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Abstract

This *Note* examines the factors associated with global banks' cross-border claims on non-bank financial institutions. In line with the substantial growth of non-bank financial intermediation internationally, banks' cross-border claims on non-bank financial institutions have grown rapidly in recent years. As a global hub for non-bank financial intermediation, Ireland hosts a large share of the non-bank financial institutions captured within these international banking data. Our results suggest that tightening (loosening) monetary policy can decrease (increase) cross-border bank claims on non-bank financial institutions at a global level. Moreover, we find that the tightening of borrower-based macroprudential policies is associated with an increase in cross-border bank flows to non-bank financial institutions. Our findings illustrate the potential for cross-border spillovers from changes to monetary and macroprudential policies and the importance of closely monitoring cross-border linkages between banks and non-bank financial institutions. Our findings also highlight the need for developing and operationalising the macroprudential policy framework for non-bank financial intermediation given the potential for spillover effects across the financial system.

1 Introduction

The structure of the global financial system continues to evolve with non-bank financial institutions now accounting for a larger share of the financial sector. The non-bank financial sector internationally has grown substantially since the global financial crisis and now accounts for approximately half of global financial assets (FSB, 2020a). Non-bank financial institutions comprise a wide array of entities with diverse business models including different types of investment funds, special purpose entities, insurance corporations and pension funds.²

Alongside the increased role of the global non-bank financial sector, recent evidence has shown that non-bank financial institutions are increasingly linked with banks with these interconnections often occurring on a cross-border basis (Aldasoro, Huang and Kemp, 2020). For example, banks' cross-border claims on non-bank financial institutions increased by more than 60 per cent since

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² In line with Aldasoro, Huang and Kemp (2020) we use the Bank for International Settlements (BIS) locational banking statistics (by residence) data in this *Note*. Non-bank financial institutions in this *Note* therefore comprise insurance companies and pension funds, finance companies, broker-dealers, special purpose vehicles, money market funds, hedge funds, other investment funds and central counterparties.

2015 and now stand at \$7.5 trillion in the third quarter of 2020 (BIS, 2021). Analysis by Abad et al. (2021) documents how EU banks have significant cross-border exposures to non-bank financial institutions such as investment funds, securitisation vehicles and finance companies, with over 60 per cent of the exposures to entities domiciled outside the EU.

A growing literature has highlighted the vulnerabilities associated with the increased role of non-bank financial institutions within the global financial system and their linkages to banks. Recent studies have highlighted the possibility of spillovers and leakages to the non-bank financial sector arising from macroprudential regulation of the banking sector (Buch et al., 2017; Forbes, 2020; Gebauer and Mazelis 2020; ESRB, 2020b). In a related paper, Claessens et al. (2021) analysed how macroprudential policies applied to banks, and to a lesser extent borrowers, can affect non-bank financial intermediation. They note that a net tightening of macroprudential policies for banks increases non-bank financial intermediation activities. By contrast, they show that a net tightening of macroprudential policies in foreign jurisdictions leads to a reduction in the share of non-bank financial intermediation domestically. Compared to their paper, our analysis focuses on cross-border bank flows to the non-bank financial sector rather than the share of financial sector assets while the sectoral definition of non-bank financial intermediation also differ. For instance, Claessens et al. (2021) focus on the Financial Stability Board's (FSB) narrow measure of non-bank financial intermediation which was previously known as the "shadow banking" measure.³ By contrast, the measure of non-bank financial intermediation in the BIS dataset and employed in this Note is much broader as it also captures insurance corporations and pension funds, broker-dealers and other non-bank financial institutions which may not be captured in the FSB's narrow measure.

Regarding spillovers from monetary policy, the existing literature highlights that monetary policy has been an important determinant of cross-border bank flows in general (Correa et al. 2021). However, the evidence for the period after the global financial crisis during which unconventional monetary policy was more prevalent is less conclusive and there is some evidence that the effects of these policies might differ across banks and NBFIs. For example, Bergant et al. (2020) demonstrate that the effect of unconventional central bank monetary policy can have different effects on the asset holdings of banks compared to other financial institutions, with the latter exhibiting a stronger tendency to rebalance their portfolios away from domestic assets toward foreign substitutes.

Policymakers have pointed to the importance of better monitoring and the need to address potential spillover risks from the linkages between banks and non-bank financial institutions in recent years (Fischer, 2015, Draghi, 2017, Nouy, 2017, Quarles, 2020). As documented in Adrian and Ashcraft (2012), banks can be interconnected with non-bank financial institutions in several ways including through the provision of credit and liquidity lines. Recognising the potential for spillovers between the banking and non-bank financial sectors, a number of post-crisis reforms have aimed to mitigate spillover risks from banks' exposures to non-bank financial institutions (see, for example, EBA, 2015 and BCBS, 2017).

