignificant in Model 5. Therefore, the results suggest that the statistically significant policy interaction was not only a feature of

[9] We address this point in our robustness checks, when we re-run our estimation with restricting the cross section to those observations which are covered by both the IBRN and the IMF iMaPP data.

unconventional monetary policy regimes. Rather, these interaction effects also generalize to the post-liftoff US monetary policy period.

5.4 Economic significance

The coefficient estimates on the interaction terms do not allow for straightforward translation to economic significance. The reason is that both macroprudential and monetary policy stances matter for characterizing the interaction effects. In addition, while we have an intuitive understanding of how significant a given monetary tightening is, it is less clear how to assess the size of change in macroprudential policies. Hence, we use percentile ranks to characterize the magnitude of the effects of macroprudential measures. We compare the interaction effect for a 100 basis points tightening in the shadow interest rates over the course of four quarters, evaluated in a source banking system with a substantial strengthening of regulatory policies (at the 99th percentile of macroprudential policy tightening) vs one with easing macroprudential rules (at the 1st percentile).[10]

The results show that the macroprudential-monetary interaction effects are economically significant (see bottom of Tables 2-4). For instance, our main model estimates show that tighter macroprudential policies in source bank lending systems (comparing the 1st and 99th percentile of macroprudential tightening) mitigate the decline induced by a 100 basis point four-quarter cumulated monetary tightening by around 20 p.p. (Models 3-6 in Table 2). These figures imply an around 5 p.p. mitigating effect for a more moderate, 25 basis point tightening. These

[10] We examine economic significance over a wider interval so as to capture sufficient variation in the index, given the high concentration of both our IBRN and iMaPP regulatory indices at zero (Table 1). There are two features of our regulatory indices that contribute to their narrow spread. First, our indices cumulate multiple individual macroprudential tools – as such, our index can show a value of zero simply because one tool tightens while another one eases simultaneously. Second, our indices are measured at a quarterly (rather than annual) frequency, which carries the correspondingly higher probability that in any give quarter a given country may not see a macroprudential action.

estimates are even larger, at around 30 p.p., when we use the IMF iMaPP data (Tables 3 and 4).

The interaction is also economically significant when we consider somewhat smaller percentile differences across macroprudential policies. For instance, our main model estimates show that tighter macroprudential policies in source bank lending systems (i.e. comparing the 5th and 95th percentile of macroprudential tightening) mitigate the lending decline induced by a 100 basis point four-quarter cumulated monetary tightening by around 10 p.p. (based on Table 2 models). This, for example, is the comparison between India (as the 5th percentile) and the Netherlands (as the 95th percentile) in 2014 Q1. In sum, the estimated interactions are not only statistically, but also economically significant.

5.5 Interpretation of policy interaction effects across policy actions

In this subsection, we detail the interpretation of the interaction of monetary and macroprudential policies. Doing so is instructive because there is no established literature or language on how to think about such interaction. We interpret positive interactions in the context of monetary policy effects. As Takats and Temesvary (2016) also show, monetary easing, i.e. lower funding costs, increases cross-border bank lending in that currency. Conversely, monetary tightening reduces lending.

First, consider when both monetary and macroprudential policies ease (Figure 2, Quadrant 1). As both policy variables are negative in this case, the positive interaction coefficient implies a positive effect: easing in both policies interact to raise cross-border lending. Macroprudential easing amplifies the positive effect of monetary easing.

Second, consider when monetary policy easing coincides with macroprudential policy tightening (Quadrant 2). As one policy variable is negative and the other is positive in this case,

the positive interaction coefficient implies lower lending. Macroprudential policy tightening mitigates the effect of monetary policy easing.

Third, consider when monetary tightening coincides with macroprudential policy easing (Quadrant 3). Similar to the previous case, the positive interaction coefficient on one positive and one negative policy variable implies lower lending. Macroprudential policy easing amplifies the negative effect of monetary policy tightening.

Finally, consider the case when both monetary and macroprudential policies tighten (Quadrant 4). The positive interaction coefficient on the two positive policy variables yields an additional increase in cross-border bank lending. Macroprudential policy tightening mitigates the effect of monetary policy tightening.

Pulling these threads together shows that easier macroprudential policy amplifies monetary policy's effect, and tighter macroprudential policy mitigates monetary policy's cross-border lending effect. These findings are consistent with the workings of the international bank lending channel. Macroprudential policy tightening at home might incentivize an internationally active bank to re-allocate liquidity from international to home activities (similar to the logic in Cetorelli and Goldberg (2012)). This in turn might make the bank's international operations less liquid, and thus more reactive to monetary policy changes.

6. Alternative specifications and robustness checks

6.1 Borrowers' country macroprudential tools

For completeness, we also examine the role of macroprudential tools applied in borrowers' countries. For instance, if the currency issuer tightens monetary policy, policymakers in borrowers' countries might want to limit the subsequent contraction in cross-border lending inflows by loosening macroprudential policies in their economies. In Table 5, Columns 1-2, 3-

4 and 5-6 repeat the Model 3-4 specifications from Table 2, 3 and 4, respectively. We do not find consistently significant evidence of interactions between borrowers' country macroprudential policies and the monetary policy of the currency of borrowing.

This suggests that the monetary-borrower macroprudential interaction is insignificant, or at least much weaker than the monetary-source macroprudential interaction. This is in part because the lending impact of borrowers' country macroprudential actions may depend on the type of action implemented: A tightening of macroprudential tools on banks' clients (that is, on the credit demand side) in borrowers' countries can further reduce credit inflows. This would amplify the contractionary lending impact of monetary tightening of the currency issuer. Conversely, a tightening of macroprudential tools on resident lenders (on the credit supply side) in borrowers' countries can lead borrowers to substitute cross-border loans for domestic credit. This would mitigate the impact of monetary tightening on inflows. Therefore, at this stage, we would not interpret our results in such a way as to exclude the possibility of policy interaction on the borrowers' country side.

