NBER WORKING PAPER SERIES

STRESS RELIEF?:
FUNDING STRUCTURES AND RESILIENCE TO THE COVID SHOCK

Kristin Forbes
Christian Friedrich
Dennis Reinhardt

Working Paper 31255
http://www.nber.org/papers/w31255

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2023

Paper prepared for the Carnegie-Rochester-NYU Conference Series on Public Policy, for the Nov 11-12, 2022 event on "Economic Resilience and Interconnectedness" at the Tepper School of Business, Carnegie Mellon University. Any views expressed are solely those of the author(s) and so cannot be taken to represent those of the Bank of England, nor the National Bureau of Economic Research, nor the Bank of Canada, nor to state Bank of England policy. This paper should therefore not be reported as representing the views of the Bank of England or members of the Monetary Policy Committee, Financial Policy Committee or Prudential Regulation Committee.

Stress Relief?: Funding Structures and Resilience to the Covid Shock
Kristin Forbes, Christian Friedrich, and Dennis Reinhardt
NBER Working Paper No. 31255
May 2023
JEL No. E44,E65,F31,F36,F42,G18,G23,G38

ABSTRACT

This paper explores the relationship between different funding structures—including the source, instrument, currency, and counterparty location of funding—and the extent of financial stress experienced in different countries and sectors during the sharp risk-off shock in early 2020 when Covid-19 spread globally. We measure financial stress using a new dataset on changes in credit default swap spreads for sovereigns, banks, and corporates. Then we use country-sector and country-sector-time panels to assess how different funding structures are related to financial stress. A higher share of funding from non-bank financial institutions (NBFIs) or in US dollars was correlated with significantly greater stress, while a higher share of funding in debt instruments (instead of loans) or cross-border (instead of domestically) was not significantly related to financial stress. The results suggest that macroprudential regulations should broaden their current focus to take into account exposures to NBFI and dollar funding, with less priority for regulations focused on residency (i.e., capital controls). After the sharp increase in financial stress in early 2020, policy responses targeting these structural vulnerabilities (i.e., US$ swap lines and focused on NBFIs) were more effective at mitigating stress related to these funding structures than policies supporting banks, even after controlling for macroeconomic policy responses.

Kristin Forbes
MIT Sloan School of Management
100 Main Street, E62-416
Cambridge, MA 02142
and CEPR
and also NBER
kjforbes@mit.edu

Dennis Reinhardt
Bank of England
Threadneedle Street
London
EC2R 8AH
United Kingdom
dennis.reinhardt@bankofengland.co.uk

Christian Friedrich
Bank of Canada
234 Laurier Avenue West
Ottawa, Ontario, K1AOG9
Canada
cfriedrich@bankofcanada.ca

I. Introduction

As Covid-19 evolved into a global pandemic in March 2020, central banks intervened with unprecedented policy packages to stabilize financial markets and provide liquidity (English, Forbes, and Ubide, 2021). This intervention was disheartening for policymakers who had hoped that the widespread financial and regulatory reforms over the past decade had strengthened the resilience of financial systems so that they would not need another "once in a lifetime" support package just twelve years after the 2008/9 Global Financial Crisis. On a more positive note, the reforms appeared to have been successful at bolstering the resilience of banking systems to this extreme risk-off shock. But did the reforms simply shift risky exposures from banks to non-bank financial institutions (also referred to as "shadow banks") and other less regulated sectors of the economy?[1] Or even if risky exposures declined in aggregate, did changes in financial intermediation increase vulnerabilities in unexpected ways?

We address these questions by assessing what funding structures were most vulnerable during the period of acute financial stress in 2020. We focus on banks and corporates and evaluate the importance of: the source of funding (from households, banks or non-bank financial institutions), the instrument of funding (loans versus debt markets), the currency of funding (US dollar versus other currencies) and the geographical location of the counterparty (domestic or cross-border). Our results suggest that some funding structures were associated with a significant increase in sensitivity to the extreme risk-off shock in early 2020: namely dependence on non-bank financial institutions (henceforth: NBFIs) and US dollars (henceforth: US$). More specifically, banks which were more reliant on funding from NBFIs experienced significantly more stress, and those more reliant on funding from household deposits experienced significantly less stress. Banks, and in some specifications corporates, were also significantly more vulnerable if they relied more on US$ funding. In contrast, whether funding in either sector was obtained via loans (instead of debt markets), or cross-border (instead of domestically), was not significantly related to resilience during March 2020. After financial stress spiked, policy responses targeting these specific vulnerabilities (i.e., NBFI-focused policies and US$ swap lines) were successful at significantly mitigating the increase in credit default swap (CDS) spreads, even after controlling for macroeconomic policies supporting the broader economy. In contrast, policies that eased banking regulations more generally did not significantly reduce stress related to these vulnerabilities.

This paper makes several contributions to the rapidly growing literature evaluating financial vulnerabilities during Covid (e.g., Falato, Goldstein, and Hortaçsu, 2020; Acharya, Engle, and Steffen, 2021; Aramonte, Schrimpf, and Shin, 2022) and evaluating the success of macroprudential reforms to date (Forbes, 2021; Chari, Dilts-Stedman, and Forbes, 2022). First, it uses data on corporates, banks and sovereigns to better capture the relationships between financial stress and funding structures not just across countries—but also across these different sectors within a country.[2] This is a broader focus than most other work, which tends to focus on just one sector, and is important as macroprudential reforms may have bolstered certain segments of the economy (such as banks), but simultaneously increased the

[1] While the term "shadow banking" was commonly used after the 2007/8 Global Financial Crisis, it is increasingly replaced by "non-bank financial institutions" or "non-bank financial intermediation." The latter terms highlight that this includes intermediation through bank-like institutions as well as market-based forms. See Section II.A.

[2] Note that we use the term "sectors" to differentiate between the banking, the corporate and the sovereign sector, and not based on industrial classifications, such as SIC or NAICS codes.

vulnerability of other sectors. Second, the paper focuses on high frequency data on CDS spreads by sector. This involved a substantial data compilation effort, but is useful to capture short-lived periods of financial stress, including stress for different reasons (from liquidity issues to solvency concerns) as well as across countries and sectors.[3] Third, we simultaneously focus on a broader set of vulnerabilities than covered by other work. This includes not only shifts in the sources of financial intermediation (such as through NBFIs), but also the extent of internationalization (through currency or cross-border exposures) and the instrument of funding (such as through loans versus debt markets). Although some of these characteristics are highly correlated, identifying exactly which aspects of funding are more closely correlated with resilience is important. Fourth, we focus on the extreme risk-off period in March 2020 as this is the first opportunity to evaluate how the widespread macroprudential reforms and corresponding changes in funding structures over the previous decade affected the resilience of financial systems. Finally, this episode also allows us to evaluate the effectiveness of different responses to a severe risk-off event in the post-2008 financial system. This has important implications for whether more targeted policies that focus on specific vulnerabilities could be an important complement to (or even substitute for) the broader policies that have recently been key components of the response to negative shocks (such as changes in interest rates, asset purchases and reductions in macroprudential buffers).

This paper begins with a brief review of the large and long-standing literature on the vulnerabilities from different forms of financial intermediation that are the focus of the empirical analysis. This includes vulnerabilities associated with: banking intermediation, non-bank financial intermediation, foreign exchange exposure, and cross-border borrowing. The review also highlights recent papers on the period of the heightened market volatility and financial stress during the early stages of the pandemic.

Then the paper introduces the key measure of financial stress used throughout the analysis: a measure calculated at a daily frequency and by sector and country. This measure is constructed from a newly created database with information on 2,532 CDS series, covering 68 countries with information for three sectors: sovereigns, banks and corporates. This high-frequency, cross-sector-country measure allows us to use two different empirical frameworks for the main analysis: a *country-sector* panel that controls for country and sector fixed effects, and a *country-sector-time* panel that also incorporates the time-series dimension. We use this data to calculate measures of financial stress during the *Covid Shock,* which we define in our baseline as the log change in CDS from January 1 of 2020 until March 23 (when most measures of stress peaked and before the numerous policy measures were announced).[4] An initial comparison of these CDS series shows that the CDS for banks increased less than for corporates and sovereigns during the *Covid Shock*, consistent with arguments that macroprudential reforms over the last decade meaningfully improved the resilience of banking systems. There is also substantial variation in these changes in CDS spreads across countries and sectors, however, particularly across banking sectors.

Are these differences in resilience related to different funding structures? In order to explore any relationships, the paper then builds on prior literature and empirical evidence to develop a framework that decomposes funding into key components that could affect the extent of financial stress experienced in different sectors and countries during the *Covid Shock*. It focuses on two forms of financial

[3] See Berndt et al. (2018) for a discussion of the advantages and disadvantages of using CDS to measure credit risk, and Eisfeldt, Herskovic, Rajan and Siriwardane (2022) for a discussion on pricing sensitivity in OTC markets.

[4] This approach is similar to in Acharya et al. (2021), which examines banks' daily excess stock returns during the same period to assess the role of balance sheet liquidity risk, including credit line commitments.

intermediation: the source of funding (household deposits, other banks, or NBFIs) and the instrument of funding (loans or "other" instruments, which are primarily debt markets).[5] It also focuses on two forms of financial *internationalization*: the currency (either US$ or local currency) and the counterparty location (either cross-border or domestic). This discussion includes information on the diverse datasets on these funding structures, relying heavily on several sources from the BIS. An initial look at how this data on funding structures correlates to measures of sector-country stress generally supports previous literature.

Next, this paper shifts to the main focus—regression analysis of the relationship between financial stress during the *Covid Shock* and pre-pandemic funding structures.[6] We use two empirical methodologies: one which focuses on the relative resilience of different sectors within countries over the full period of the *Covid Shock* (the *country-sector* approach), and one which focuses on daily changes in financial stress within each country-sector pair (the *country-sector-time* approach). We examine the role of different forms of financial *intermediation* and *internationalization*, both individually and simultaneously. Several patterns occur consistently across specifications. Banks with a higher share of funding from NBFIs were less resilient during the *Covid Shock*, and those that were more reliant on funding from household deposits were significantly more resilient. Banks—and in some specification corporates—with a higher share of funding in US$ were also significantly less resilient. In contrast, there is only weak evidence on whether funding through loans (instead of debt markets) was correlated with greater resilience, and no consistent evidence on whether obtaining funding domestically (instead of cross-border) was related to resilience. These findings are fairly consistent across specifications, including for a series of sensitivity tests that contain different control variables (including for asset exposures), exclude emerging markets, and adjust the timing of the window defined as the *Covid Shock*.

By the end of April 2020, however, the financial stress experienced in some sectors and related to certain funding structures fell significantly. Why did banks with greater exposure to NBFI and US$ funding no longer experience significantly greater stress—with no comparable improvement for corporates with similar vulnerabilities? How important were policies targeting vulnerabilities around NBFI and dollar funding relative to broader policies aimed at banks or easing financial conditions? To answer these questions, we then test how different policy responses in March and April of 2020 affected the stress related to certain funding structures. In other words, after the risk-off shock, which policies were most effective at reducing the stresses highlighted earlier in the paper? Identifying the impact of different policies during this period is challenging, however, as countries enacted multiple policies around the same time to address a range of concerns around market liquidity and other aspects of market functioning, as well as to support growth, incomes and employment and slow the spread of the virus. The *country-sector* framework used in this paper can help solve this identification challenge by isolating the differential impact on specific structures across sectors within each country. The daily data used in the *country-sector-time* framework also allows us to identify the immediate impact of key policy announcements. Put slightly differently, our approach allows us to better test exactly which policies reduced stress related to specific structures and which policies "broke the link" between higher global volatility and country-sector stress.