In this Note we contribute to the growing literature by assessing the nature and scale of the linkages between global banks and non-bank financial institutions. Our main contribution is threefold: First, using data from the BIS Locational Banking Statistics, we examine the cross-border claims of global banks' on non-bank financial institutions over recent years and how these have evolved since the onset of the COVID-19 shock in March 2020. We show that claims spiked in the first quarter of

³ As detailed in FSB (2020a), the narrow measure of non-bank financial intermediation comprises a subset of entities within the non-bank financial sector that authorities have assessed as being involved in credit intermediation activities that may pose bank-like financial stability risks (i.e. credit intermediation involving maturity/liquidity transformation, leverage or imperfect credit risk transfer) and/or regulatory arbitrage, according to the methodology and classification guidance used in the FSB's annual monitoring exercise.

2020 (see also Aldasoro, Huang and Kemp, 2020), while the rate of growth has slowed in the following two quarters.

Second, we document the importance of non-bank financial institutions resident in Ireland within the BIS international banking data. As an international financial centre for non-bank financial intermediation (Cima, Killeen and Madouros, 2019), Ireland hosts a large number of different types of non-bank financial institutions. Indeed, according to FSB (2020b) Ireland ranks sixth in the world for the share of non-bank financial intermediation that involves bank-like financial stability risks (the FSB's narrow measure of non-bank financial intermediation). The significant role played by Ireland as a host for cross-border international financial intermediation is also reflected in the BIS international banking data. For instance, by country of domicile of non-bank financial institutions, Ireland ranks fifth globally for the claims of global banks on these types of entities.

Third, we empirically examine the factors associated with global banks' cross-border claims on non-bank financial institutions using data up to the end of 2018. Our analysis suggests that changes to monetary policy and borrower-based macroprudential policies in their country of residence can affect the cross-border claims of banks on non-bank financial institutions. Our results suggest tightening (loosening) monetary policy can decrease (increase) cross-border bank claims on non-bank financial institutions. This finding is related to several studies that point to a search for yield motive for the increasing role of non-bank financial intermediation within the financial system. For example, as noted by IMF (2014), Doyle et al. (2016) and Hodula (2018), investors' search for higher returns in the low interest rate environment has contributed to the growth in the non-bank financial sector internationally. Moreover, we find that the tightening of borrower-based macroprudential policies is associated with an increase in cross-border bank claims on non-bank financial institutions. We do not find a significant effect from changes to lender macroprudential policies on such claims.⁴

The remainder of the *Note* is structured as follows. Section 2 briefly summarises the international evidence on interconnectedness of banks and non-bank financial institutions and the potential for cross-border spillovers. Section 3 describes the BIS data on banks' claims on non-bank financial institutions including how these linkages evolved in recent years including since the onset of the COVID-19 pandemic in March 2020. This section also documents the role of non-bank financial institutions domiciled in Ireland in these data. Section 4 provides empirical evidence on the factors associated with global banks' claims on non-bank financial institutions while Section 5 concludes.

2 Interconnectedness and cross-border spillovers: vulnerabilities and international evidence

The growth of the international non-bank financial sector can support the financing of the real economy but can also pose financial stability risks. Interconnections between entities and sectors can reflect globalisation and increased financial integration that can promote risk sharing across the financial system. However, such linkages might also lead to the potential for cross-border spillovers, from the banking system to the non-bank financial sector and vice versa while in some

⁴ This *Note* relates to a sizeable literature on cross-sectoral and cross-border spillovers and leakages from macroprudential policy by adding a specific focus on spillovers to the non-bank financial sector. See Forbes (2020) for a survey of the literature. McCann and O'Toole (2019) find evidence of cross-border spillovers to the UK from macroprudential limits targeting mortgage lending in Ireland. Relatedly, Acharya et al. (2020) show that Irish banks constrained by macroprudential regulations adjust their portfolio choice, as more-affected banks substitute their risk-taking into holdings of securities and corporate credit. The results for Ireland in these papers are consistent with the international literature on leakages and spillovers from prudential regulation (Aiyar et al. 2014, Forbes et al. 2017).

cases it may also create scope for regulatory arbitrage.⁵ Adrian (2017) notes that regulatory arbitrage may occur where capital, liquidity, taxation or information requirements can potentially be circumvented to make activities more profitable than might otherwise be.

The cross-border connections between banks and non-bank financial institutions have been a focus of macroprudential policymakers since the global financial crisis. As a consequence, the interconnectedness of non-bank financial intermediation now forms a key element of international monitoring exercises. For instance, the FSB annual monitoring report assesses banks' claims on non-bank financial institutions while the European Systemic Risk Board (ESRB) also examines interconnectedness between sectors as a pillar of their monitoring framework (see, for example, FSB, 2020a and ESRB, 2020a). Yet such monitoring efforts are still evolving and, so far, these mapping exercises have been hampered by a lack of consistent and granular data on these interconnections. In a related paper to ours, Aldasoro, Huang and Kemp (2020) use these BIS data and note that the COVID-19 shock in March 2020 again highlighted how such linkages between banks and non-bank financial institutions can lead to the amplification of stress. Therefore, understanding the patterns and drivers of these cross-sectoral and cross-border flows are particularly important to monitoring international spillovers and the build-up of vulnerabilities.