6.2 Source loan-to value ratio caps

In the next step, we focus on a single macroprudential tool: limits on Loan-to-Value (LTV) ratios. While our initial hypothesis does not concern single tools (and rather focuses on the joint effect of macroprudential tools), the LTV is special for both economic and technical reasons. Economically, the LTV is often perceived to be very effective at constraining demand as it does not have to work through price signals (IMF-FSB-BIS, 2016). Furthermore, Alam et al (2019) show emerging evidence that LTV ratio has a significant lending impact. Technically, the LTV is also directly comparable across the IBRN and IMF iMaPP databases. Insofar as tightening in source LTV limits (a credit demand-side measure) reduces borrowers' credit

demand domestically, such tightening would push source banks' lending "outward" into cross-border lending outflows. Hence, such tightening would mitigate the cross-border lending contraction resulting from monetary tightening by the currency issuer.

In analyzing the LTV ratios, we replicate Equations (3) and (4) for both the short and long sample, and for both the IBRN and IMF iMaPP databases. That is, we replicate columns 3 and 4 of Tables 2, 3 and 4 for the LTV ratio (see Columns 1-2, 3-4 and 5-6 of Table 6, respectively). Consistent with our benchmark results, we find significantly positive interactions throughout. That is, tightening source LTV limits significantly mitigates the cross-border lending-reducing effect of a tighter monetary policy.

6.3 Source FX reserve requirements

Given the significant results on the LTV ratio caps that operate on the credit demand side, we apply our analytic setup on a credit supply-side tool: reserve requirements on banks' FX funds. There is some recent evidence that macroprudential FX regulations impact cross-border lending flows (when enacted on banks in borrowers' countries; Ahnert et al, 2019), and, technically, this tool is also directly comparable across the IBRN and IMF iMaPP databases.

In analyzing the FX reserve requirements, we follow similar steps as in the case of the LTV limits. We again replicate Equations (3) and (4) for both the short and long sample, and for both the IBRN and IMF iMaPP databases. That is, we replicate columns 3 and 4 of Table 2, 3 and 4 focusing on FX reserve requirements as the macroprudential tool of interest (see Columns 1-2, 3-4 and 5-6 of Table A3, respectively). Our results show no significant interaction between monetary policy and *source* lending system FX reserve requirements in driving cross-border lending flows.

Importantly, the results do not imply that source FX reserve requirements would not work as macroprudential tools. They merely suggest that FX reserves requirements do not interact with the monetary policy of the currency issuer in affecting cross border bank loans. These results, when we combine them with those on LTV ratios, might suggest that not all macroprudential policies imposed on source banking systems are equally effective in reducing the lending effects of monetary policy.

6.4 Level of initial macroprudential stringency

As described above, both the IBRN and IMF iMaPP macroprudential databases provide information on *changes* in regulatory stringency over time, but not on the *level of the policy stance*. While focusing on *changes* in regulatory stringency, as we do, is consistent with the approach taken in the literature on the lending impact of policies, a concern remains on potential non-linearity. Thus, the level might be relevant in conjunction with the change for macroprudential policies.

To address this feature, we use the historic macroprudential changes to create a proxy for the level of macroprudential stance by country. We define a new level variable *(Level of Initial Macroprudential Stringency)* as the cumulative sum of regulatory changes in each source banking system from 2000 Q1 to 2012 Q1. We define this *Level of Initial Macroprudential Stringency* both for the IBRN and the IMF iMaPP databases. Naturally, this variable should only be seen as a proxy for the unobserved macroprudential stance and be interpreted cautiously.

To examine the impact of this *Level of Initial Macroprudential Stringency* variable, we horserace its interaction impact with our standard interaction measure (Table A4). More formally, we interact this *Level of Initial Macroprudential Stringency* with our standard change

in *Source Regulatory Stringency* measure and horserace this interaction with the monetary – macroprudential interaction that has been our main focus. The results confirm that the significance of our monetary – macroprudential change interaction results remains generally robust to controlling for cross-sectional differences across countries in the level of macroprudential stringency.

6.5 Common IBRN – IMF iMaPP Sample

We address a potential concern about the implication that the differing cross-section coverage of the IBRN and IMF iMaPP databases may have for our results. While in Section 5.2 we have already estimated our interaction results on the same time series for the two databases, we have not yet addressed the potential impact of cross-section heterogeneity across the two databases.

We re-estimate Equations (3), (4) and (6) from Tables 2 and Table 3, restricting the estimation sample to a common set of observations for each model (Table A5). The significance of the policy interaction term remains highly consistent with our main findings.

We conduct several additional robustness checks. In the interest of space, we do not show the detailed results of the following estimations, but make them available by request.

6.6 Interaction term implied model restriction

The standard estimation technique implies that all four possible interactions have the same sign and size. However, potentially the four possible interactions (as described in Figure 2 and Subsection 5.5) may differ in size, or at least in size. In additional specifications, we allow the interaction effect to vary depending on stance of macroprudential and monetary policies. That is, we separately estimate all four coefficients, i.e. we estimate an interaction coefficient for

each quadrant of Figure 2, and test their statistical equivalence. Doing so, we find that the standard Wald tests cannot reject the null hypothesis that the interaction coefficient estimates across all four cases are equal, or even that they are pairwise equal. This provides further evidence that our interaction model is well specified.

6.7 Endogeneity of macroprudential policies to monetary policy

The main advantage of our identification strategy is that macroprudential policies enacted in source lending systems are almost fully exogenous to the monetary policy of the issuers of the three reserve currencies – thereby avoiding the endogeneity pitfall of studying policy interaction effects in a domestic setting. We further ensure the clarity of our identification strategy by excluding "same country lending" and "own currency lending" from our specifications. However, a potential concern that may remain is the extent to which the macroprudential policies of a reserve currency issuer may be endogenous to the monetary policies of other reserve currency issuers. To address this issue, we exclude completely the US, the euro area and Japan (home regions of the reserve currency issuers). Given the limits imposed by the resultant reduction in the cross-section of our dataset, we focus on the long IMF iMaPP (2012-2016) series (i.e. Table 4). Our findings remain robust to this exclusion.