[5] Our main analysis evaluates bank exposure to household deposits, while sensitivity tests (in Section V.C) also incorporate bank exposure to corporates (including corporate deposits). This has no impact on the key results.

[6] Our analysis focuses on vulnerabilities related to funding structures (i.e., liabilities), as this is where critical fragilities often become apparent and this has been a focus of macroprudential reforms. In the sensitivity tests, we also consider vulnerabilities related to asset exposures (including through interactions with funding structures).

Critical to this approach is the ability to integrate our analysis with a new and extremely rich high-frequency dataset on policy responses during Covid from Kirti et al. (2022). This data includes over 5,000 policy announcements for 74 countries on a daily basis during the early stage of the pandemic, which we divide into three broad categories. First, "structure-specific policies" (or "targeted policies") are policies related to NBFIs, market-based intermediation, and central bank swap lines. The first two could affect the vulnerabilities identified above related to NBFI funding and the last could affect the vulnerabilities associated with dollar funding. Second, "bank-specific" policies are a variety of changes to prudential regulation, including changes to macroprudential buffers. Finally, "economy-wide" policies are changes to the central bank's policy interest rate, asset purchases, liquidity policy, and fiscal policy. All of these policies were used extensively during the *Covid Shock* to support the broader economy, but could also have affected the relationship between funding structures and CDS spreads.

The results show that some structure-specific policies were effective at alleviating specific forms of financial stress. More specifically, policies aimed at supporting NBFIs significantly reduced the stress experienced by banks that were more reliant on NBFI funding. New US$ swap lines also significantly reduced the stress related to FX funding by banks—providing evidence on the channels through which US$ swap lines reduced strains in funding markets (see Goldberg and Ravazzolo, 2021). These structure-specific policies appeared to be more effective at reducing the forms of stress identified in banks than policies easing broader bank regulations and buffers. These very targeted policies also significantly improved resilience when controlling for policies aimed at supporting the broader economy, suggesting that economy-wide policies (such as adjusting interest rates, purchasing assets and adopting broader liquidity programs) were not able to get "*in all of the cracks*" of the financial system (Stein, 2013).[7]

Two caveats are important for interpreting this paper's results. This analysis only focuses on one episode—the period of acute financial stress during the first months of the Covid pandemic. Relationships may be different during this period than other periods of financial stress, especially as the shock was not generated by the typical financial boom-bust cycle, but instead generated by a pandemic and the corresponding government restrictions. This focus on one period severely limits the degrees of freedom, and thereby constrains our ability to include as extensive a set of controls as we would like in some specifications. Also, the analysis identifies correlations between different funding structures and the extent of financial stress, but not the underlying factors which could drive the evolution of these structures, and which could in turn reflect underlying resilience (i.e., endogeneity). For example, countries with certain vulnerabilities may have been more likely to adopt certain funding structures (e.g., relying more on NBFIs or US$ funding). Although we control for country and sector effects, our results cannot fully identify whether it is the underlying vulnerability in the sector or the related funding structure that increased fragility during the *Covid Shock*.

Overall, however, the results should contribute to the rapidly growing body of literature that helps understand the financial fragility in the spring of 2020 and sets priorities for the next phase of financial regulation. The results highlight the importance of focusing on vulnerabilities related to NBFIs and dollar exposures—especially in banks. The fragilities exposed in the spring of 2020 suggest that although the post-2008 regulatory reforms improved the resilience of banks, there is still more work to be done. Our findings also highlight priorities for regulations related to international exposures. The evidence that the

[7] Stein (2013) suggested that monetary policy "has one important advantage relative to supervision and regulation—namely that it gets in all of the cracks."

currency of the funding—rather than whether the funding is cross-border—is more important during a period of stress suggests that macroprudential FX regulations (which focus on the currency of the transaction) would be more effective at reducing vulnerabilities in the future than capital controls (which focus on the residency of the parties to the transaction).

The results also provide guidance, and raise important questions, on how to best address certain periods of financial stress in the future. In situations where key vulnerabilities contributing to financial stress can be identified (e.g., from NBFIs or US$ exposure), policies targeting these specific vulnerabilities should be considered as part of the policy response.[8] During the *Covid Shock* these policies appeared to complement the simultaneous support from changes in broader prudential regulations and economy-wide measures. In the future, are there conditions under which more targeted policy responses could not only complement, but substitute for, broader regulatory easing and monetary stimulus? If these targeted policies addressed specific areas of financial stress, could this reduce potential conflicts with efforts to achieve other macroeconomic or wider financial stability objectives? Would relying more on targeted responses in the future generate moral hazard in the specific sectors that receive support, possibly increasing vulnerabilities? These questions will become increasingly important if fragilities that emerge in specific segments of financial markets can evolve into systemic financial risks and if financial intermediation continues to shift outside the banking system.

The remainder of the paper is as follows. Section II reviews the literature on the financial vulnerabilities that are the focus of the analysis, as well as recent work describing the period of financial stress in the early stages of the pandemic. Section III discusses our new dataset of credit default swaps capturing stress in different sectors, including key patterns in early 2020. Section IV develops the framework to analyze the relationship between different funding structures and financial stress, including key data and some initial correlations. Section V presents the core of our empirical analysis, including the two estimation methodologies and the series of results relating financial stress to funding structures. Section VI estimates the impact of different policy responses (targeting specific structural vulnerabilities, banks, or the broader economy) in alleviating financial stress. Finally, Section VII concludes.

II. Related Literature

This paper contributes to the rapidly growing body of literature that helps understand the stress in the financial system in the spring of 2020 and steers the next stage of regulatory reforms.[9] Many countries adopted widespread macroprudential reforms after the 2008/9 Global Financial Crisis, such as a tightening of capital and liquidity requirements on banks, and in some cases limiting banks' exposure to foreign currency (FX) and access to foreign capital. Evidence from the literature suggests that these reforms have made banks more resilient to shocks, including reducing their exposure to foreign currency borrowing and exchange rate movements (Ahnert et al., 2021).

These developments, however, also generated changes in the structures and patterns of financial intermediation. Firms relied less on banks and shifted to other sources of funds, contributing to rapid

[8] See FSB (2020a) for a discussion of the FSB work program on NBFIs, including policies to reduce systemic risks.
[9] See FSB (2020a) for an overview of the factors contributing to financial stress in spring 2020.

growth in non-bank financial intermediation.[10] This shift in financial intermediation caused companies to obtain more financing from market-based sources, in dollars, and/or from abroad. As well summarized in Chari (2022), we are beginning to see evidence that these changes may have shifted risks in ways that are harder to assess—especially through intermediaries and markets that are less well regulated—possibly making some sectors (and even countries) less resilient overall. Subsequently, the *Covid Shock* was the first real test for the robustness of the post-2008 financial system. Although the macroprudential reforms appear to have prevented banking systems from amplifying the *Covid Shock* to other segments of the economy, the results in this paper suggest that the stress in non-bank sectors was being transmitted back to the banking system to some extent.

To motivate our empirical tests and place our work in the context of previous studies, this section discusses the literature on different vulnerabilities of financial intermediation, including vulnerabilities associated with: banking intermediation, non-bank financial intermediation, foreign exchange exposure, and cross-border borrowing. This section ends by summarizing the fast-growing literature on the period of heightened market volatility and financial stress during the early stages of Covid-19.

A. Vulnerabilities of Financial Intermediation

A longstanding literature explores the vulnerabilities to **financial intermediation via banks**. Banks conduct a maturity transformation that converts short-term liabilities into long-term assets, introducing potential vulnerabilities if funding sources are not stable (e.g., Diamond and Dybvig, 1983; Shin, 2009; Gertler, Kiyotaki and Prestipino, 2016). To address these vulnerabilities, policymakers have introduced a wide range of regulatory reforms (updates to Basel II; Basel III). Moreover, recent advances in the measurement of macroprudential policies (e.g., Alam et al., 2019) have sparked a rich literature examining their effectiveness. The literature suggests that regulatory reforms have reduced vulnerabilities related to banking intermediation and therefore made banking systems around the world more resilient to shocks. (See surveys by Galati and Moessner, 2013; Cerutti, Claessens, Laeven, 2017; and Forbes, 2021.)

As banks have adjusted to these stricter regulations, some financial intermediation has shifted to **non-bank financial institutions** (or **"shadow banks"**).[11] This intermediation can take on a variety of forms, ranging from small scale relationship lending (e.g., borrowing from mortgage lenders) all the way to large scale market-based intermediation (e.g., obtaining funding from bond and stock markets).[12] What all these entities and forms of intermediation have in common is that traditional banking regulations do not apply to them. Banks are still connected to these evolving forms of intermediation, however, as banks often fund their business activities through issuing bonds and equity, and in some cases borrowing from and lending to NBFIs.[13] This increased importance of non-bank financial intermediation, including the shift away from loans to more market-based forms of financing, has raised concerns about the corresponding financial stability risks, particularly to liquidity shocks and new forms or interconnectedness (e.g., FSB,

[10] See FSB (2020b) for trends in the size and links of the NBFI sector, with the caveat that cross-country data availability for non-bank financial intermediation is limited (e.g., OECD, 2020).

[11] For example, Claessens et al. (2021) finds that net tightening of domestic macroprudential policies increases the activities of non-bank financial institutions, raising the share of these activities in total financial assets.

[12] NBFIs comprise a wide range of entities, such as mortgage lenders, insurance companies, corporate development companies, and investment companies, as well as money market funds, pension funds, mutual funds, hedge funds.

[13] See Aldasoro, Huang, and Kemp (2020) for growing cross-border links between NBFIs and banking systems; and Caparusso and Hardy (2022) for the growing importance of financing from non-banks for the home offices of global banks in advanced economies.

2020a; Aramonte et al., 2022). This has also prompted recommendations for policymakers to better regulate this sector (Carstens, 2021). The evidence from the early stages of Covid-19 suggest that these non-bank forms of financial intermediation can be highly vulnerable to risk-off shocks, although it is unclear how exposed the traditional banking system is to risks through these non-bank forms of finance.

In addition to the source and instrument of financial intermediation, another broad area of vulnerability can emerge from exposure to **FX and currency mismatches**. This vulnerability can occur for firms, households and banks. If the currency denomination of an entity's assets is not aligned with that of its liabilities, exchange rate fluctuations can generate sharp changes in net worth. As discussed in Ahnert et al. (2021) and Shin (2013),[14] FX exposures and currency mismatches have been long-standing vulnerabilities in the financial system, although as some countries tightened regulations on the FX exposures of banks, risks related to currency mismatches have partially shifted to non-bank financial intermediaries, such as increased US$ bond issuance by companies. Possible tools available to mitigate this vulnerability are: macroprudential FX regulations (Ahnert et al., 2021); capital controls (Keller, 2019); FX interventions (Mrkaic, Kim, and Mano, 2020); and hedging (Alfaro, Calani, and Varela, 2021).