One potential explanation for the increase in non-bank finance is the increased regulation of the banking sector. Post-global financial crisis reforms aimed at improving banking sector resilience may have encouraged the migration of activities to the non-bank financial sector particularly as many non-bank financial institutions are subject to different regulatory requirements and often less intensive supervision than banks. Kashyap, Stein and Hanson (2010) argue that increasing capital requirements and increasingly intrusive supervision could push some of the traditional activities of banks to more loosely regulated sectors. Similarly, Saporta (2018) argues that unintended consequences of bank regulation might not be evident in the banking sector itself, but in other parts of the financial system. It follows that post-crisis bank regulatory reform efforts may have unintentionally increased the motivation for non-bank financial intermediation, as they increased the gap between capital, liquidity and other requirements between banks and other financial institutions. In a related paper, Irani et al. (2020) using data on the US corporate loan market, provide empirical evidence that a tightening of bank capital regulation leads to an increasing role for non-bank financial institutions.

While some non-bank financial institutions may operate outside the perimeter of prudential regulation, they often maintain strong links to regulated parts of the banking and financial sector, such that financial regulation or tax or information requirements can potentially be circumvented to make activities more profitable (Adrian and Ashcraft 2012; Adrian 2017). While progress is being made in the regulation of non-bank finance, these links between non-bank financial institutions and the traditional financial sector mean that they remain a potential source of systemic risk (Adrian and Jones, 2018).

A number of existing papers in the literature document the importance of the non-bank financial sector in the transmission of shocks across borders during the global financial crisis. For instance, Acharya, Schnabl and Suarez (2013) show that regulatory arbitrage was the main motive behind the establishment of securitisation vehicles in the pre-crisis period. Guarantees applied to structured investment vehicles were designed specifically to reduce regulatory capital requirements, and this was more frequently exploited by banks with less capital.

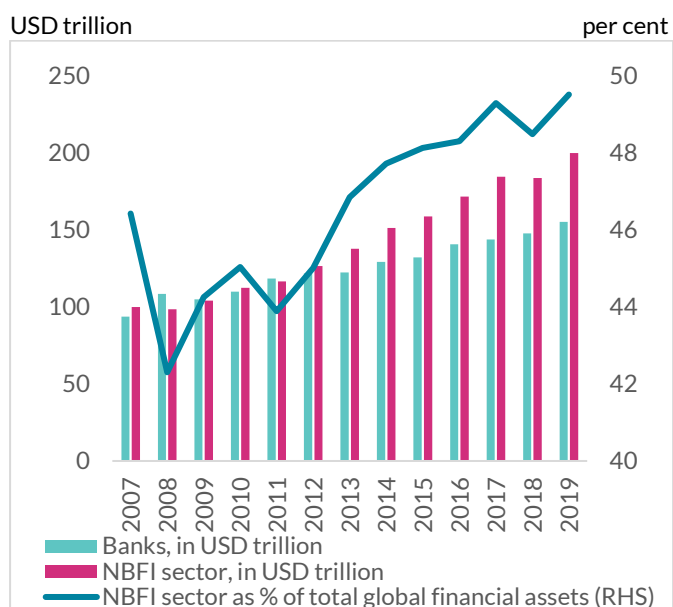
⁵ In order to fully assess the potential for the propagation of shocks between the bank and non-bank financial sectors, detailed data on the assets and liabilities of these entities would be required at a global level as noted by Abad et al. (2021). Such detailed data would allow for an assessment on whether non-bank financial institutions receiving flows from banks in turn invest back in the same countries where those banks are located, as well as the degree of cross-sector and cross-border overlap and concentration in the assets and liabilities of banks and non-bank financial institutions. Given the lack of availability of such granular data at an international level, such an assessment is beyond the scope of this Note.

3 New data on banks' claims on non-bank financial institutions

As highlighting in the growing literature on non-bank finance, understanding the nature and complexity of the linkages between banks and non-bank financial institutions is of increasing importance from a systemic risk perspective. As shown in Figure 1, the non-bank financial sector has grown rapidly in recent years and accounted for almost 50 per cent of the total global financial assets at the end of 2019, according to data compiled by FSB (2020).

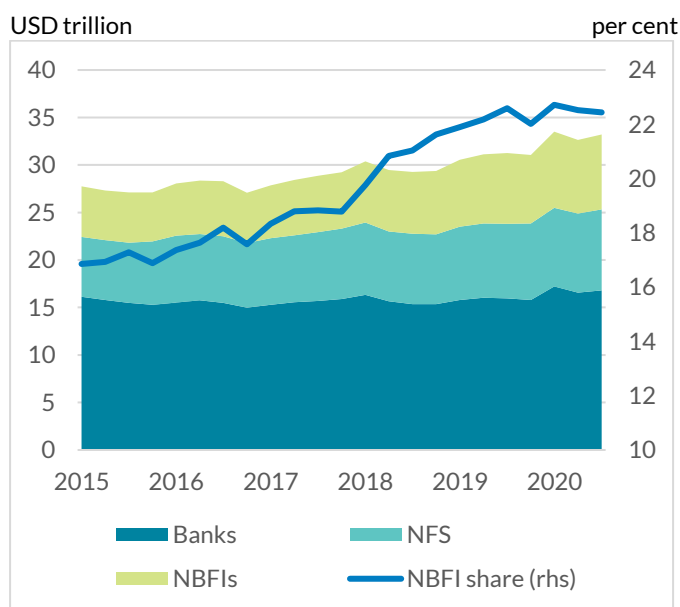
The recently enhanced BIS international banking data provide additional sectoral granularity that can be used to close data gaps and improve systemic risk monitoring at a global level.⁶ Similar to the broad growth in the non-bank financial sector at an international level, these data show that global banks' claims on non-bank financial institutions have also grown rapidly and now account for almost 23 per cent of all cross-border claims (Figure 2).