6.8 Foreign currency (FX)-based macroprudential tools

An interesting question is the extent to which macroprudential tools applied to banks' domestic vs. cross-border lending may operate differently. An intuitive way to address such potential differences is to examine macroprudential tools on FX lending separately – as cross-border lending flows are overwhelmingly denominated in non-domestic currencies in non-reserve currency issuing source lending systems. The IMF iMaPP database provides additional

information on macroprudential tools imposed on FX lending flows – which tend to be credit supply-side measures. We re-estimate our benchmark specifications using the long IMF iMaPP (2012-2016) dataset, i.e. Table 4, using a newly created macroprudential index encompassing only FX-related macroprudential tools. Our benchmark results remain robust to the use of this new FX -focused macroprudential index.

6.9 Additional robustness checks

Our benchmark results are also robust to further changes. First, using the IBRN pre-defined macroprudential index construction which includes minimum capital requirements does not materially affect our main results. Therefore, our exclusion of capital requirements, which allows us to hone in precisely on our focus of macroprudential policies, does not materially affect our quantitative results. Second, we exclude the euro area and, later, emerging market borrowers from our sample to ensure that the results hold in major subsamples as well.

7. Conclusion

We apply a novel identification strategy to a unique and rarely accessed dataset to examine the interactions between monetary policy and macroprudential policy in cross-border bank lending. We find strong evidence that tighter macroprudential policy mitigates the lending effect of monetary policy – whereas easier macroprudential policy amplifies it. The results are also robust and economically significant.

The interaction results are policy relevant. First, they help policymakers assess credit supply changes in those countries where cross-border bank lending plays a major role in credit provision. Consider the example of USD-denominated lending from UK banks to Malaysia. Understanding the policy interactions helps Malaysian authorities gauge the impact on

domestic credit conditions. Second, the results are important for regulators of major international banks in assessing the effect of their macroprudential regulation on lending outflows. In our example, understanding the policy interactions can help UK policymakers assess the impact on USD-denominated lending outflows. Third, the results are also policy relevant from the perspective of major currency issuer countries. In our example, understanding the policy interactions can help US policymakers evaluate potential spillbacks.

Furthermore, the results suggest that there may be meaningful interactions between monetary and macroprudential policies in the domestic setting as well – a strand of research which we hope our results will motivate.

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Table 1: Summary Statistics

	[1] Mean	[2] S.D.	[3] Min	[4] p1	[5] p5	[6] p25	[7] p50	[8] p75	[9] p95	[10] p99	[11] Max	[12] N
Panel A: IBRN Database 2012 Q2 -2014 Q4												
Dependent variable:												
Total Currency-specific Cross-border Lending Flows	1.24	32.98	-86.88	-86.88	-57.61	-10.80	-0.03	12.49	66.54	93.51	93.51	8,155
Regulatory measures:												
Source PruC6 Macropru Stringency	0.06	0.29	-1	-1	0	0	0	0	1	1	1	8,155
Source Loan-to-Value Cap	0.05	0.21	0	0	0	0	0	0	0	1	1	3,518
Source FX Reserve	0.01	0.13	-1	0	0	0	0	0	0	1	1	8,155
Borrower PruC6 Macropru Stringency	0.05	0.26	-1	0	0	0	0	0	1	1	1	8,155
Macro controls:												
Δ Source Policy Interest Rate	-0.02	0.37	-1.25	-0.50	-0.25	-0.10	0	0	0.15	1	5.5	8,155
Source Real GDP Growth	1.57	1.90	-5.96	-2.69	-1.30	0.39	1.61	2.45	5.01	7.06	7.99	8,155
Borrower Real GDP Growth	1.76	2.28	-14.78	-3.75	-1.45	0.31	1.71	2.86	6.03	7.50	7.90	8,155
Δ Source - Borrower Exchange Rate	-0.67	9.37	-33.30	-25.58	-17.28	-4.70	0	3.16	13.72	26.24	67.95	8,155
Panel B: IMF iMapp Database 2012 Q2 - 2014 Q4												
Dependent variable:												
Total Currency-specific Cross-border Lending Flows	1.19	49.84	-103.60	-103.60	-103.60	-18.36	-0.03	18.91	105.00	105.00	105.00	6,304
Regulatory measures:												
Source PruC6 Macropru Stringency	0.00	0.19	-1	-1	0	0	0	0	0	1	1	6,304
Source Loan-to-Value Cap	0.00	0.14	-1	0	0	0	0	0	0	1	1	6,304
Source FX Reserve	0.00	0.06	-1	0	0	0	0	0	0	0	0	6,304
Borrower PruC6 Macropru Stringency	0.02	0.20	-1	0	0	0	0	0	0	1	1	6,304
Macro controls:												
Δ Source Policy Interest Rate	-0.02	0.45	-1.25	-1.00	-0.25	-0.10	0	0	0.15	1	5.5	6,304
Source Real GDP Growth	1.97	1.73	-3.59	-2.02	-0.91	1.11	2.05	2.71	5.08	7.06	7.99	6,304
Borrower Real GDP Growth	1.75	2.23	-14.78	-5.31	-1.45	0.42	1.73	2.82	6.02	7.40	7.90	6,304
Δ Source - Borrower Exchange Rate	-0.23	10.12	-33.30	-25.58	-17.38	-4.98	0	4.22	16.35	27.57	67.95	6,304
Panel C: IMF iMapp Database 2012 Q2 - 2016 Q4												
Dependent variable:												
Total Currency-specific Cross-border Lending Flows	0.34	49.31	-103.60	-103.60	-103.60	-18.97	-0.19	18.63	105.00	105.00	105.00	10,794
Regulatory measures:												
Source PruC6 Macropru Stringency	0.01	0.22	-1	-1	0	0	0	0	0	1	1	9,967
Source Loan-to-Value Cap	0.00	0.14	-1	0	0	0	0	0	0	0	1	9,967
Source FX Reserve	0.00	0.05	-1	0	0	0	0	0	0	0	0	9,967
Borrower PruC6 Macropru Stringency	0.03	0.22	-1	-1	0	0	0	0	0	1	1	9,967
Macro controls:												
Δ Source Policy Interest Rate	-0.03	0.37	-1.25	-0.70	-0.38	-0.05	0	0	0.15	1	5.5	10,794
Source Real GDP Growth	1.93	1.83	-5.40	-2.89	-0.91	1.06	1.94	2.68	5.32	7.60	8.30	9,954
Borrower Real GDP Growth	1.78	2.32	-17.16	-5.40	-1.45	0.57	1.73	2.85	6.15	7.40	7.90	9,891
Δ Source - Borrower Exchange Rate	0.65	11.54	-48.30	-26.31	-17.66	-4.98	0	6.09	20.18	38.92	76.08	9,878