A final vulnerability is **cross-border exposure**, which emerges when domestic residents acquire assets or liabilities from abroad. While cross-border transactions are traditionally associated with FX exposure (as discussed above), the two vulnerabilities are not necessarily identical. For example, countries can borrow cross-border in their own currencies or currency mismatches can occur in the domestic economy (e.g., via "deposit dollarization"). A key feature of this cross-border vulnerability is that funding obtained abroad is more vulnerable to "sudden stops," which may occur when foreign investors reallocate their portfolios during global risk-off periods. Hofmann, Shim, and Shin (2020) and Hofmann, Patel, and Wu (2022) highlight this effect during the *Covid Shock*, showing how investors reallocated their portfolios to safe haven countries (including for cross-border funding in domestic currency), creating a feedback loop that generated even more capital outflows and higher currency depreciations for emerging markets. Cross-border exposure may have also increased in response to advances in financial regulation, which usually apply primarily to domestic banks.[15]

While each of these vulnerabilities—through banks, NBFIs, foreign-currency exposure and cross-border borrowing—have all been explored in the academic literature, our paper is the first (to the best of our knowledge) to simultaneously measure and analyze all of these vulnerabilities. Our data allows us to compare how strongly each of these different forms of financial *intermediation* and *internationalization* contributed to financial stability risks during the *Covid Shock*. Controlling for all of the vulnerabilities at once, rather than just focusing on one form or in one sector (such as banks), is particularly important as many of these vulnerabilities are interlinked. Examining one vulnerability that is highly correlated with another (such as increased reliance on FX borrowing and non-bank financial intermediation, or reduced reliance on banks and loans as a funding instrument) could mistake the true source of vulnerability. Likewise, only focusing on one sector could miss how vulnerabilities shifted across sectors. For example, if a reduction in one type of vulnerability shifts risks to sectors that are less able to handle a risk-off shock,

[14] McGuire and von Peter (2016) finds that in the 2008-09 financial crisis, affiliate banks shrank credit more sharply if they had relied on non-core sources of funding, including in foreign currency.

[15] A counter example is the countercyclical capital buffer (CCyB), which is equipped with an international reciprocity rule that can prevent such effects (e.g., see Chen and Friedrich, 2021).

this could aggravate vulnerabilities for the broader economy. This type of broader assessment is therefore important for policymakers to set priorities for their next stage of regulatory reform.

B. Financial Stress During Covid

A more recent literature assesses the impact of Covid on banks and financial markets in the early stages of the pandemic.[16] The impact on banks can be broken down into negative effects on banks' stock returns through a "credit line drawdown" channel (Acharya et al., 2021), their non-performing loans and loss provisions due to lockdown measures and Covid cases, (Beck and Keil, 2021), and their international lending (Temesvary and Wei, 2021). While each of these studies shows that Covid negatively impacted banks, the overall financial impact of the *Covid Shock* on the banking sector was much more benign than during the 2008/9 Global Financial Crisis. Most authors suggest that this resilience at least partly resulted from the adoption and tightening of prudential and macroprudential regulations over the last decade (see Berger and Demirgüç-Kunt, 2021; English et al., 2021; and Giese and Haldane, 2020), although other work highlights the different policies that supported banks during Covid (Demirgüç-Kunt et al., 2021).

A second group of papers has focused on the impact of Covid on financial markets, highlighting the role of NBFIs, market-based intermediation, US$ exposure or cross-border borrowing. Haddad, Moreira, and Muir (2021) examines disruptions in debt markets, Falato et al. (2021) focuses on corporate bond markets, and Eren and Wooldridge (2021) on how NBFIs amplified the *Covid Shock*. Moreover, Eguren-Martin et al. (2020), Cesa-Bianchi and Eguren-Martin (2021), Czech et al. (2021) and Eren, Schrimpf, and Sushko (2020a and 2020b) highlight the role of dollar-denominated borrowing, as investors sold dollar-denominated assets to repay dollar-denominated liabilities. Finally, Aldasoro, Huang, and Kemp (2020) links this literature on NBFIs to that on banks and the dollar by discussing how the greater exposure of banks to NBFIs (especially in US$), contributed to market turmoil during the *Covid Shock*.

Our work focusses on many of the vulnerabilities highlighted in this literature (including the role of banks, NBFIs, dollar exposure and cross-bordering borrowing), but takes a broader view than most of the studies above by simultaneously comparing the impact of different funding structures across countries and different sectors, and assessing a wide range of policy options to address these vulnerabilities. We are also one of the only studies (to the best of our knowledge) to use credit default swaps to measure the extent of financial stress.[17]

III. Financial Stress: The CDS Data and the *Covid Shock*

A. Measuring Financial Stress

In order to assess which sectors and countries experienced the greatest financial stress during the *Covid Shock*, we focus on credit default swaps (CDS). This market-based measure has several advantages. First, it is available for sovereigns, banks, and non-financial companies in a broad range of countries; this allows us to compare effects across different sectors within individual countries, as well as across countries. Second, it is available at a high frequency, and thereby able to capture the amount of stress in different sectors/countries at different points in time, even if the pressure was short-lived and/or

[16] For excellent overviews of what is a rapidly growing literature, see FSB (2020a) and Vissing-Jorgenson (2021).
[17] The only two other papers we know of that incorporate CDS during the *Covid Shock* are Daehler, Aizenman, and Jinjarak (2020) and Hasan, Marra, Wu, and Zhang (2023). Each addresses different questions than in this analysis.

occurred at different windows in different countries. Finally, this measure should capture a range of different types of "stress," from short-term liquidity/pricing pressures to longer-term solvency/valuation concerns. Focusing on CDS also has disadvantages, such as not capturing stress in companies for which these products do not exist (including small and medium enterprises), that different types of CDS can exhibit different pricing patterns (discussed in more detail below), and that trading frictions and other characteristics of CDS market structure can influence pricing. Keeping these important caveats in mind, CDS are the broadest and most timely measure to capture the various forms of sectoral financial stress that are the focus of this analysis.[18]

Compiling data on CDS for a broad range of countries, sectors, and companies was a lengthy process that involved a number of steps and decisions. Appendix A provides details. We began by downloading all available CDS from Refinitiv via Datastream for the period from January 1, 2020, through October 20, 2020 and then excluded series that did not meet certain criteria (such as being actively traded and affiliated with a specific country or company). Then, we used a variety of criteria to classify the remaining CDS into five sectors (*Sovereigns, Banks, Corporates* (the residual), *Other Financials,* and *Extended Government*), of which we focus on the first three for the analysis.[19] This process yields information on 2,532 CDS series, covering 68 different countries, with 127 for *Sovereigns*, 396 for *Banks,* and 2009 for *Corporates*.[20] Finally, we create a composite measure at the country-sector level, yielding data for 61 countries for *Sovereigns,* 32 for *Banks*, and 40 for *Corporates*. Appendix Table A1 lists each of the countries in the sample, with the number of CDS series for each of the sectors. The coverage of EMEs is very limited for some analyses (especially those including banks); for example, regressions which require a country to have data on each of the three sectors limits our sample of emerging markets to Brazil, India and Russia. We therefore do not focus on a split between AEs and EMEs in the empirical analysis, but do report sensitivity tests that show that excluding the EMEs has no meaningful impact on the key results**.**

B. Financial Stress during the *Covid Shock*

As a first look at our measures of financial stress, we focus on the first half of 2020, when Covid-19 evolved from being of minimal concern to a global pandemic and causing countries to close borders and limit economic activity. Figure 1 graphs the mean and median CDS for each of the three sectors (*Sovereigns*, *Banks*, and *Corporates*) for all countries which have data for all three sectors (to ensure results are not driven by sample composition). In each graph, the CDS index is set to 100 on 1 January 2020 to better compare relative movements. Each of these graphs shows the sharp increase in CDS for each sector during the period of acute financial stress in March 2020. Stress moderated by the end of the month after substantial policy interventions, but each series remained elevated through June relative to the start of 2020. As explained below, our empirical analysis focuses on the acute period of financial stress through when the CDS series peaked on March 23, which we call the *Covid Shock*.[21]

[18] Berndt et al. (2018) discusses the advantages and disadvantages of using CDS to measure default risk.

[19] Funding vulnerabilities of the sovereign sector are not a direct focus of this paper, but we use the sovereign as a benchmark to better identify developments in the bank and corporate sectors.

[20] The CDS series are composites of all the traded and reported CDS contracts that fall in the same category (e.g., US$ denomination, 5-year maturity). Hence, even a single series can represent a large sample of individual CDS.

[21] We also examine different time periods, including after policy responses were announced (see Section V.C).

In each of the graphs in Figure 1, *Sovereigns* experienced the greatest increase in financial stress. *Banks* were the most resilient (as assessed by the smaller increase in the CDS indices).[22] This is consistent with the thesis that macroprudential reforms since 2008 aimed at strengthening the banking system helped buffer this sector from the *Covid Shock*.

These graphs of the mean and median CDS by sector, however, mask important differences in the distribution of changes over time. Therefore, Figure 2 graphs the mean and median CDS, as well as the 25th and 75th percentiles, for the three sectors.[23] For *Corporates* and *Sovereigns,* the mean is consistently above the median, reflecting the rightward skew of the distribution (i.e., a fatter tail of sharper increases in CDS). For *Sovereigns*, countries at the 75th percentile experienced substantially more pressure on CDS relative to other sectors, while those at the 25th percentile experienced less, suggesting a set of countries that were seen as much risker (and some as more resilient). These types of patterns suggest that there is substantial variation in how the period of financial stress affected different countries and sectors.

Finally, and to further understand these different patterns, we calculate a measure of *Peak Stress* for each sector and country. More specifically, we calculate the log change in the CDS for each entity from January 1, 2020 (before Covid began to be priced into financial markets) to March 23, 2020. We use March 23 as the date of *Peak Stress* in financial markets as this is the date in the first half of 2020 when the average CDS peaked for each of the three sectors in our analysis. It is also the date when several other broad market indices troughed or peaked—including the trough for the all-country MSCI total return index and peak in the EMBI and CEMBI indices.[24] Acharya et al. (2021) also uses this window as the focus of their analysis on "the first phase of the pandemic," justifying their end-date as just before "decisive monetary and fiscal support measures were introduced."

Figure 3 shows the resulting mean of *Peak Stress* for each sector, for all countries and then for just AEs and EMEs. It confirms the results in Figure 1 that *Sovereign* CDS increased the most, and that *Banks* were more resilient than *Corporates* (or *Sovereigns*). In contrast, in the much smaller subset of EMEs, *Banks* experienced more *Peak Stress* than *Corporates,* potentially reflecting less progress on macroprudential reforms. The graph on the right also shows the standard deviation for the different sectors and country groups. The greatest variation in stress occurs across countries—particularly in the EMEs. For AEs, the much smaller standard deviation for *Corporates* is noteworthy given the very different effects Covid had on different types of companies (i.e., services versus manufacturing). This may reflect confidence that governments would respond with large support packages for the corporate sector—and by more than in EMEs that may have been more fiscally constrained. The larger standard deviation for *Banks*, despite the relatively smaller average effects, also suggest some differentiation in expectations of how different banks would be affected. The empirical analysis below provides evidence of several funding structures that contributed to this variation in bank resilience to the *Covid Shock.*

[22] If this graph is replicated for just the three EMEs with data for each sector, EME *Banks* experienced a greater increase in CDS than *Corporates* early in the *Covid Shock*.