Figure 1: The share of the non-bank financial sector in total global financial assets has grown (2007-2019)



Source: FSB (2020a) Global Monitoring Report on Non-Bank Financial Intermediation 2020 and authors' calculations.
 Note: The FSB collate these data from jurisdictions' 2020 submissions (national sector balance sheet and other data). The chart refers to data compiled from 21 jurisdictions plus the euro area.

Figure 2: Banks' cross-border claims on non-bank financial institutions have increased substantially (2015 - 2020)



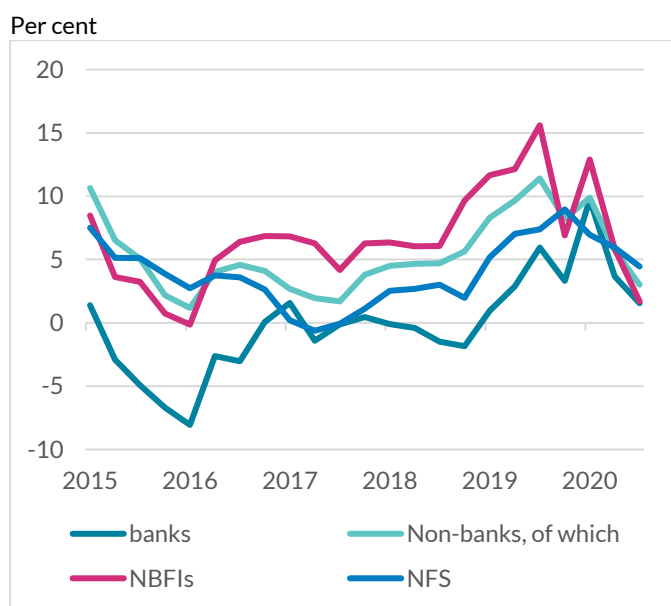
Source: BIS locational banking statistics at end September 2020 and authors' calculations.
 Note: Cross-border claims by counterparty sector in USD trillion. Share of claims on NBFIs in per cent. Based on a varying number of reporting countries in respective quarters. The figure show global banks' cross-border claims to other banks (denoted *Banks*), the non-financial sector (*NFS*), non-bank financial sector (denoted *NBFIs*).

These data show that global cross-border bank claims on non-bank financial institutions have increased in recent years and spiked in the first quarter of 2020 at the onset of the COVID-19 shock. As noted by Aldasoro, Huang and Kemp (2020), this large increase may have been driven by non-bank financial institutions' use of credit lines from banks (Glancy, Gross and Ionescu, 2020). Aldasoro, Huang and Kemp (2020) also note that the financial turmoil induced by COVID-19 shock revealed the vulnerabilities associated with cross-border linkages between banks and non-bank financial institutions. While global cross-border bank claims have remained notably resilient to date, this may also reflect the rapid policy response of the Federal Reserve, ECB and other central banks in providing additional liquidity to the global financial system since the onset of the COVID-19 shock. The benefits of such international policy support can ultimately be extended to the non-bank financial sector and therefore captured in the corresponding part of the BIS international

⁶ See Avdjiev et al. (2015) for details.

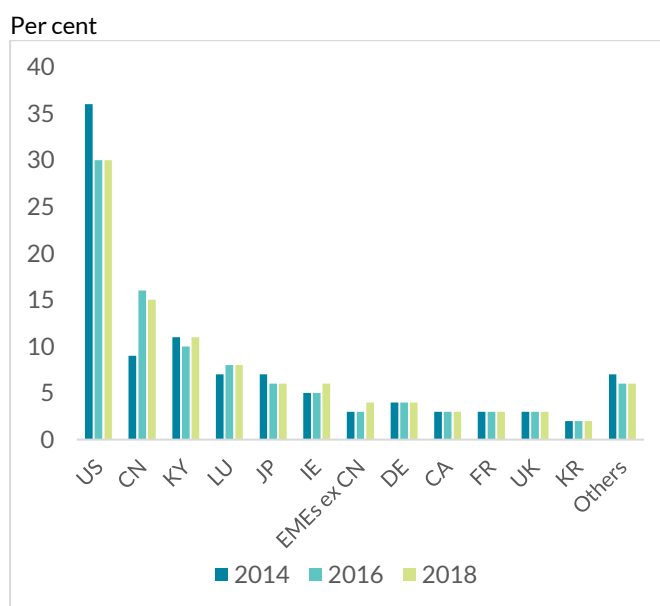
banking data. For example, more recent data show that global cross-border bank claims on non-bank financial institutions continued to grow in the second and third quarters of 2020, but at a much slower pace (Figure 3). The slowdown in growth was also evident in banks' cross-border claims on other banks and on the non-financial sector. In terms of the composition of flows, about 60 per cent of these claims on non-bank financial institutions take the form of loans and deposits.