Table 2: Main specifications: Source Macroprudential Stringency - IBRN Database; 2012 Q2 - 2014 Q4

Model	[1]	[2]	[3]	[4]	[5]	[6]
ΣΔ Source Macropru Stringency {t-1 to t-4}	9.939	10.08	5.609	5.787		6
	[4.796]**	[5.069]**	[2.782]**	[6.401]		[5.628]
ΣΔ Shadow Interest Rate {t-1 to t-4}		-3.319	-4.342			
		[2.25]	[2.304*]			
ΣΔ Source Macropru Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}			9.791	10.733	6.755	10.09
			[4.672]**	[5.453]**	[2.310]***	[6.134]*
ΣΔ Borrower Macropru Stringency {t-1 to t-4}						-1.181
						[5.296]
ΣΔ Shadow Interest Rate* ΣΔ Source Macropru Stringency {t-1 to t-4}* ΣΔ Borrower Macropru Stringency {t-1 to t-4}						0.634
						[17.43]
Constant	2.854	1.792	1.579	2.64	1.765	-0.735
	[2.276]	[1.962]	[2.162]	[2.752]	[0.393]***	[1.981]
Source Macro Controls	Yes	Yes	Yes	Yes	n/p	Yes
Borrower Macro Controls	Yes	Yes	Yes	n/p	n/p	Yes
Source Fixed Effects	Yes	Yes	Yes	Yes	--	--
Time Fixed Effects	Yes	Yes	Yes	--	--	--
Borrower Fixed Effects	Yes	Yes	Yes	--	--	--
Currency Fixed Effects	Yes	Yes	Yes	--	--	--
Source * Borrower Fixed Effects	No	No	No	No	No	Yes
Borrower * Time Fixed Effects	No	No	No	Yes	Yes	No
Source * Time Fixed Effects	No	No	No	No	Yes	No
Currency * Time Fixed Effects	No	No	No	Yes	Yes	Yes
R - squared	0.07	0.07	0.06	0.10	0.15	0.07
Number of Observations	8,155	8,155	9,173	9,173	9,173	9,173

Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, originating from a source lending system with easing macroprudential rules (at the 1st percentile of the Source Macropru Stringency index) vs a source banking system with tightening macroprudential rules (at the 99th percentile).

			19.58	21.47	13.51	20.18
			[9.344]**	[10.91]**	[4.620]***	[12.27]*

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system *I* to a borrower country *j,* denominated in one of the three reserve currencies (USD, EUR, JPY). The coefficients shown are cumulative over the preceding four quarters. Source Macropru Stringency is an index of several macroprudential tools enacted at the level of the source banking system (as shown in Table A1) that we construct from the IBRN database over the 2012 Q2 - 2014 Q4 period. Two-way clustered standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 3: Main specifications: Source Macroprudential Stringency - IMF iMapp Database; 2012 Q2 - 2014 Q4

Model	[1]	[2]	[3]	[4]	[5]	[6]
ΣΔ Source Macropru Stringency {t-1 to t-4}	-3.396	-2.586	-13.781	-15.378		-33.45
	[11.43]	[12]	[14.752]	[12.194]		[12.36]***
ΣΔ Shadow Interest Rate {t-1 to t-4}		-15.51	-3.104			
		[9.757]	[5.509]			
ΣΔ Source Macropru Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}			25.2	20.51	-107.485	16.17
			[10.13]**	[8.481]**	[69.491]	[7.896]**
ΣΔ Borrower Macropru Stringency {t-1 to t-4}						-14.96
						[21.2]
ΣΔ Shadow Interest Rate* ΣΔ Source Macropru Stringency {t-1 to t-4}* ΣΔ Borrower Macropru Stringency {t-1 to t-4}						-82.13
						[59.71]
Constant	4.589	-7.883	-6.838	-7.536	1.037	-2.51
	[13.84]	[17.2]	[5.693]	[3.529]	[2.496]	[5.854]
Source Macro Controls	Yes	Yes	Yes	Yes	n/p	Yes
Borrower Macro Controls	Yes	Yes	Yes	n/p	n/p	Yes
Source Fixed Effects	Yes	Yes	Yes	Yes	--	--
Time Fixed Effects	Yes	Yes	Yes	--	--	--
Borrower Fixed Effects	Yes	Yes	Yes	--	--	--
Currency Fixed Effects	Yes	Yes	Yes	--	--	--
Source * Borrower Fixed Effects	No	No	No	No	No	Yes
Borrower * Time Fixed Effects	No	No	No	Yes	Yes	No
Source * Time Fixed Effects	No	No	No	No	Yes	No
Currency * Time Fixed Effects	No	No	No	Yes	Yes	Yes
R - squared	0.08	0.08	0.08	0.13	0.18	0.08
Number of Observations	6,304	5,393	5,440	5,440	5,440	5,393

Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, originating from a source lending system with easing macroprudential rules (at the 1st percentile of the Source Macropru Stringency index) vs a source banking system with tightening macroprudential rules (at the 99th percentile).