[23] The graphs exclude Argentina from the mean, as movements in its CDS are an extreme outlier.

[24] Based on the median value across all countries for the MSCI, EMBI and CEMBI indices. The EMBI is the emerging market bond index (which is primarily sovereign bonds, with some corporate debt), and the CEMBI is the corporate emerging market bond index, both from JP Morgan. The VIX was also close to its high (peaking on March 16).

What explains the differences in resilience across countries and sectors during the period of acute financial stress from Covid? Can different funding structures, including changes in financial intermediation and internationalization since the 2008/9 Global Financial Crisis, explain these differences?

IV. *Intermediation* and *Internationalization* Structures: The Framework, Data and Correlations with Financial Stress

This section develops the framework and introduces the data that will be used to test if different funding structures were related to this substantial variation in the degree of stress experienced across countries and sectors during the *Covid Shock*. The literature review (Section II) highlighted a range of vulnerabilities in financial systems that became apparent during Covid, some of which are related to shifts in global financial intermediation over the last decade, but which have not been a focus of macroprudential regulations in most countries. To analyze the role of these funding structures in contributing to these vulnerabilities, this section introduces a simple framework focusing on different forms of financial *intermediation* (the funding sources and instruments) and *internationalization* (the currency and location of the counterparty) that have been highlighted in this literature and that can be tested using our cross-country, sectoral data. Then the section discusses the data used to test these channels and reports some preliminary correlations between these different funding structures and the extent of financial stress experienced in the banking and corporate sectors during the *Covid Shock*.

A. Financial *Intermediation* and *Internationalization:* The Framework

In order to analyze how different funding structures performed in the initial phase of Covid, we focus on four funding characteristics highlighted in the literature review: the source, instrument, currency, and counterparty location. We will refer to the first two characteristics as forms of *intermediation* and the last two as forms of *internationalization*. Since the analysis below captures not only the impact of each of these funding structures independently, but also considers their interactions and simultaneous effects, it is useful to begin by developing a framework to evaluate the various relationships.

The first broad category, financial *intermediation*, is shown in Figure 4a and concentrates on different funding sources and instruments for banks and corporates (in blue). We focus on three funding sources for banks (in green): households (primarily deposits)[25], other banks, and non-bank financial institutions (NBFIs).[26] Corporates can receive funding from banks and NBFIs.[27] For this part of the analysis, there is no differentiation between institutions located domestically or abroad, or the funding currency (both of which are captured in the *internationalization* discussed below). Each of these five funding flows

[25] Since the median share of bank funding from households in other forms than deposits (such as through equity) is about 1 percent of total banks' financing from households, we do not split out this alternate funding source.

[26] The share of bank funding by sector in 2019 Q4 is on average in our baseline sample: 31% households, 25% other banks, 13% NBFIs, 13% (non-financial) corporates, 3% general government, and the remainder non-allocated. Although we do not focus on funding from corporates (through deposits or other forms) in the main analysis, sensitivity tests (discussed in Section V.C.) suggest that the share of bank funding from corporate deposits did not significantly impact resilience during the *Covid Shock*.

[27] Corporates' funding from NBFIs is proxied by total credit to corporates minus bank credit from BIS reporting banking systems to corporates as a share of total credit (see Appendix Table B1). We assume that households contribute only a very small share of direct funding to corporates, e.g., that purchases of corporate equity or debt primarily occur through NBFIs (such as mutual funds).

are numbered in the figure and some can be further subdivided into different instruments (marked by letters). Funding from banks (to other banks or corporates) can occur through: (a) loans or (b) debt purchases and other forms (such as equity). The NBFIs include a range of institutions that provide funding to banks and corporates through (a) loans and (b) market-based purchases of debt and equity. This diagram is a simplification, as additional forms of financing exist, as well as indirect linkages between the three sources of funding (such as households providing funds to NBFI, which can then fund banks and corporates). The main empirical analysis, however, will focus on the numbered flows capturing the funding source in Figure 4a, and/or their lettered subcomponents capturing the funding instrument, as these are the largest direct channels highlighted in the literature and for which data is available for the sectoral analysis.

Section II provides guidance on how these different funding sources and instruments in Figure 4a would be expected to affect the resilience of the borrowing entities during a risk-off shock (such as in March 2020). More specifically, NBFI funding would be expected to be the least stable source of funding (for banks and corporates) during the *Covid Shock,* and households would be expected to be the most stable source of financing for banks, especially given the strength of household balance sheets during Covid. This implies that banks with a higher share of funding from households (channel 1) should be more resilient, and those with a higher share of funding from NBFIs (channel 3) should be less resilient, with the impact of bank funding from other banks in between. Similarly, corporates with a higher share of funding from banks (channel 4) should be more resilient than those with a higher share of funding from NBFIs (channel 5). Shifting to the other aspect of *intermediation* (the funding instrument instead of the source), entities with a higher share of liabilities from loans (channels 2a+3a for banks, and 4a+5a for corporates) would be expected to be more resilient than those more reliant on more volatile debt markets.

In addition to these various forms of financial *intermediation,* the literature review also highlighted the potential vulnerabilities linked to financial *internationalization*, i.e., the currency of the funding or whether the source of funding was cross-border (i.e., came from abroad instead of domestic sources). Adjusting the mapping in Figure 4a to take account of these international components, Figure 4b shows the framework focusing on either the funding currency or counterparty location. The funding of banks and corporates can be decomposed by currency (into either US$ or local currency, LC) or by counterparty location (into either cross-border or domestic). These divisions are captured in the arrows denoted by Roman numerals. Although there is a high correlation between the funding currency and whether it is cross-border, this relationship is weaker in some countries and for certain funding sources. For example, in some countries households chose to keep a larger share of domestic bank deposits in US$, some companies issue a large share of domestic debt in US$, and some companies issue a large share of international debt in local currency.

The literature review in Section II suggests that banks and corporates that are more reliant on dollar funding and on “flighty” funding from abroad would be more vulnerable during periods of financial stress. This would imply that banks and corporates with a higher share of funding in local currency or from domestic sources (channels II and IV) should be more resilient during the *Covid Shock* than those more reliant on US$ and from cross-border sources (channels I and III).

Finally, one benefit of this framework is that it also allows us to analyze the interaction between different forms of *intermediation* and *internationalization* by evaluating the different subcomponents, shown by the capital letters and Arabic numerals inside the boxes of the relevant funding source in Figure

4b. For example, US$ funding can be broken into funding from households (primarily deposits), from banks (through either loans or other channels), or NBFIs (through loans or other sources). Similarly, funding flows can be decomposed by instrument type, such as the loan share of banks' US$ bank liabilities. This more detailed decomposition can be important to better evaluate the underlying source of vulnerability. For example, if corporates with a higher share of funding in US dollars appear to be more vulnerable, but most of this funding in US dollars is from NBFIs, is it the source of funding (NBFIs) or the currency (US$) that is driving the vulnerability? To better understand which financial structures are most important, we examine combinations of vulnerabilities based on the funding source, instrument, currency and counterparty location—with the selection of variables heavily influenced by data availability for these more disaggregated breakdowns.

To keep track of these different predictions, Table 1 lists the key forms of *intermediation* and *internationalization* discussed above, along with the corresponding identification for each channel in Figure 4, as well as the expected relationship between the funding structure and the amount of stress in the sector during the *Covid Shock*. A "+" indicates a prediction of more stress (i.e., a larger increase in CDS spreads) and a "-" indicates less stress. For example, the "+" sign next to *Corporates* for *NBFI liabilities/total liabilities* indicates that countries in which the corporate sector has a higher share of liabilities from NBFIs are expected to experience a larger increase in CDS spreads during the *Covid Shock*. When the sign of effect is uncertain based the previous literature, we use a question mark in the table.[28]

B. Financial *Intermediation* and *Internationalization:* The Data and Correlations with Financial Stress

In order to measure these different funding structures capturing *intermediation* and *internationalization* across sectors, it is necessary to draw on a number of different data sources. The data measuring the funding profile of banks and corporates are generally quarterly, and in order to capture funding structures before the *Covid Shock*, we use statistics for 2019 Q4. The majority of the data for the funding profile of banks are taken from the BIS International Banking Statistics. They provide rich information on the claims and liabilities of banks for the key aspects of our analysis: from different sectors (including households, other banks and NBFIs); in different currencies (including US$ and all currencies); in different instruments (including loans/deposits, debt securities and other) and by counterparty location (domestic and cross-border). These data not only provide information on the liabilities of the banks but also the claims of banks on corporates (i.e., the liabilities of corporates vis-à-vis BIS reporting banks).

The second key data source relevant for both corporates and banks are the BIS International Debt Statistics. They provide information on the US$ amount of debt securities outstanding by issuer residence and issuer nationality, as well as issuing sector and issuing currency. For the data on US$ exposures, we focus on debt calculated on a nationality basis to capture the global exposures for banks and corporates, including via the issuance of affiliates located abroad. The importance of the latter source of US$ funding is frequently highlighted by the BIS, e.g., Shin (2013) and BIS (2021). For the data on cross-border exposures, we focus on debt statistics calculated on residency basis—the standard for these variables.

Finally, we use BIS data on domestic credit to measure total credit from all sources extended to non-financial corporations. Appendix B provides more detailed definitions, sources and summary statistics

[28] An example when the effect is uncertain is the share of bank financing from other banks; this is expected to be correlated with less stress than financing from NBFIs, but with more stress than financing from deposits.

for all of these variables on funding structures (as well as other variables). In some cases, these measures are not identical to those in the figures (or theory), but are the best available proxy for our cross-section.

As a first look at whether the funding structures are related to resilience, we calculate simple correlations between the different forms of *intermediation* and *internationalization* and the stress in the banking or corporate sector (*s*) during the *Covid Shock* (defined in Section III.A):

$$Stress_i^s = \alpha + \delta Structure_i^s + \varepsilon_i, \quad (1)$$

where *Stress* is measured as the log change in the CDS from Jan 1 through March 23, 2020 for each country *i* in each sector *s*. *Structure* is measured using the different variables discussed above capturing various aspects of financial market *intermediation* and *internationalization*. To estimate raw correlations, we include only one structure variable per regression. The resulting correlations for each of the measures are listed in the far right column of Table 1, with ***, ** and * indicating significance at the 1%, 5% and 10% levels, respectively.

The results—albeit only showing raw correlations and not controlling for other variables that could affect these relationships—generally support our priors and existing evidence (summarized in Section II). Starting with the results for *intermediation* on the different sources of funding, banks that had a higher share of funding from household deposits experienced significantly less stress during the *Covid Shock* (i.e., a smaller percent increases in CDS spreads), and banks with a higher share of funding from NBFIs experienced significantly more stress. Similarly, corporates with a higher share of funding from NBFIs experienced more stress, and those more reliant on banks experienced less, although these effects were not significant. Shifting to the funding instruments, when banks had a higher share of total liabilities in the form of loans, and when either banks or corporates had a higher share of their bank liabilities in the form of loans, they experienced less stress. This increased resilience from loans, however, is only significant for banks when measured as the overall share of liabilities. Shifting to the results for *internationalization*, when banks or corporates have a higher share of borrowing in US$ or cross-border, they experienced larger increases in CDS spreads (as expected)—although in most cases these correlations are insignificant when ignoring the form of *intermediation*. The regression analysis below shows, however, that when controlling for both the funding source as well as the currency, these relationships are usually highly significant for both banks and corporates. This highlights the importance of simultaneously focusing on various funding characteristics (as in Figure 4), rather than examining only one aspect of funding *intermediation or internationalization*, as previously done in this literature.[29]

To summarize, this first look at the data suggests that the different forms of financial *intermediation* and *internationalization* were correlated with the resilience of banks and companies during the *Covid Shock* in directions that agree with the existing literature. But which of these funding structures were most important in contributing to this period of acute financial stress?