Figure 3: Annual growth of global cross-border bank claims by sector (2015 Q1 – 2020 Q3)



Source: BIS locational banking statistics at end September 2020 and authors' calculations.
 Note: Growth rates in per cent. NFS denotes non-financial sector. Based on a varying number of reporting countries in respective quarters.

Figure 4: Share of the global narrow measure of non-bank financial intermediation, by jurisdiction (2014-2018)

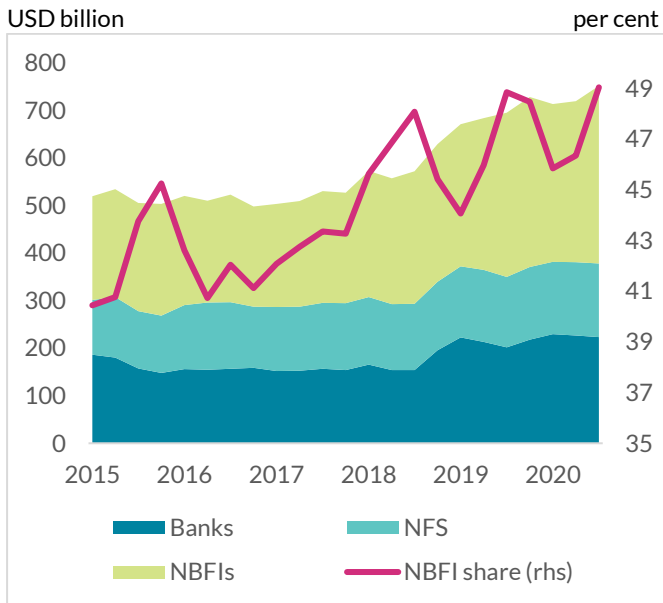


Source: FSB (2020b) Global Monitoring Report on Non-Bank Financial Intermediation 2019 and authors' calculations.
 Note: Shares are expressed in per cent. The FSB collate these data from jurisdictions' 2020 submissions (national sector balance sheet and other data). The chart refers to data compiled from 29 jurisdictions.

The non-bank financial sector resident in Ireland is large by international standards and Ireland is now one of the main global hubs for hosting non-bank financial institutions. As documented in Cima, Killeen and Madouros (2019), the investment fund sector is one of the largest components of the non-bank financial sector in Ireland and has grown rapidly in recent years. The scale of non-bank financial intermediation activities domiciled in Ireland is reflected in the FSB's annual global monitoring exercises on non-bank financial intermediation. As illustrated in Figure 4, Ireland ranks sixth globally for the share of the narrow measure of non-bank financial intermediation (formerly known as the shadow banking measure). While this measure only accounts for a subset of the total non-bank financial sector captured in the BIS international banking statistics, it nevertheless reflects the large role Ireland plays in non-bank financial intermediation globally.

The sizeable linkages between non-bank financial institutions resident in Ireland is also observable in the enhanced BIS international banking statistics. These data show that almost 50 per cent of global cross-border bank claims on counterparties resident in Ireland are on non-bank financial institutions, with the remainder on banks and the non-financial sector (Figure 5). In addition, these data show that Ireland ranks fifth globally for the share of global cross-border bank claims on non-bank financial institutions (by the jurisdiction of the non-bank financial institutions) (Figure 6). Cross-border connections with international banks of non-bank financial institutions resident in Ireland are primarily vis-à-vis banks resident in the EU. These banks have also extended their claims on non-bank financial institutions in Ireland most rapidly since 2014 (Figure 7).

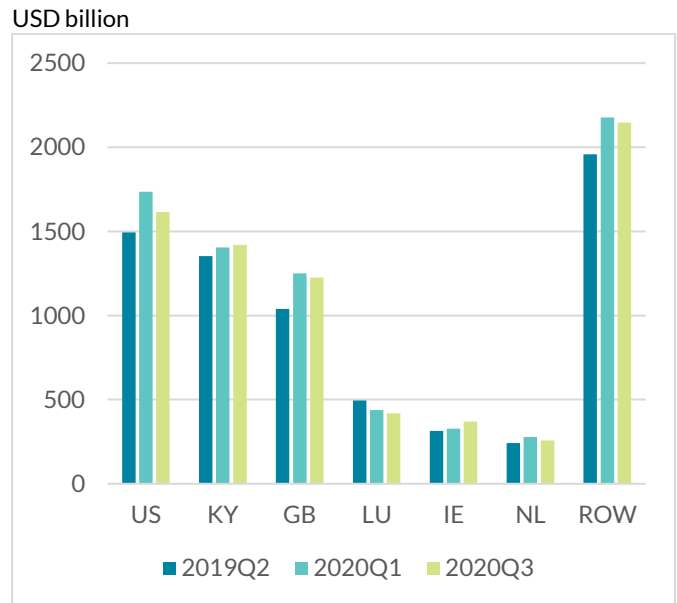
Figure 5: Global cross-border bank claims on non-bank financial institutions domiciled in Ireland (2015 – 2020)



Source: BIS locational banking statistics at end September 2020 and authors' calculations.