			50.4	41.02	-214.97	32.35
			[22.26]**	[16.96]**	[138.98]	[15.79]**

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system *I* to a borrower country *j,* denominated in one of the three reserve currencies (USD, EUR, JPY). The coefficients shown are cumulative over the preceding four quarters. Source Macropru Stringency is an index of several macroprudential tools enacted at the level of the source banking system (as shown in Table A1) that we construct from the IMF iMap database over the 2012 Q2 - 2014 Q4 period. Two-way clustered standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 4: Main specifications: Source Macroprudential Stringency - IMF iMapp Database; 2012 Q2 - 2016 Q4

Model	[1]	[2]	[3]	[4]	[5]	[6]
ΣΔ Source Macropru Stringency {t-1 to t-4}	-9.988	-10.33	-6.176	-4.954		-6.467
	[8.763]	[9.463]	[6.692]	[5.879]		[11.12]
ΣΔ Shadow Interest Rate {t-1 to t-4}		1.916	2.789			
		[5.736]	[7.066]			
ΣΔ Source Macropru Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}			15.253	14.02	-11.601	14.72
			[6]***	[6.10]**	[19.485]	[6.694]**
ΣΔ Borrower Macropru Stringency {t-1 to t-4}						-9.533
						[11.94]
ΣΔ Shadow Interest Rate* ΣΔ Source Macropru Stringency {t-1 to t-4}* ΣΔ Borrower Macropru Stringency {t-1 to t-4}						-28.84
						[29.1]
Constant	11.31	9.94	12.682	-2.65	-3.085	6.386
	[8.583]	[10.26]	[5.805]**	[1.540]*	[1.903]	[3.092]**
Source Macro Controls	Yes	Yes	Yes	Yes	n/p	Yes
Borrower Macro Controls	Yes	Yes	Yes	n/p	n/p	Yes
Source Fixed Effects	Yes	Yes	Yes	Yes	--	--
Time Fixed Effects	Yes	Yes	Yes	--	--	--
Borrower Fixed Effects	Yes	Yes	Yes	--	--	--
Currency Fixed Effects	Yes	Yes	Yes	--	--	--
Source * Borrower Fixed Effects	No	No	No	No	No	Yes
Borrower * Time Fixed Effects	No	No	No	Yes	Yes	No
Source * Time Fixed Effects	No	No	No	No	Yes	No
Currency * Time Fixed Effects	No	No	No	Yes	Yes	Yes
R - squared	0.08	0.08	0.08	0.13	0.18	0.08
Number of Observations	10,794	9,875	10,076	10,076	9,875	9,887

Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, originating from a source lending system with easing macroprudential rules (at the 1st percentile of the Source Macropru Stringency index) vs a source banking system with tightening macroprudential rules (at the 99th percentile).

			30.51	28.04	-23.201	29.44
			[12]***	[12.20]**	[38.97]	[13.39]**

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system *l* t a borrower country *j,* denominated in one of the three reserve currencies (USD, EUR, JPY). The coefficients shown are cumulative over the preceding four quarters. Source Macropru Stringency is an index of several macroprudential tools enacted at the level of the source banking system (as shown in Table A1) that we construct from the IMF iMap database over the 2012 Q2 - 2016 Q4 period. Two-way clustered standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 5: Selected specifications: Borrower Macroprudential Stringency

Model	[1]	[2]	[3]	[4]	[5]	[6]
Database	*IBRN*		*IMF iMap*		*IMF iMap*	
Time period	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2016 Q4*	*2012 Q2 - 2016 Q4*
ΣΔ Borrower Macropru Stringency {t-1 to t-4}	-0.019	-0.578	-15.05	-15.17	-11.07	-10.42
	[2.914]	[5.000]	[14.05]	[13.36]	[11.43]	[11.93]
ΣΔ Shadow Interest Rate {t-1 to t-4}	-3.692		-6.466		2.145	
	[2.610]		[4.315]		[3.567]	
ΣΔ Borrower Macropru Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}	8.326	9.788	-8.77	-9.929	4.36	5.303
	[4.513]*	[6.042]*	[14.51]	[14.80]	[12.30]	[10.67]
Constant	0.21	0.788	-7.372	-2.893	11.26	5.33
	[2.386]	[0.964]	[4.526]	[2.782]	[3.660]***	[1.804]***
Source Macro Controls	Yes	n/p	Yes	n/p	Yes	n/p
Borrower Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Source Fixed Effects	Yes	--	Yes	--	Yes	--
Time Fixed Effects	Yes	--	Yes	--	Yes	--
Borrower Fixed Effects	Yes	Yes	No	Yes	No	Yes
Currency Fixed Effects	Yes	--	Yes	--	Yes	--
Source * Borrower Fixed Effects	No	No	No	No	No	Yes
Borrower * Time Fixed Effects	No	No	No	No	No	No
Source * Time Fixed Effects	No	Yes	No	Yes	No	Yes
Currency * Time Fixed Effects	No	Yes	No	Yes	No	Yes
R - squared	0.06	0.12	0.08	0.12	0.08	0.12
Number of Observations	9,173	9,173	5,440	5,440	10,076	10,089
Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, to borrowers in a Borrower country with easing macroprudential rules (at the 1st percentile of the Borrower Macropru Stringency index) vs a Borrower country with tightening macroprudential rules (at the 99th percentile).						
	24.98	29.36	-17.54	-19.86	8.719	10.61
	[13.54]*	[18.13]*	[29.02]	[29.60]	[24.59]	[21.33]

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system I to a borrower country j, denominated in one of the three reserve currencies (USD, EUR, JPY). The coefficients shown are cumulative over the preceding four quarters. Borrower Macropru Stringency is an index of several macroprudential tools enacted at the level of the Borrower country of borrowers (as shown in Table A1) that we construct from the IBRN database (Models 1-2) and the IMF iMapp database (Models 3-6) over the time period indicated at the top of each column. Models 1-2 replicate the Model 3-4 specifications from Table 2. Models 3-4 replicate the Model 3-4 specifications from Table 3 and Models 5-6 replicate the Model 3-4 specifications from Table 4. Two-way clustered standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 6: Selected specifications: Source Loan-to-Value Cap Stringency