[29] Forbes et al. (2022) includes additional information on the predications for and correlations between the *Covid Shock* and different funding structures, with the funding structures decomposed into more granular categories incorporating multiple forms of financial intermediation and internationalization simultaneously.

V. Financial Stress and Funding Structures: Regression Analysis

In order to better understand the relationships between different funding structures and the extent of financial stress during the acute phase of Covid, this section moves beyond the unconditional correlations in the last section to estimate these relationships while taking into account factors that could simultaneously affect each country and sector. More specifically, we take advantage of the country-sector-time variation in this data to estimate two models. The first approach tests if funding structures were associated with the variation in stress *across sectors* within countries over the full period of the *Covid Shock*. The second uses higher frequency data to capture the variation in stress *across time for each country-sector* in order to better incorporate the size of the financial shock at different dates. These tests build on the various channels of financial *intermediation* and *internationalization* (capturing the funding source, instrument, currency and counterparty location) as developed above in Section IV, Table 1 and Figure 4.

A. Financial Stress and Funding Structures: Empirical Methodology

Our first estimation methodology, which we will refer to as the "c*ountry-sector approach*" focuses on how funding structures were correlated with stress in the banking and corporate sectors relative to stress experienced by the sovereigns within the same country during the *Covid Shock*. We estimate:

$$Stress_{i,s} = \alpha_i + \alpha_s + \delta \boldsymbol{Structure_i^s} * \alpha_s + \gamma \boldsymbol{Controls_i} * \alpha_s + \varepsilon_{i,s}, \qquad (2)$$

where $Stress_{i,s}$ is the measure of financial stress for each country *i* for the *Bank, Corporate* or *Sovereign* sector *s*, measured as the log change in CDS (between 1 January and 23 March) as discussed in Section III. The α_i and α_s are country and sector fixed effects, respectively (with *Sovereign* being the excluded category). The $Structure_i^s$ variables are vectors of different combinations of the measures of financial *intermediation* and/or *internationalization* in the relevant sector, all measured before the *Covid Shock* (throughout the paper, variable matrices in equations are shown in bold).[30] These variables are interacted with a sectoral dummy, so that the δ captures how the structural variables correlate to stress in that sector relative to those of the other sectors in the same country. These δ coefficients would be expected to have the signs in Table 1. Given the limited degrees of freedom for this cross-country analysis, in our baseline we only include one additional variable for *Controls*: the number of new Covid cases per 100k population averaged over the two weeks prior to the 23 March date of *Peak Stress* (as discussed in Section III.B). For our baseline, we interact this control with the sector dummy to capture different effects of the incidence of Covid across sectors.[31] The country fixed effect absorbs any time-invariant heterogeneity across countries, so that it is not necessary to include controls for country characteristics that do not change over this window and do not have different effects across sectors.

[30] $Structure_i^s$ indicates one variable per sector for each of the structure measures where data are available (i.e., one for banks and another for corporates) rather than as $Structure_{i,s}$, which would combine the structure measures across sectors into a panel variable. This is done to identify the importance of sector-specific funding structures for financial stress from the between and within country variation (rather than between sector and within country variation) in our data. This is also done due to data constraints. For example, although we have data on the direct funding from households to banks, we do not have comparable data on household funding for corporates or sovereigns. In addition, the data for NBFI funding of banks and corporates are not comparable enough in terms of the underlying data collection to code these series within the same variable (see footnote 23).

[31] The sensitivity analysis shows that dropping these controls for Covid has no impact on the key results.

Our second estimation approach, which we will refer to as the "*country-sector-time approach*," focuses on the time-series dimension of how changes in financial stress relate to the funding structures within each country and sector. This has the advantage of using the higher frequency daily (or weekly) CDS data to better capture the magnitudes of stress experienced by different sectors at different times over the full *Covid Shock* window. This could be important as Covid spread more quickly in some countries than others, and thereby affected some variables at different times in different countries. We estimate:

$$Stress_{i,s,t} = \alpha_{i,t} + \alpha_{s,t} + \delta \boldsymbol{Structure_i^s} * \alpha_s + \emptyset \Delta vix_{t-1} \boldsymbol{Structure_i^s} * \alpha_s + \gamma \boldsymbol{Controls_{i,t}} * \alpha_s + \varepsilon_{i,s,t} \quad (3)$$

where $Stress_{i,s,t}$ is now measured as the day to day log change in CDS by sector for each country over the *Covid Shock*; Δvix_{t-1} is the day to day growth in the VIX (measured as a growth rate to be consistent with the *Stress* variable), lagged by 1 day to avoid endogeneity. The $\alpha_{i,t}$ is a country-time fixed effect and the $\alpha_{s,t}$ measure sector-time fixed effects (for *Banks* and *Corporates*, with *Sovereign* being the excluded category). The $Structure_i^s$ variables continue to be vectors of different combinations of the *intermediation* and *internationalization* variables for *Banks* and *Corporates*, now interacted with the VIX as well as the sector dummies. The $\emptyset$ coefficients on this interaction are the key focus and should capture whether on days after the VIX spiked there is a relatively larger response in CDS spreads in the banking or corporate sectors (relative to other sectors in the same country) for sectors with certain structural characteristics. We also control for the number of Covid cases per 100k reported each day in $Controls_{i,t}$.[32] In our baseline analysis below, we focus on results based on daily data, but the key results are unchanged when the analysis is based on weekly data (as shown in the Sensitivity Analysis).[33]

The *country-sector* and *country-sector-time* approaches each have distinct advantages and disadvantages. The *country-sector* approach has very limited degrees of freedom (which constrains our ability to include multiple controls simultaneously), while the *country-sector-time* approach assumes that movements in our high-frequency measure of the financial shock (the VIX) quickly affect the country-sector relationship between structures and stress. More specifically, the latter approach assumes that the VIX interacts with the country-sector funding structures to generate different degrees of financial stress over the next day (or week). In contrast, the *country-sector* approach assumes that these relationships are more protracted and better captured over the full window of the *Covid Shock*. There is no strong evidence to justify one approach over the other.

Also important, both approaches capture correlations and could miss important omitted variables that could impact estimated coefficients and drive underlying relationships. For example, institutions in countries with higher political risk may have more difficulty obtaining funding in foreign currency, with a greater relative disadvantage for the banking sector relative to the corporate sector. Regression results which find that banking sectors more reliant on dollar funding experienced greater financial stress during the *Covid Shock* (relative to other sectors in the country), could reflect concerns about political risk during the *Covid Shock* (which also could be greater for the banking sector) rather than the direct impact of differences in the funding currency. Similarly, banks (or corporates) with a greater share of funding from NBFIs may have unobserved characteristics that make them riskier, and therefore make it more difficult for them to obtain funding from deposits or other banks. These unobserved characteristics may also make

[32] Results are qualitatively and quantitatively the same for lagged Covid cases.

[33] We calculate weekly changes from Wednesday to Tuesday, and include all full weeks in our baseline period.

them more vulnerable during risk-off episodes, and thereby generate a positive correlation between the share of bank funding from NBFIs and vulnerability to the *Covid Shock*—even though the relationship is driven by the underlying riskiness of the institutions rather than directly from the share of NBFI funding. We attempt to control for some of these potential omitted variables in the sensitivity test (such as controlling for asset exposures of banks to NBFI and dollar funding), and we control for country-level omitted variables through our country dummies, but especially in a cross-country setting it is impossible to control for all potential omitted variables that could affect these relationships.

Finally, in both regression approaches, we control for the possible impact of outliers by winsorizing key variables. Specifically, we winsorize the dependent variable and the number of Covid cases at the 1% level.[34] The *Structure* variables are defined as shares, ranging between 0 and 1, and are not winsorized. Also, to lessen sample effects, we focus on a sample of 25 countries which report the key structure variables on *internationalization* for banks (cross-border and US$) as well as at least two of the three *intermediation* variables.[35] Summary statistics for all the variables are reported in Appendix Tables B1 and B2.

B. Financial Stress and Funding Structures: Regression Results

To begin, and before focusing on the relationship between funding structures and stress during the *Covid Shock*, it is worth highlighting several coefficient estimates from unconditional regressions that do not include the full set of controls. Appendix Table C1 shows estimates in columns (1) to (3) using the *country-sector* approach with only controls for the respective sectoral dummies. The coefficients on the banking sector dummy are negative and significant, whereas those on the corporate sector dummy fluctuate in sign and are not significant. The -0.37 coefficient on the banking dummy in columns (3) and (6) implies that the growth rate of CDS spreads is on average 30.9 percentage points lower for banks relative to other sectors of the economy.[36] These patterns agree with Figures 1 and 3 showing that *Banks* experienced less financial stress than *Corporates* or *Sovereigns* during the *Covid Shock*. Also, columns (4) through (6) show results when the interactions between Covid cases and the sectoral dummies are added. In these regressions, the interaction with the corporate sector dummy is positive and significant (at least at the 10% level), while the interactions with the banking dummy are not significant. This indicates that countries with a higher incidence of Covid experienced greater stress in the corporate sector (but not in the banking sector). This may not come as a surprise; in countries where the virus was more prevalent, businesses were expected to be more directly affected than banks. The relative resilience of banks may also reflect confidence that the banking system was well positioned to handle this shock, possible due to stronger macroprudential regulations and/or expectations of a rapid central bank response.

Next, we shift to the main analysis and estimate the role of financial *intermediation* through the funding source (households, banks or NBFIs), as shown in the green boxes at the top of Figure 4a and

[34] Results are qualitatively and quantitatively robust to other winsorization choices, including a 2.5% threshold.

[35] The following countries are thus included in the sample: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Malaysia, Netherlands, Philippines, Portugal, Saudi Arabia, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan and the United Kingdom. The variable for banks' deposits from households is only available for 21 countries. We do not use this variable for all the specifications, and therefore do not constrain the sample based just on this variable.

[36] Calculated as the log change in CDS = 1*dummy coefficient = -0.37. Taking the exponential and subtracting 1 on both sides yields: exp(1*-0.37) - 1 = -0.309, which corresponds to 30.9pp lower growth rate in CDS spreads.

specified in equations (2) and (3). Table 2 shows results using the *country-sector* approach and Table 3 the comparable results using the *country-sector-time* approach. Columns (1) through (4) control for one source of funding at a time, then columns (5) and (6) control for multiple sources for banks and corporates simultaneously, and column (7) focuses on just the role of funding from NBFIs (for both banks and corporates). In each case, it is necessary to exclude at least one funding source to avoid collinearity. This series of coefficient estimates supports the predictions in Table 1. Banks with a greater share of funding from households experienced a smaller increase in CDS during the *Covid Shock*, and banks and corporates with a greater share of funding from NBFIs experienced a greater increase in CDS. These effects are always significant for banks, but usually insignificant for corporates (with mixed signs for the *country-sector-time results*). To put these estimates in context, the coefficient of 2.67 in column (7) of Table 2 implies that if a banking system had a 10pp higher share of funding from NBFIs, CDS spreads in the banking sector would have been correlated with an additional increase of 30.6 percentage points relative to the other sectors in the same economy during the *Covid Shock*.[37] Funding from other banks is also correlated with improved resilience for banks relative to funding from NBFIs, but with less resilience for funding from banks than funding from households (as also expected).