Note: Cross-border claims by counterparty sector in USD trillion. Share of claims on NBFIs in per cent. Based on a varying number of reporting countries in respective quarters.

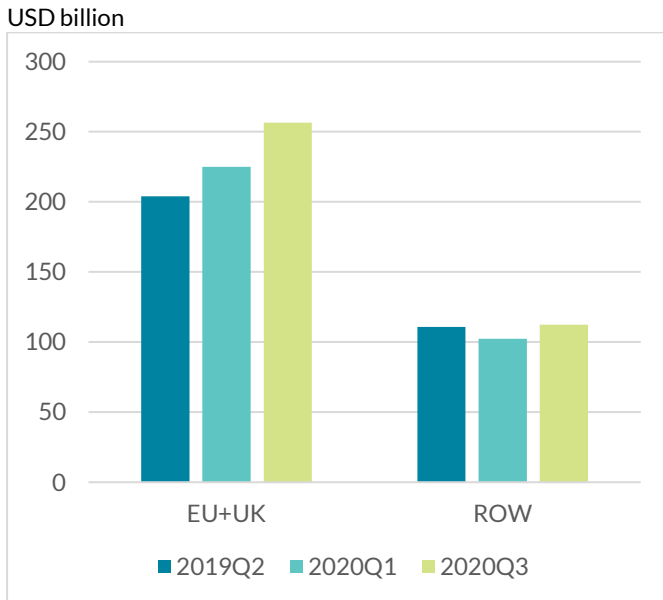
Figure 6: Global cross-border bank claims on non-bank financial institutions, by location of non-bank financial institutions



Source: BIS locational banking statistics at end September 2020 and authors' calculations.

Note: Cross-border claims in USD billion.

Figure 7: Global cross-border bank claims on non-bank financial institutions resident in Ireland, by location of international banks



Source: BIS locational banking statistics at end September 2020 and authors' calculations.

Note: Cross-border claims on NBFIs in Ireland in USD billion.

4 Factors associated with global banks' lending to non-bank financial institutions

Having described the broad patterns in the most recent international banking data from the BIS, this section provides an empirical examination of some of the structural factors associated with global banks' lending to non-bank financial institutions. To do so, we make use of the bilateral nature of the BIS locational banking statistics in a regression analysis based on a sample of 20 reporting (source) countries reporting positions vis-à-vis non-bank financial institutions resident in up to 59 counterparty (host) countries between 2014Q1 and 2018Q4.

The two key explanatory variables of interest are: (i) changes in macroprudential policies for banks; and (ii) changes in monetary policy. In particular, we test if lending to non-bank financial institutions in a certain country increased more from banking systems that tightened macroprudential and/or monetary policy compared to lending from those banking systems that did not tighten policies (Khwaja and Mian, 2008; Cetorelli and Goldberg, 2011). This allows us to control for non-bank financial institutions' demand for loans from global banks so that, together with controls for other confounding factors like macroeconomic developments and bilateral trade, we can better identify the effect of the policies of interest.⁷

To measure changes in the macroprudential policy framework in the country of residence of the banks' lending cross-border to non-bank financial institutions we construct a macroprudential policy index based on data from Alam et al. (2019). While such a measure cannot account for the intensity of the changes in the policy stance, it should accurately capture the direction of a macroprudential policy measure, i.e. whether policy is tightened, loosened or remains unchanged in a given quarter. We split the index into measures aimed at borrowers and lenders to account for the differential impact of the respective policies documented in the literature (e.g. Buch et al., 2017; Emter et al., 2019, Everett et al. 2021).⁸ The expected sign on the aggregate MPPI index is ambiguous because it contains a variety of measures that are expected to have offsetting effects. Increased borrower-oriented measures in the country of residence of international banks may be associated with higher cross-border bank claims on non-bank financial institutions as the constraints imposed by macroprudential regulations on domestic activities may drive banks to seek alternative sources of profitable lending opportunities. As higher values of the macroprudential indices denote tightening of macroprudential policies, we expect a positive coefficient on the borrower-oriented measures variable. Overall, we expect the sign of the tightening of lender-oriented measures in the source country to be negative as most of these measures, such as basic capital requirements or other capital buffers, are expected to – everything else constant – reduce the return on equity from extending credit generally, which may also feed into lower cross-border bank claims on non-bank financial institutions.

Changes in monetary policy are measured by data on policy rates from Datastream supplemented with the Krippner (2016) data on shadow rates. The advantage of using shadow rates is that they capture changes in monetary policy through unconventional (e.g. quantitative easing, forward guidance, etc.), as well as conventional monetary policy tools (e.g. changes to interest rates) (Forbes and Warnock, 2020). We expect more accommodative monetary policy to be associated with larger

⁷ See Appendix for details on the econometric specification.