Model	[1]	[2]	[3]	[4]	[5]	[6]
Database	*IBRN*		*IMF iMapp*		*IMF iMapp*	
Time period	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2016 Q4*	*2012 Q2 - 2016 Q4*
ΣΔ Source Loan-to-Value Cap Stringency {t-1 to t-4}	17.16	18.43	-7.698	-14	0.787	-1.2
	[6.405]***	[8.363]**	[11.69]	[9.242]	[18.81]	[19.43]
ΣΔ Shadow Interest Rate {t-1 to t-4}	-1.079		-22.14		-1.389	
	[5.808]		[4.571]***		[2.15]	
ΣΔ Source Loan-to-Value Cap Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}	15.27	16.23	49.56	44.12	33.48	21.77
	[8.548]*	[7.533]**	[12.46]***	[15.56]***	[18.88]*	[26.57]
Constant	6.506	-11.51	-7.055	-7.923	12.33	-3.509
	[5.567]	[2.629]***	[2.13]***	[2.748]***	[1.227]***	[1.368]**
Source Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Macro Controls	Yes	n/p	Yes	n/p	Yes	n/p
Source Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	--	Yes	--	Yes	--
Borrower Fixed Effects	Yes	--	Yes	--	Yes	--
Currency Fixed Effects	Yes	--	Yes	--	Yes	--
Source * Borrower Fixed Effects	No	No	No	No	No	No
Borrower * Time Fixed Effects	No	Yes	No	Yes	No	Yes
Source * Time Fixed Effects	No	No	No	No	No	No
Currency * Time Fixed Effects	No	Yes	No	Yes	No	Yes
R - squared	0.07	0.15	0.08	0.14	0.07	0.13
Number of Observations	3,796	3,785	5,440	5,440	10,076	10,076
Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, originating from a source lending system with easing Loan-to-Value cap rules (at the 1st percentile of the Source Loan-to-Value cap index) vs a source banking system with tightening Loan-to-Value cap rules (at the 99th percentile).						
	15.27	16.23	99.12	88.25	66.97	43.53
	[8.548]*	[7.533]**	[24.93]***	[31.12]***	[37.76]*	[53.14]

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system *I* to a borrower country *j,* denominated in one of the three reserve currencies (USD, EUR, JPY). The coefficients shown are cumulative over the preceding four quarters. Source Loan-to-Value Cap Stringency captures limits imposed on Loan-to-Value ratios at the level of the source banking system (as shown in Table A1) that we construct from the IBRN database (Models 1-2) and the IMF iMapp database (Models 3-6) over the time period indicated at the top of each column. Models 1-2 replicate the Model 3-4 specifications from Table 2. Models 3-4 replicate the Model 3-4 specifications from Table 3 and Models 5-6 replicate the Model 3-4 specifications from Table 4. Two-way clustered standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table A1: Construction of Macroprudential Indices

Panel A: IBRN Macroprudential Subcategories

sscb_res	Change in sector specific capital buffer: Real estate credit. Requires banks to finance a larger fraction of these exposures with capital.
sscb_cons	Change in sector specific capital buffer: Consumer credit Requires banks to finance a larger fraction of these exposures with capital.
sscb_oth	Change in sector specific capital buffer: Other sectors. Requires banks to finance a larger fraction of these exposures with capital.
Concrat	Change in concentration limit. Limits banks' exposures to specific borrowers or sectors.
Ibex	Change in interbank exposure limit. Limits banks exposures to other banks.
ltv_cap	Change in the loan-to-value ratio cap. Limits on loans to residential borrowers.
rr_foreign	Change in reserve requirements on foreign currency-denominated accounts.
rr_local	Change in reserve requirements on local currency-denominated accounts.

Panel B: IMF iMapp Macroprudential Subcategories

CCB	Changes in countercyclical capital buffers based on various private sector credit exposures.
LCG	Changes in limits and penalties on banks' household-sector and corporate-sector credit growth.
LTV	Changes in limits to the loan-to-value ratios, including thosetargeted at housing, automobile and commercial real estate loans.
RR	Changes in ieserve requirements (domestic or foreign currency) for macroprudential purposes.

Table A2: Characterization of the BIS IBS Stage 1 Enhanced Banking Statistics

	Currency composition (A)	Residence of borrower (B)	Nationality of lending bank (C)
Consolidated Data	No	Yes	Yes
Locational Data			
by Residence	Yes	Yes	No
by Nationality	Yes	No	Yes
Stage 1 data	**Yes**	**Yes**	**Yes**

Table A3: Selected specifications: Source FX Reserve Requirement Stringency

Model	[1]	[2]	[3]	[4]	[5]	[6]
Database	*IBRN*		*IMF iMapp*		*IMF iMapp*	
Time period	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2016 Q4*	*2012 Q2 - 2016 Q4*
ΣΔ Source FX Reserve Requirement Stringency {t-1 to t-4}	15.8	14.48	89.34	77.5	141.2	132.5
	[6.254]**	[4.687]***	[64.12]	[58.48]	[19.95]***	[26.85]***
ΣΔ Shadow Interest Rate {t-1 to t-4}	-3.577		-22.13		-4.1	
	[2.551]		[4.07]***		[1.363]***	
ΣΔ Source FX Reserve Requirement Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}	-2.367	1.709	-2.846	10.93	-0.464	37.16
	[3.155]	[5.495]	[48.65]	[46.77]	[44.69]	[42.45]
Constant	0.325	2.022	-7.381	-8.457	10.08	-2.909
	[2.478]	[3.153]	[2.703]***	[3.769]**	[0.593]***	[1.285]**
Source Macro Controls	Yes	n/p	Yes	n/p	Yes	n/p
Borrower Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Source Fixed Effects	Yes	--	Yes	--	Yes	--
Time Fixed Effects	Yes	--	Yes	--	Yes	--
Borrower Fixed Effects	Yes	Yes	No	Yes	No	Yes
Currency Fixed Effects	Yes	--	Yes	--	Yes	--
Source * Borrower Fixed Effects	No	No	No	No	No	Yes
Borrower * Time Fixed Effects	No	No	No	No	No	No
Source * Time Fixed Effects	No	Yes	No	Yes	No	Yes
Currency * Time Fixed Effects	No	Yes	No	Yes	No	Yes
R - squared	0.06	0.10	0.08	0.14	0.08	0.14
Number of Observations	9,173	9,173	5,440	5,440	10,076	10,076
Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, originating from a source lending system with easing FX reserve requirements (at the minimum level of the source FX reserve requirement index) vs a source banking system with tightening FX reserve requirements (at the maximum level).						
	-4.734	3.418	-5.693	21.86	-0.928	74.33
	[6.311]	[10.99]	[97.31]	[93.53]	[89.38]	[84.9]