We also test for the other characteristic of financial *intermediation,* the funding instrument, as shown by the numbered subcomponents in the green boxes at the top of Figure 4a. Due to data limitations, we focus on the role of loans versus other instruments, measured by the share of loans in total funding for banks, or the share of loans in corporates' funding from banks. The data available for the corporate sector does not capture the overall share of loans in funding—but only the share of bank funding in the form of loans—and thereby does not fully reflect the vulnerability introduced by the instrument type for corporates. With this important caveat, the right side of Tables 2 and 3 shows the results, with the loan shares estimated separately in columns (8) and (9) and then simultaneously for banks and corporates (in column (10)). A higher share of loans corresponds to a smaller rise in CDS spreads during the *Covid Shock* for banks and corporates, but the relationship is only significant for banks in the *country-sector* results. These results are consistent with arguments that relying on loans instead of debt markets increased resilience—especially of banks—during the period of acute financial stress.

Next, we test for the two aspects of financial *internationalization* shown in Figure 4b, the currency and location of the counterparty. For the currency of funding, we control for the share of funding in US$, and for the counterparty location, we control for the share of funding from abroad (i.e., cross-border). Tables 4 and 5 show the results for the *country-sector* and *country-sector-time* estimates, respectively. Columns (1) through (4) control for one aspect of exposure at a time, and column (5) controls for all simultaneously. In most cases the relevant coefficient estimates are positive—suggesting that banks and companies more reliant on US$ and cross-border funding experienced a significantly larger increase in CDS during the *Covid Shock*. The significance of the coefficients varies across specifications, however, with the relationship more often significant for banks and more often for funding in dollars.

One possible explanation for the mixed significance in many of these results is that we do not simultaneously control for different forms of financial *intermediation* and *internationalization.* These

[37] Calculated as the log change in CDS = change in funding share * coefficient = 0.1*2.67. Taking the exponential and subtracting 1 on both sides yields: exp(2.67*0.1) - 1 = 0.3060, which corresponds to a growth rate in CDS spreads of 30.6 pp. To put the 0.10 increase in the share of funding from NBFIs in context, Table B1 shows this is less than the cross-country mean of the share of NFBI funding (0.13) and slightly larger than one standard deviation (0.08).

omitted variables capturing different funding characteristics could work in different directions to mitigate—or aggravate—any relationships. For example, if companies were more reliant on loans for funding (the more stable instrument for financing), but these loans were largely in US$ (the less stable currency for funding), then the relationship between the loan share of financing and stress during Covid could be estimated to be insignificant, even though the underlying relationship is positive and significant (when controlling for the omitted variable of the funding currency). To better understand these relationships, we estimate regressions which simultaneously control for *intermediation* and *internationalization.* Due to the limited number of countries in our sample and corresponding limited degrees of freedom, however, we can only control for a subset of different channels in any regression.

The results for the *country-sector* approach are shown in Table 6. Columns (1) and (2) include controls for the funding source as well as the funding currency and counterparty location, with NBFI funding for each sector as the excluded category in column (1) and then including just NBFI as a funding source for each sector in column (2). Columns (3) through (6) include more detailed breakdowns of NBFI funding by currency and counterparty location that is only available for banks; for corporates a detailed breakdown into currency and counterparty location is only available for funding from banks (columns (5) and (6)). The share of funding from NBFIs continues to be correlated with a larger increase in CDS spreads, with this relationship consistently significant for banks. The estimates show a higher share of funding in US$ is positively and significantly correlated with the increase in CDS spreads for both banks and corporates, and even the narrow measure of the share of bank funding in US$ from NBFIs is significantly and positively correlated with higher CDS spreads. To put these estimates in context, the coefficient of 2.25 in column (1) implies that if the corporate sectors' share of US$ liabilities was 10pp higher, CDS spreads in the corporate sector would have been correlated with an increase of an additional 25.2 percentage points relative to the other sectors in the economy. In contrast, the share of funding cross-border for both banks and corporates is not significant—and is even often negative.

Finally, columns (7) to (9) use more detailed data that controls for the loan share in US$ funding and cross-border for each sector. These results also support the earlier estimates that a greater reliance on loans was correlated with a reduced sensitivity to financial stress during the *Covid Shock*, especially for banks (as found above), and for loans in US$ (supporting the more general results on the vulnerability of US$ funding). These results are less robust across specifications and usually insignificant, however, suggesting that the instrument of funding does not play a crucial role in this case.

Two important patterns in this series of results are worth highlighting. First, for *intermediation*, the funding source appears to be more important than the instrument. More specifically, when banks had a higher share of funding from household deposits, they experienced significantly less financial stress during the *Covid Shock,* and when banks or corporates had a higher share of funding from NBFIs, they experienced more stress (with the effects more often significant for banks). In contrast, banks and corporates with a higher share of funding from loans experienced less stress, but the effect was usually not significant (albeit with data limitations for corporates). Second, for financial *internationalization*, the currency of the funding appears to be more important than the nationality of the funding source. More specifically, when corporates and banks had a higher share of funding in dollars, they generally experienced significantly more financial stress during the *Covid Shock*. In contrast, there is less consistent evidence on whether a higher share of funding from abroad affected vulnerability—with the estimates for cross-border borrowing not only being insignificant in most cases, but having varying signs.

The corresponding results for simultaneously controlling for different forms of *intermediation* and *internationalization* in the *country-sector-time* approach yield estimates that vary across specifications—both in terms of significance as well as sign.[38] This suggests that the vulnerabilities may be more difficult to capture in daily relationships than over the longer periods of time in the *country-sector* approach.

C. Financial Stress and Funding Structures: Sensitivity Analysis

In order to assess if the key results cited above are robust, we estimate six sets of sensitivity tests: drop controls for the incidence of Covid or drop emerging markets; add controls for different types of asset exposures; incorporate any vulnerabilities related to bank funding from corporates; use alternate measures of volatility; adopt different timing and lag conventions; and use different windows to define the *Covid Shock.* A sample of these results is reported in Table 7 for the *country-sector* approach and Table 8 for the *country-sector-time* approach. Each of these tests focuses on the main set of significant results that simultaneously controls for funding *intermediation* and *internationalization* (i.e., columns (1) and (2) of Table 6 for the *country-sector* approach). We do not focus on results on the funding instrument due to data limitations and the insignificance of these results (which also occurs in unreported sensitivity tests). In each table, columns (1) and (2) replicate the baseline results.

First, columns (3) and (4) of Tables 7 and 8 drop the Covid controls interacted with sectoral dummies. The key results are basically unchanged for banks, but some become insignificant for corporates (such as the impact of the share of liabilities in US$). This is not surprising given the greater sensitivity of the corporate sector to the incidence of Covid, as shown in Appendix Table C1 and discussed in Section V.B. Next, we drop emerging market economies.[39] Results for the *country-sector* approach are reported in columns (5) and (6) of Table 7, and are basically unchanged from the baseline. The degrees of freedom are too limited to estimate the comparable *country-sector-time* results.[40]

Second, we add controls for the asset-side of banks' balance sheets in order to assess if the key results on the fragilities related to banking systems' dependence on NBFIs and US$ is driven by the funding side rather than the asset-side (which may be correlated).[41] Specifically, we include banks' NBFI and US$ assets as a share of total assets in columns (7) and (8) of Table 7 and (5) and (6) of Table 8. Each of these asset-side measures has a negative but insignificant coefficient, suggesting that it is the funding source (rather than the asset exposure) driving vulnerabilities related to NBFI and US$ exposures. Column (7) of Table 7 also suggests that a higher share of US$ in banks' assets led to a significant reduction in financial stress during the *Covid Shock;* these results, however, are not significant when also controlling for banks' NBFI liabilities or using the *country-sector-time* approach.

[38] The full set of results is not reported to save space, but key columns are in the sensitivity analysis in Table 8. The full set of results is available in Table 7 in Forbes et al. (2022).

[39] We define EMEs based on the classifications in the BIS International Banking Statistics, which causes South Korea, South Africa, Saudi Arabia and Malaysia to be dropped from the sample. Further countries listed in Table A1 are not included in the baseline regressions due to limited data on the main bank and corporate funding measures.

[40] The degrees of freedom become too limited to calculate our clustered standard errors due to the larger number of variables compared to the number of countries in the *country-sector-time* setup when dropping EMEs.

[41] For example, banks with a higher share of assets in US dollars may be more likely to obtain funding in US dollars.

Third, we assess if the share of bank funding from corporates affects resilience (instead of just focusing on funding from household deposits, other banks, and NBFIs as mapped in Figure 4a), as reliance on (uninsured) corporate deposits appeared to contribute to the vulnerability of certain banks (such as Silicon Valley Bank) in March 2023. Specifically, we repeat the baseline specifications, but include controls for the share of bank funding from corporates—either as the only funding variable of interest, or simultaneously with controls for exposures to other types of funding. In each case, the coefficient on the share of bank funding from corporates is insignificant, and the coefficient sign changes based on which other funding controls are included in the regression. The other key results highlighted above remain unchanged. This suggests that during the *Covid Shock,* bank exposure to corporate funding (including to corporate deposits) did not significantly affect vulnerability.

Fourth, we test for the impact of using three different measures of risk/volatility instead of the US-focused VIX—a sensitivity test that is only relevant for the *country-sector-time* approach. We begin with a broad measure of global volatility: the risk-on-risk-off (RORO) measure from Chari, Dilts-Stedman and Lundblad (2020). This index is computed as the realized variation in global investor risk appetite using the first principal component of a multi-faceted set of daily changes in several standardized asset market variables based on data from the US and the Euro Area.[42] Then we use a measure of the volatility of global stock returns, based on the MSCI all-country-world index (or ACWI). Finally, we use a measure of country-specific stock returns, based on the MSCI country indices. Volatility for these two equity-based measures is calculated as the standard deviation of daily returns over rolling 30-day periods on a daily measure. The correlation of the percent change in the VIX in our sample with the RORO index is 77%, and with the percent change in volatility of global stock returns is 59%, showing that although these measures of volatility move with the VIX—they also capture different aspects of global volatility. When we re-estimate our main regressions using each of these new measures of global or country volatility instead of the VIX, the key results are basically unchanged. A sample of these results—using the RORO measure and country-specific volatility are reported in columns (7)-(10) of Table 8.

Fifth, we explore the impact of using different timing conventions for the regression analysis. Table 8 explores the use of weekly data in columns (11) to (14), where the dependent variable is the weekly (instead of daily) log change in CDS spreads. In columns (11) and (12), we include only full weeks running from Wednesday to Tuesday (i.e., to March 17) and in columns (13) and (14) we lag the VIX by a week (instead of being simultaneous).[43] The key results are robust: banks and (to a lesser extent) corporates more reliant on NBFI funding were more vulnerable, and banks more reliant on household funding were less vulnerable, during the *Covid Shock*.