⁸ The measure of net macroprudential policy tightening is equal to one if, in a given quarter, the sum of changes in the individual instruments is larger than one. Borrower based measures include limits on loan to value (LTV) and debt service to income (DSTI) ratios. Measures aimed at lenders include limits on leverage, loan loss provision and liquidity requirements, limits on growth and other loan restrictions, as well as loan-to-deposit ratios, limits on foreign currency lending and on net or gross open foreign exchange positions, as well as taxes and levies applied to specified transactions, and Reserve requirements (domestic or foreign currency) for macroprudential purposes. Moreover, the measure includes information on tightening of capital requirements such as capital and liquidity surcharges for global and domestic systemically important financial institutions (SIFIs), as well as changes to countercyclical capital and capital conservation buffers.

cross-border bank claims on non-bank financial institutions as some of the increase in the liquidity available to banks through such monetary accommodation can potentially be lent on to the non-bank financial sector.

The results of the regression analysis suggest that more accommodative monetary policy is statistically significantly associated with an increase in the claims of banks on non-bank financial institutions. This sign is consistent with the findings of related papers examining cross-border bank claims more generally (Takats and Temesvary 2019, 2020). These papers find the greater availability of liquidity associated with looser monetary policy leads to increased cross-border lending.

Turning to macroprudential policies, the results suggest that the tightening of *borrower-oriented* macroprudential policy measures may incentivise banks to lend to the non-bank financial sector on a cross-border basis.⁹ This finding is consistent with concerns that the increasing tightening of domestic borrower-oriented macroprudential measures could have cross-border spillovers and result in leakages to the non-bank financial sector.¹⁰ Such leakages may occur as banks seek alternative profitable lending opportunities in less tightly regulated countries or sectors.¹¹

5 Conclusion

Linkages between banks and non-bank financial institutions have grown substantially in recent years and now represent an important potential transmission channel for the propagation of shocks across borders and sectors. The spillovers of risk from the banking sector was evident in the 2008 global financial crisis while the COVID-19 shock again illustrated the importance of better surveillance of the key nodes and channels of risk within the financial system. The monitoring of such linkages to date from a financial stability perspective have been hampered by a lack of granular and timely data.

In this Note, we highlight the importance of recent advances in international banking data produced by the BIS for tracking cross-border claims of global banks on non-bank financial institutions. Drawing on these data, we show that the claims of global banks have increased in recent years and spiked at the onset of the COVID-19 shock in March 2020. Since then, the cross-border claims of global banks on non-bank financial institutions have continued to grow, albeit at a slower pace. We have also highlighted the role of Ireland as a global hub for the hosting of non-bank financial institutions. In particular, the BIS international banking data reflect the substantial claims of global banks on non-bank financial institutions domiciled in Ireland. This illustrates the exposure of the

⁹ The results for lender-oriented macroprudential policy measures are not found to be statistically significant. Yet this indicator aggregates a wide variety of measures with potentially offsetting effects. The results of preliminary analysis, introducing disaggregated lender-oriented measures as separate explanatory variables, suggest that some lender-oriented policies may also have cross-border spillover effects. Notably, variables relating to bank-capital ratios are found to have a negative and statistically significant coefficient, indicating that the introduction of such measures could be associated with a reduction in cross-border bank claims on NBFIs. This is consistent with the findings of Forbes et al. (2017) for cross-border bank lending more generally. The robustness of these findings could be further tested in future analysis when a greater number of observations become available.

¹⁰ It is also broadly consistent with the findings of the meta-analysis the spillovers of prudential policies in cross-border bank lending to other banks of Buch et al. (2017). This suggests that the LTV caps are among those measures that are often found to have significant cross-border spillovers from the home country of global banks to bank loans in host countries. At the same time, our findings could be interpreted as being contrary to those of Claessens et al. (2021), which suggest that tightening macroprudential policies in foreign jurisdictions lead to a reduction in the share of NBFi assets in total financial assets.

¹¹ Our results are robust to the inclusion of additional banking sector controls, as shown in Table 1 (column 3) in the Appendix, as well as controlling for changes in claims vis-à-vis all counterparty sectors or banks and including country-pair fixed effects or a common trend (not reported).

Irish domiciled non-bank financial sector to developments in the global financial system, in particular the international banking sector.

We also empirically examine the factors associated with global banks' cross-border claims on non-bank financial institutions. Our results point to the importance of changes in both monetary policy and borrower-based macroprudential policies that can influence the cross-border claims of global banks on non-bank financial institutions. We do not observe a significant impact of changes to lender based macroprudential policies on banks' cross-border claims to non-bank financial institutions.

From a policy perspective, our analysis highlights the importance of granular and timely data on cross-sector and cross-border linkages to assess the potential build-up of vulnerabilities within the financial system. The results also emphasise the importance of taking a holistic view of the impact of policy changes on both the banking and non-bank financial sectors when developing and operationalising macroprudential policy for both segments of the financial system. In particular, our analysis illustrates the potential for cross-border spillovers arising from policy decisions, including changes to macroprudential policy. Given the potential for such cross-border spillovers, further consideration should be given to developing and operationalising the macroprudential policy framework for non-bank financial intermediation as noted by, amongst others, Draghi (2017, 2019), Makhoul (2020) and Donnery (2021).