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system *I* to a borrower country *j,* denominated in one of the three reserve currencies (USD, EUR, JPY). The coefficients shown are cumulative over the preceding four quarters. Source FX Reserve Requirement Stringency captures FX reserve requirements at the level of the source banking system (as shown in Table A1) that we construct from the IBRN database (Models 1-2) and the IMF iMapp database (Models 3-6) over the time period indicated at the top of each column. Models 1-2 replicate the Model 3-4 specifications from Table 2. Models 3-4 replicate the Model 3-4 specifications from Table 3 and Models 5-6 replicate the Model 3-4 specifications from Table 4. Two-way clustered standard errors are shown in parentheses; *** p<0.01, ** p<0.05, *

Table A4: Selected specifications: Role of Initial Macropru Stringency

Model	[1]	[2]	[3]	[4]	[5]	[6]
Database	*IBRN*		*IMF iMapp*		*IMF iMapp*	
Time period	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2014 Q4*	*2012 Q2 - 2016 Q4*	*2012 Q2 - 2016 Q4*
ΣΔ Source Macropru Stringency {t-1 to t-4}	14.37	15.04	-47.04	-41.01	-9.051	-8.552
	[7.95]*	[7.215]**	[39.29]	[39.98]	[10.98]	[10.89]
ΣΔ Shadow Interest Rate {t-1 to t-4}	-4.602		-26.79		-4.198	
	[2.628]*		[6.008]***		[4.629]	
ΣΔ Source Macropru Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}	10.37	11.38	-5.801	-3.611	14.2	13.75
	[6.082]*	[5.556]**	[20.95]	[20.15]	[7.606]*	[7.844]*
ΣΔ Source Macropru Stringency * Level of Initial Macropru Stringency	-1.635	-1.662	7.567	5.808	0.445	0.642
	[1.238]	[1.366]	[9.922]	[10.52]	[2.318]	[2.281]
Constant	0.883	2.587	-5.952	-7.743	11.89	-2.627
	[2.541]	[2.855]	[5.569]	[3.31]**	[6.756]*	[2.868]
Source Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Macro Controls	Yes	n/p	Yes	n/p	Yes	n/p
Source Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	--	Yes	--	Yes	--
Borrower Fixed Effects	Yes	--	Yes	--	Yes	--
Currency Fixed Effects	Yes	--	Yes	--	Yes	--
Source * Borrower Fixed Effects	No	No	No	No	No	No
Borrower * Time Fixed Effects	No	Yes	No	Yes	No	Yes
Source * Time Fixed Effects	No	No	No	No	No	No
Currency * Time Fixed Effects	No	Yes	No	Yes	No	Yes
R - squared	0.06	0.10	0.08	0.14	0.08	0.14
Number of Observations	9,173	9,173	5,440	5,440	10,076	10,076
Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, originating from a source lending system with easing Loan-to-Value cap rules (at the 1st percentile of the Source Loan-to-Value cap index) vs a source banking system with tightening Loan-to-Value cap rules (at the 99th percentile).						
	20.74	22.76	-11.6	-7.223	28.41	27.5
	[12.16]*	[11.11]**	[41.89]	[40.31]	[15.21]*	[15.69]*

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system *I* to a borrower country *j,* denominated in one of the three reserve currencies (USD, EUR, JPY). The coefficients shown are cumulative over the preceding four quarters. Level of Initial Macropru Stringency captures regulatory actions (ΔSource Macropru Stringency) cumulated over the full 2000 2012 period for each source country. Models 1-2 replicate the Model 3-4 specifications from Table 2. Models 3-4 replicate the Model 3-4 specifications from Table 3 and Models 5-6 replicate the Model 3-4 specifications from Table 4. Two-way clustered standard errors are shown in parentheses; *** p<0.01, **

Table A5: Selected specifications: Source Macroprudential Stringency - IBRN and IMF iMapp Common Sample; 2012 Q2 - 2014 Q4