Finally, we test for the impact of using different windows for the *Covid Shock* in the *country-sector* results. In Table 7, columns (9) and (10) use a shorter window*,* moving the start date to February 24 (from January 1), so that we focus more narrowly on the one-month window before the *Peak Stress* on March

[42] This index includes a range of measures capturing credit risk, risk aversion, and funding liquidity. See Appendix Table B2 for details.

[43] Results are similar if we extend the sample by a few extra days so that it is the exact same window as for the cross-section results (even though the last period is shorter than week).

23.[44] The key results are unchanged. More noteworthy, columns (11) through (14) extend the window of the *Covid Shock* to the end of April 2020 with these two start dates (the beginning of 2020 and 24 February). This is a type of counterfactual experiment to see if the patterns survived after the significant policy interventions at the end of March and early April, interventions which meaningfully reduced the aggregate measures of financial stress (as shown in Figure 1). Several of the key results change significantly in this counterfactual. Specifically, more bank exposure to NBFI funding is no longer correlated with significantly greater financial stress, and more bank exposure to deposit funding is no longer correlated with significantly less stress. Instead, a greater share of bank funding from other banks is correlated with significantly less stress. Also, banks are no longer significantly impacted by the currency of their funding.

These extensions suggest that banking sectors more reliant on NBFI and dollar funding benefited meaningfully from the policy actions taken in late March/early April. More vulnerabilities may have emerged in the banking sector over time if policy support mitigating these vulnerabilities had not been provided. Also noteworthy, the policy support did not appear to alleviate the significant vulnerability of the corporate sector to dollar funding, but did meaningfully reduce the stress experienced by corporates that were more reliant on cross-border funding. Understanding what policy responses caused this reduction in stress for certain sectors and structures is the key question for the next section.

VI. Which Policy Responses Reduced Financial Stress?

After the pandemic began, what alleviated the financial stress experienced by certain countries and sectors at the end of March and early April 2020? Why was the exposure of banks to NBFI funding and US$ funding no longer correlated with significantly greater stress in April? Did banks experience greater reductions in stress because of the adjustments in prudential policy that focused on alleviating constraints on banks—or because of the reforms targeting the specific vulnerabilities? Were policies aimed specifically at the vulnerabilities around NBFI funding or dollar funding more important to deal with the impact of these vulnerabilities than policies aimed at easing broader financial conditions?

This section attempts to answer these questions by testing how different policies enacted in March and April of 2020 (i.e., after CDS spreads spiked) affected the stress related to the funding structures and forms of financial intermediation that were highlighted as increasing vulnerability in the last section. Identifying the impact of different policy responses is challenging, as most countries enacted multiple policies around the same time to address a range of concerns around market liquidity and functioning, as well as to support growth, incomes and employment and slow the spread of the virus. The country-sector framework used in this paper can help solve this identification challenge, however, by isolating the differential impact on specific structures within each sector and country—both over the March-April 2020 window as well as at the high frequency in our daily data. Put slightly differently, our approach allows us to test exactly (1) which policies reduced stress related to specific structures in each sector and (2) which policies "broke the link" between higher global volatility and country-sector stress.

This section begins by discussing the new, high-frequency dataset on policy responses to Covid from Kirti et al. (2022). Then it builds on our earlier framework to test for the impact of policies related to

[44] We have also checked whether our results are robust for choosing another date than March 23, namely confirming that key results are robust to +/-3, 2, or 1 working day perturbations around March 23.

NBFIs, market-based intermediation, swap lines, banking sector regulations, and "economy-wide" policies. Finally, the section reports an extensive series of results and summarizes the implications for policy responses to reduce periods of financial stress in the future.

A. Policy Responses to Covid: The Data

Critical to our analysis of how different policies alleviated the financial stress in different countries and sectors in the spring of 2020 is our ability to integrate our analysis with a new and rich high-frequency dataset from Kirti et al. (2022). This data includes over 5,000 policy announcements classified into 28 granular policy categories for 74 countries on a daily basis during the early stage of the pandemic. The policies cover a wide range of announcements, which we divide into three broad categories: "structure-specific policies", "bank-specific policies", and "economy-wide policies".

Our first group of policy responses, structure-specific policies, are those most likely to affect the vulnerabilities identified in the last section: NBFI policies, market-based measures, and US$ swap lines.[45] The first two could affect the vulnerabilities related to NBFI funding, and the last could affect the vulnerabilities associated with dollar funding (or foreign currency funding). More specifically, the ***NBFI Policies*** are "all prudential measures applied to non-bank financial institutions", which include: modifying reporting requirements, supervisory flexibility, regulatory and capital relief, providing instructions on how to handle customer claims during the pandemic, and placing restrictions on share buy backs and dividend payouts for insurance companies. The ***Market-Based Measures*** are: "regulations on financial market participants or recommended actions in response to Covid" and include rules on short selling, security issuance, and reporting. Since Kirti et al. (2022) does not distinguish tightening and loosening actions for each of these policies, we code each of the responses for these two variables directionally. (For details, see Appendix D.) Finally, the ***US$ Swap Lines*** are US$ swap lines between central banks.[46]

Our second group of policy responses, the "bank-specific policies", target the overall banking sector rather than specific vulnerabilities within the bank (or corporate) sector: changes in prudential regulations and macroprudential buffers. These policies could explain why banks experienced a significant reduction in vulnerability (related to NBFI funding shares and dollar exposures) after the *Peak Stress,* while corporates did not experience a similar decrease in vulnerability (Table 7). More specifically, ***Prudential Regulations*** are any changes in overall prudential policy, including changes in macroprudential buffers, prudential measures related to borrowers, capital requirements, liquidity requirements, and buffer usability, and any adjustments to dividend restrictions, lending standards, reporting requirements, special provisioning rules, and supervisory expectations. This is measured as a dummy variable equal to one if any loosening occurred on a given day (or equal to negative one for any tightening).[47] ***Macroprudential Buffers*** is one subset of these regulations, a dummy variable which records any cuts in the countercyclical capital buffer (CCyB), the capital conservation buffer (CCoB), or the systemic risk buffer (SyRB).

[45] These are from a subset of the policies which Kirti et al. (2022) lumps into their group of "other" policies. There were not enough changes in FX-related macroprudential regulations in our sample to include in the analysis.

[46] Kirti et al. (2022) only record this for the counterparty with a relatively greater need for foreign exchange, but if relative need cannot be determined between the countries, they record the measure for both. All swap lines for the countries in our main sample are for US$, so we are not able to extend the results to swap lines in any currency.

[47] We do not attempt to measure the magnitude of any adjustments in regulations as it is impossible to sum across different measures. We use a dummy variable for each day as often multiple changes are adopted simultaneously on related buffers as part of one policy change (i.e., adjusting liquidity/cyclical and capital buffers).

Our final group of policy responses, the "economy-wide policies", are those which would be more likely to affect the broader economy (albeit could still have differential effects by sector) and include a range of announcements related to monetary policy, fiscal policy, liquidity policy, and regulatory policy.[48] These policies were used by many countries during the *Covid Shock* to support the broader economy, but could also have affected the relationship between funding structures and CDS spreads. More specifically, monetary policy is captured by ***Policy Rate Changes*** (reductions in the main policy rate, with cuts expressed as a positive number) and ***Asset Purchases*** (measured as purchases of securities, such as bonds, stocks and commercial paper in the secondary market by the central bank[49], all as a share of 2019 GDP). ***Fiscal Policy*** is the sum of all fiscal policy measures (as a share of 2019 GDP) and ***Market Liquidity Policy*** is "short-term lending or interventions in asset markets, with the explicit and sole intention of improving short-term market liquidity." For specifications focusing on structure-specific vulnerabilities instead of bank vulnerabilities, we also include ***Prudential Regulations*** as an economy-wide policy, defined as above.

Before testing if these different policies affected the degree of stress experienced in different countries and sectors during the *Covid Shock*, it is helpful to understand the timing and use of these policies in our sample. We focus on the announcements for each policy, which may differ from the implementation date. Figure 5 shows each of the sector-specific policies (in panels A through C), bank-specific policies (in panels D and E), and economy-wide policies (in panels F through I). For each policy, the left graph shows the distribution of individual policy actions from January through July 31, 2020 and the right graph shows the cumulated policy actions for gross loosenings, gross tightenings, and net loosenings. In other words, the left panel shows policy changes, while the right panel shows policy levels.

The figures show that the majority of policy changes were announced in late March, consistent with our use of March 23, 2020 as the date of peak stress that prompted a policy response. Moreover, the period in late March and April is dominated by loosening announcements (i.e., positive bars in the panels on the left-hand side), reflecting the objective of policymakers to ease financial and economic stress (rather than tighten policies with the intention of guarding against additional, unmaterialized risks). The one exception is for the *Market-Based Measures*, which includes several tightening announcements, e.g., increases in reporting requirements or a decrease in the notification threshold for net short positions.

The duration and timing over which each of the policies was used varies significantly. *NBFI Policies, Market-Based Measures, and Macroprudential Buffers* were primarily announced in late March and throughout April, and then rarely after May. *US$ Swap Lines* were announced immediately after the *Covid Shock* and over an even shorter period—primarily on two dates: 15 and 20 March, 2020. In contrast, most economy-wide policies were enacted in late-March/early April, before a pause, and then used again in July (such as for *Asset Purchases* and *Market Liquidity Policy*), and in some cases used more continuously over several months**.** These patterns suggest that some policies were part of a "first line of defence" (the *US$ Swap Lines*, *NBFI Policies*, *Market-Based Measures*, *Macroprudential Buffers, Market Liquidity Policy*, and *Asset Purchases),* while others were relied on more heavily to support the economy after the initial period of extreme financial stress had diminished (such as fiscal, monetary and other prudential policies).

[48] We repeat estimates both with and without controls for changes in prudential policy as one of the "economy-wide" policies, with no meaningful change in the key results.

[49] Purchases made only with the intention to improve market liquidity are not included.

In our empirical specification we focus on the effects on specific structures and intermediaries that are likely to be more affected by specific policies and utilize the daily frequency available in the data to better identify the impact of individual policies announced on different dates.[50]

B. Policy Response to Covid and Financial Stress: Specification

In order to test if the sector-specific, bank-specific and economy-wide policies affected the degree of stress experienced in different countries and sectors during the *Covid Shock*, and to identify the effects when many policies were announced around the same time, we extend the *country-sector* and *country-sector-time* specifications used in the last section. This section outlines the methodology, which uses a range of specifications to capture somewhat different aspects of the potential relationships. Section C then estimates these specifications and discusses the results.