Looking ahead, the empirical analysis presented in this *Note* can be extended once international macroprudential policy and monetary policy databases have been updated to capture policy changes made from 2018-2020. Moreover, a better understanding of the effects of macroprudential policy on cross-border lending could be gained by enhanced measures capturing the intensity of policy measures. These data updates and enhancements could, in particular, allow for an examination of the impact of monetary and macroprudential policy changes since the onset of COVID-19 shock and their contribution, if any, to the sharp increase of banks' cross-border claims on non-bank financial institutions in the first quarter of 2020. Empirical evidence from this period can also usefully inform any assessment of policy decisions made in response to the COVID-19 shock. Moreover, the availability of more granular data at an international level on banks' and non-bank financial institutions' assets and liabilities would also allow for a more detailed assessment of their degree of overlap and concentration and the potential for the propagation of shocks across sectors in times of stress. In particular, more granular data on the types of non-bank financial institutions would allow for a deeper assessment of these linkages given the diverse range of entities within the non-bank financial sector.

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Appendix

The empirical specification underlying the results discussed in Section 4 is expressed by the following equation:

$$\Delta XB_{ijt} = \alpha + \beta \Delta MP_{it-1} + \gamma \Delta MPPI_{it-1} + \rho X_{it-1} + \mu B_{ijt-1} + \delta \Delta XB_{ijt-1} + \rho_i + \vartheta_{jt} + \epsilon_{ijt}$$

where ΔXB_{ijt} are changes in logs of cross-border assets of banks located in country i on the non-bank financial sector in country j in quarter t . We adjust bilateral stocks reported by the BIS for valuation effects due to exchange rate variations by backward adjustment, i.e. we subtract FX-adjusted flows from the latest reported stocks (see Emter et al. (2019)). As is common in the literature on cross-border banking, all explanatory variables are lagged by one quarter and a lagged value of the dependent variable is included to account for persistence in lending flows (Kashyap and Stein, 2000; Cetorelli and Goldberg, 2011; Takats and Temesvary, 2019).¹²

$MPPI_{it}$ is a macroprudential policy index based on data from Alam et al. (2019). The database by these authors provides dummy-type indices of tightening and loosening actions for 17 macroprudential policy instruments. I.e. the measure is 1 for tightening actions in a given month and -1 for loosening actions (and 0 for no change). Changes in the monetary policy stance (ΔMP_{it-1}) are measured by data on policy rates from Datastream supplemented with the Krippner (2016) shadow rates.

The effect of monetary and macroprudential policy on cross-border lending can be identified using a Khwaja and Mian (2008) identification strategy which was first applied to aggregate cross-border lending data by Cetorelli and Goldberg (2011).¹³ Hence, we include time varying host-country fixed effects ϑ_{jt} to absorb any demand-driven changes in cross-border lending. In addition, we control for a wide array of potentially confounding factors. Source country time-varying characteristics included in vector X_{it} are: growth in GDP and lending to the domestic non-financial sector, as well as banking sector controls (NPL ratio, return on equity, regulatory capital to risk weighted assets from the IMF Financial Soundness Indicators).¹⁴ B_{ijt} includes bilateral determinants of cross-border bank lending that are time varying (trade). Macroeconomic variables are from the IMF International Financial Statistics and Eurostat, while changes in bilateral trade is sourced from the IMF DOTS. To account for the possibility that flows of banks are driven by time-invariant source country-specific unobservable factors, source country fixed effects, ρ_i are included. Finally, ϵ_{it} is the error term and standard errors are clustered at the source and host country level in all regressions.¹⁵

¹² To limit the influence of potential outliers and noise from very small bilateral claims we winsorise the observations at the 5th and 95th percentile and exclude country pairs with less than 100 million USD in bilateral claims throughout the sample period. We also exclude countries which do not report the bilateral breakdown of cross-border claims of non-bank financial institutions before 2015. The resulting sample of 20 reporting countries (reporting positions vis-à-vis up to 59 counterparty countries) includes Belgium, Canada, Denmark, Finland, France, Greece, Hong Kong, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, Portugal, South Africa, Sweden, Switzerland, Turkey, United Kingdom, and the United States.

¹³ See Takats and Temesvary (2019, 2020).

¹⁴ For banking sector controls changes in annual figures are linearly interpolated to quarterly frequency.

¹⁵ Results are robust to clustering standard errors at the country-pair level.

Table 1: Estimates from Regressions

VARIABLES	(1)	(2)	(3)
Monetary policy	-0.027*** (0.008)	-0.026*** (0.008)	-0.022* (0.011)
MPI	0.007 (0.005)		
MPI lender		0.008 (0.013)	0.013 (0.013)
MPI borrower		0.035*** (0.007)	0.032*** (0.007)
Observations	7,063	7,063	5,964
R-squared	0.20	0.21	0.22
Time period	'14q1-'18q4	'14q1-'18q4	'14q1-'18q4
Macro controls	yes	yes	yes
Bilateral controls	yes	yes	yes
Banking sector controls	no	no	yes
Source country FE	yes	yes	yes
Host country-time FE	yes	yes	yes

The dependent variable is the quarterly change in the bilateral cross-border lending flows to non-bank financial borrowers from a source lending system i to a borrower country j . Robust standard errors (two-way clustered at the source and host country level) in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

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