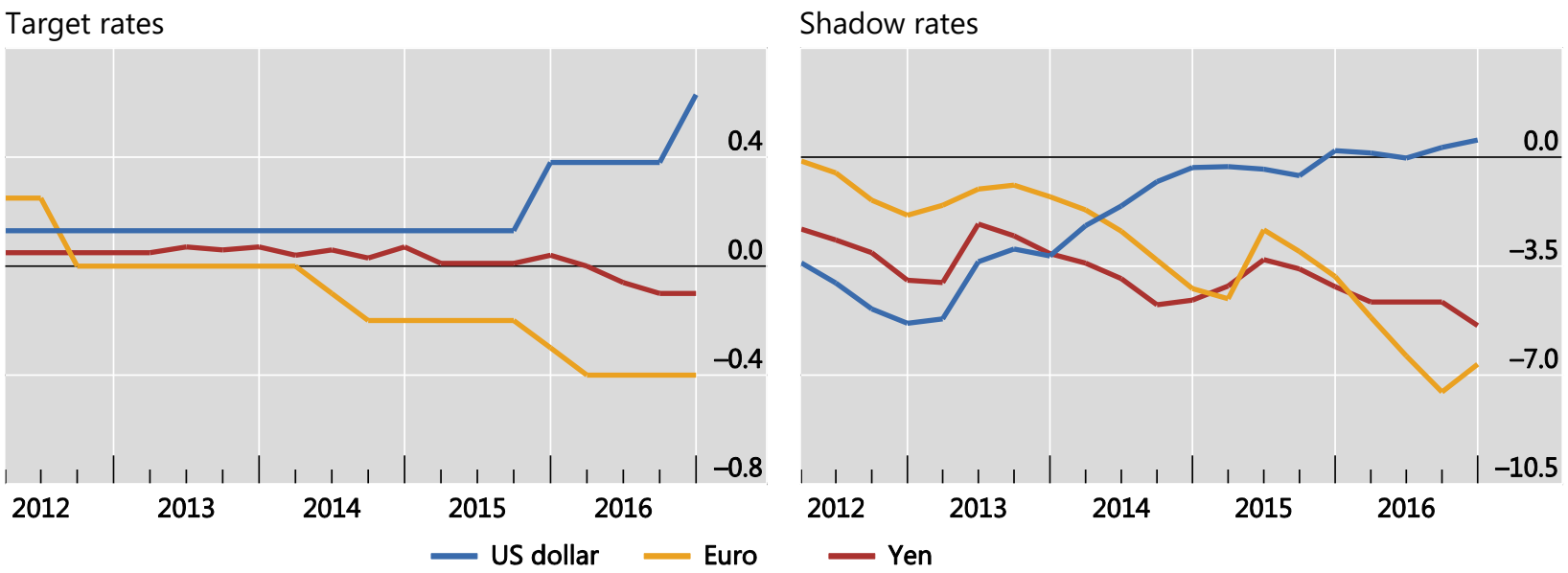
Model	[1]	[2]	[3]	[4]	[5]	[6]
Database		*IBRN*			*IMF iMapp*	
ΣΔ Source Macropru Stringency {t-1 to t-4}	24.25	23.62	23.52	-13.71	-12.19	-36.92
	[7.916]***	[12.86]*	[15.08]	[13.03]	[15.91]	[29.86]
ΣΔ Shadow Interest Rate {t-1 to t-4}	5.686			-25.92		
	[5.854]			[10.61]**		
ΣΔ Source Macropru Stringency * ΣΔ Shadow Interest Rate {t-1 to t-4}	24.78	26.29	26.28	31.66	34.74	7.64
	[7.782]***	[10.73]**	[10.21]***	[12.76]**	[7.471]***	[9.817]
ΣΔ Borrower Macropru Stringency {t-1 to t-4}			-9.557			-25.15
			[9.157]			[20.7]
ΣΔ Shadow Interest Rate* ΣΔ Source Macropru Stringency {t-1 to t-4}* ΣΔ Borrower Macropru Stringency {t-1 to t-4}			17.53			88.11
			[45.67]			[54.88]
Constant	3.23	0.859	-0.504	-7.004	-2.291	-5.423
	[4.571]	[9.275]	[5.175]	[9.666]	[4.015]	[9.676]
Source Macro Controls	Yes	Yes	Yes	Yes	Yes	Yes
Borrower Macro Controls	Yes	n/p	Yes	n/p	Yes	Yes
Source Fixed Effects	Yes	Yes	--	Yes	Yes	--
Time Fixed Effects	Yes	--	--	--	Yes	--
Borrower Fixed Effects	Yes	--	--	--	Yes	--
Currency Fixed Effects	Yes	--	--	--	Yes	--
Source * Borrower Fixed Effects	No	No	Yes	No	No	Yes
Borrower * Time Fixed Effects	No	Yes	No	Yes	No	No
Source * Time Fixed Effects	No	No	No	No	No	No
Currency * Time Fixed Effects	No	Yes	Yes	Yes	No	Yes
R - squared	0.11	0.18	0.11	0.10	0.19	0.12
Number of Observations	2,787	2,784	2,787	2,787	2,784	2,787
Economic significance: Difference (in percentage points) in the impact of a 100 basis point change in the short-term shadow interest rate associated with the currency of lending, originating from a source lending system with easing source macroprudential stringency (at the 1st percentile of the Source Macropru Stringency) vs a source banking system with tightening macroprudential rules (at the 99th percentile).						
	49.56	52.58	52.56	63.33	69.48	15.28
	[15.56]***	[21.46]**	[20.42]***	[25.52]**	[14.94]***	[19.63]

The dependent variable is the quarterly change in the bilateral cross-border lending flows (to both bank and non-bank borrowers) from a source lending system I to a borrower country j, denominated in one of the three reserve currencies (USD, EUR, JPY). This table shows results of estimations on a data sample that was constructed so that each datapoint is present in both the IBRN and IMF iMapp estimations samples (from Tables 2 and 3, respectively). The coefficients shown are cumulative over the preceding four quarters. Borrower Macropru Stringency is an index of several macroprudential tools enacted at the level of the Borrower country of borrowers (as shown in Table A1) that we construct from the IBRN database (Models 1-3) and the IMF iMap database (Models 4-6) over the 2012 Q2 - 2014 Q4 period. Models 1-3 replicate the Model 3-4 and 6 specifications from Table 2. Models 4-6 replicate the Model 3-4 and 6 specifications from Table 3. Two-way clustered standard errors are shown in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Short –term policy and shadow interest rates

In per cent

Figure 1



Sources: Krippner (2016); national data.

Figure 2: Policy interactions			
How do monetary and macroprudential policy interactions impact cross-border bank lending?	Monetary easing (in lending currency)	Monetary tightening (in lending currency)	*Macroprudential policy impact on monetary policy*
Macroprudential easing (in source bank lending system)	**Amplify (positive)** Macroprudential easing strengthens the positive impact of monetary easing	**Amplify (negative)** Macroprudential easing strengthens the negative impact of monetary tightening	**Amplify** Macroprudential easing strengthens the impact of monetary policy
Macroprudential tightening (in source bank lending system)	**Mitigate (negative)** Macroprudential tightening weakens the positive impact of monetary tightening	**Mitigate (positive)** Macroprudential tightening weakens the negative impact of monetary tightening	**Mitigate** Macroprudential tightening weakens the impact of monetary policy