More specifically, we estimate the following specifications for each of the five sector- and bank-specific policies, (using both the *country-sector* and the *country-sector-time* approach), and then a similar set of specifications for the five economy-wide policies (discussed at the end). Tables (9) and (10) report the full set of results for NBFI policies in order to show the range of specifications. Then, Tables (11) and (12) summarize a subset of the key results for the different sector- and bank-specific policies simultaneously in order to facilitate a comparison.[51]

First, column (1) in Table 9 estimates if the policy change was correlated with a reduction in country-level stress:

$$Stress_{i,s} = \alpha + \alpha_s + \beta \boldsymbol{Policy_i} + \gamma \boldsymbol{Controls_i} + \varepsilon_{i,s} , \quad (4)$$

where $Stress_{i,s}$ is the log change in stress (for the sovereign or sector) from March 10 until April 30 (the window used for the tests showing the reduction in stress in Table 7); α_s are the sector dummies (for banks or corporates); $Policy_i$ is one of the policies discussed in Section A for each country *i*; and $Controls_i$ is the number of Covid cases over the same window. For the regressions for *US$ Swap Lines*, we use a shorter window of March 10 until March 30 to capture the much shorter period (of just a few days) when all the swap lines were announced. If the *Policy* reduces stress in each country on average, we expect β<0.

Next, column (2) estimates if the policy change was correlated with a reduction in sector-level stress and add controls for the country dummies[52]:

$$Stress_{i,s} = \alpha_i + \alpha_s + \beta \boldsymbol{Policy_i} * \alpha_s + \gamma \boldsymbol{Controls_i} * \alpha_s + \varepsilon_{i,s} . \quad (5)$$

If the policy reduces stress in the banking or corporate sector, we expect β<0 for the given sector.

Then, columns (3) through (5) test if the policy change is correlated with a reduction in stress from the structural vulnerabilities or in the banking sector as a whole:

[50] Table D1 contains summary statistics for our baseline sample with daily data (e.g., column (1) of Table 10). Table D2 in Forbes et al. (2022) shows that the weekly, time-series correlation between the policy variables is high.
[51] The full set of results for the other structure- and bank-specific policies are in Forbes et al. (2022).
[52] In most cases these results do not change significantly with the country dummies, so we include them to be consistent with the following specifications.

$$Stress_{i,s} = \alpha_i + \alpha_s + \delta \boldsymbol{Structure_i^s} * \alpha_s + \beta \boldsymbol{Policy_i} * \alpha_s + \mu \boldsymbol{Policy_i} * \boldsymbol{Structure_i^s} * \alpha_s + \gamma \boldsymbol{Controls_i} * \alpha_s + \varepsilon_{i,s} . \quad (6)$$

If the policy reduces stress from the specific structure, we expect μ<0 for the given sector, while δ<0 suggests that the policy reduced stress in the sector overall, but not necessarily linked to the specific structure. We estimate equation (6) focusing on vulnerabilities for just banks, just corporates, and then for both sectors simultaneously (continuing to include the sovereign in each specification).

Finally, columns (6) through (8) in Table 9 add controls for the economy-wide policies in order to assess if the reduction in stress corresponded to the economy-wide policies. Column (6) simply adds controls for the economy-wide policies to equation (4), while columns (7) and (8) add the same controls to equation (6) interacted with banking or corporate sector dummies, respectively, allowing the impact of each policy (including the economy-wide policies) to vary by sector.[53] If any of the economy-wide policies reduce stress in each country on average, we would expect the corresponding coefficient to be negative. Equally important, if any significant effects of the structure-specific (or bank-specific) policies remain significant (in the μ and δ coefficients), this suggests that the estimated effects were not driven by the economy-wide policies.

These specifications in equations (4) through (6) correspond to the *country-sector* results in equation (2). As also discussed in Section V, however, the daily frequency of our data also allows us to estimate and identify relationships based on the time-series dimension. Therefore, we also estimate a corresponding series of *country-sector-time results*, building on equation (3), to better capture how specific policies affected the relationship between stress and the structures and sectors in our sample.

An example of these results is shown in Table 10 for NBFI policies. Column (1) begins by estimating if the policy change was correlated with a reduction in country-level stress at the higher daily frequency *t*, including controls for country- and sector- effects over the full period (as done above):

$$Stress_{i,s,t} = \alpha_i + \alpha_s + \beta \boldsymbol{Policy_{i,t}} + \gamma \boldsymbol{Controls_{i,t}} * \alpha_s + \varepsilon_{i,s,t} \quad (7)$$

We estimate these relationships over the window from March 23 through April 30, including the early period in order to estimate relationships before the period of active policy responses. If the *Policy* reduces stress in countries on average immediately after being announced, we expect β<0.

Next, column (2) tests if the policy change was correlated with a reduction in sector-level stress, while including country-time and sector-time dummies:

$$Stress_{i,s,t} = \alpha_{i,t} + \alpha_{s,t} + \beta \boldsymbol{Policy_{i,t}} * \alpha_s + \gamma \boldsymbol{Controls_{i,t}} * \alpha_s + \varepsilon_{i,s,t} \quad (8)$$

If the policy reduces stress in the banking or corporate sector immediately after it was announced, we would expect β<0 for the given sector.

Then columns (3) through (5) test if the policy change is correlated with a reduction in stress from the structural vulnerabilities or in the banking sector at this higher frequency and while controlling for changes in overall risk:

[53] We do not include banks and corporates simultaneously in this specification due to limited degrees of freedom.

$$Stress_{i,s,t} = \alpha_{i,t} + \alpha_{s,t} + \delta \boldsymbol{Structure}_{\boldsymbol{i}}^{\boldsymbol{s}} * \alpha_s + \beta \boldsymbol{Policy}_{\boldsymbol{i,t}} * \alpha_s + \mu \boldsymbol{Policy}_{\boldsymbol{i,t}} * \boldsymbol{Structure}_{\boldsymbol{i}}^{\boldsymbol{s}} * \alpha_s + \emptyset \Delta vix_{t-1} \boldsymbol{Structure}_{\boldsymbol{i}}^{\boldsymbol{s}} * \alpha_s + \gamma \boldsymbol{Controls}_{\boldsymbol{i,t}} * \alpha_s + \varepsilon_{i,s,t}\ , \quad (9)$$

where Δvix_{t-1} is the lagged percent change in the VIX. We estimate equation (9) for just banks, just corporates, and then both sectors simultaneously. If the policy reduces stress from the specific structure at this high frequency, we expect $\mu<0$ for the given sector, while $\beta<0$ suggests that the policy reduced stress in the sector overall, but not necessarily linked to the specific structure.

Finally, columns (6) through (8) repeat these results with additional controls for the economy-wide policies in order to assess if the reduction in stress corresponded to the economy-wide policies, as well as if any earlier results were driven by economy-wide policies adopted around the same time. If any of the economy-wide policies reduce stress in the bank or corporate sector after controlling for the other structure- or bank-specific policies, we would expect the corresponding coefficient to be negative. Equally important, if any significant effects of the structure-specific (or bank-specific) policies from equation (9) remain significant (in the μ and β coefficients), this suggests that the estimated effects were not driven by the economy-wide policies.

C. Policy Responses to Covid: Results

Tables 9 through 12 report the results of this extensive series of tests of whether different policy responses to the *Covid Shock* significantly mitigated stress in different sectors with certain exposures in March and April of 2020. We focus on estimates of the impact of the three structure-specific policies (*NBFI Policies*, *Market-Based Measures*, and *US$ Swap Lines*) that would be more likely to impact the two key vulnerabilities related to NBFI and dollar funding, and then on the impact of two bank-specific policies (*Prudential Regulations* and *Macroprudential Buffers*) that would be more likely to affect the sector which experienced the significant reduction in vulnerability during April 2020. For each of these five policies, we also include controls for changes in economy-wide policies, and there is one table with the *country-sector* results (equations (4) to (6)) and a second table with the *country-sector-time* results (equations (7) to (9)).

We begin with policies focused on supporting NBFIs, with key results in Tables 9 and 10. The estimates based on the *country-sector* results (Table 9) indicate that a loosening in *NBFI Policies* was correlated with a significant reduction in country-level spreads (column (1)) over March 10 to April 30. Estimates of the impact on different sectors that do not control for the exposure to NBFIs suggest that this reduction in country-level stress may reflect an impact of *NBFI Policies* on the corporate sector (column (2)), but when also controlling for the exposure of each sector to NBFIs, the estimates show that *NBFI Policies* worked by significantly lowering the spreads of banks that were more reliant on NBFI funding (columns (3) to (5)). There was some corresponding benefit to all corporates (independent of NBFI exposure), but the reduction in corporate spreads becomes insignificant. Also important, all results are robust to controlling for a range of economy-wide policies (*Policy Rate Changes, Asset Purchases, Fiscal Policy, Market Liquidity Policy* and *Prudential Regulations*), in columns (6) to (8). It is noteworthy that none of the economy-wide policies correspond to a significant reduction in spreads across all of the specifications, while the *NBFI Policies* consistently correspond to a significant reduction in spreads for the country as a whole, driven by banks with more NBFI exposure, in each of the specifications.

Table 10 repeats the corresponding tests for the impact of *NBFI Policies*, while incorporating the time-series dimension available in our daily data, plus controls for changes in global risk interacted with NBFI funding vulnerabilities in some specifications. The results are very similar—although there is now

evidence that *NBFI Policies* reduced spreads for both corporates, as well as banks, with greater NBFI exposure. More specifically, a loosening in *NBFI Policies* is correlated with a significant reduction in country-level spreads (column (1)) when only controlling for country- and sector-effects and the interaction of Covid cases with each sector. When allowing the effects to vary by sector, *NBFI Policies* cause a larger reduction in corporate spreads than banking spreads (although both effects are now significant in column (2)), and works by significantly reducing the spreads of both banks and corporates with greater NBFI exposure (columns (3) to (5)). These results continue to be significant when controlling for the economy-wide policies, with no consistent effects of the economy-wide policies on spreads in the economy overall, or just the bank or corporate sectors (columns (6) to (8)).

Next, Tables 11 and 12 report a subset of these results for other policies using the *country-sector* and *country-sector-time* approach, respectively. For reasons of brevity, we report the key columns (5), (7) and (8) of Tables 9 and 10 for each policy.[54] Results for *Market-Based Measures* (instead of *NBFI Policies*) are shown in columns (4) to (6) of each table. These policies could not only reduce stress for the economy overall, but also have more impact on institutions with more exposure to NBFIs, as more NBFI transactions occurred through the markets that are affected by these policies. The estimated impact of these *Market-Based Measures* on spreads, however, varies across estimation approaches. The *country-sector* results in Table 11 suggest that the impact of *Market-Based Measures* is smaller and less consistently significant than for the *NBFI* policies, although usually still negative. More specifically, the *Market-Based Measures* are not correlated with a significant reduction in spreads in entities more exposed to NBFIs. In contrast, however, the *country-sector-time* results in Table 12 find somewhat stronger effects of these *Market-Based Measures* on spreads, especially through banks more exposed to NBFIs (as found for all the results focusing on *NBFI Policies*). The stronger results for the estimates incorporating the time-series dimension (as found for corresponding results assessing the impact of *NBFI Policies)* supports our hypothesis that the higher frequency data is useful to help identify the impact of different policies during this volatile period.

As a final analysis of structure-specific policies, we assess the impact of the *US$ Swap Lines*. Since these policies were enacted over a much narrower window (mostly on 15 and 20 March, 2020), we modify our framework slightly. For the *country-sector* results, we focus on changes in spreads from March 10 to 30 (with changes in the *country-sector-time* approach discussed below). Also, instead of focusing on whether the policies differentially affected banks and corporates which were more reliant on NBFI funding (a characteristic that was most relevant when assessing the impact of the other *structure-based measures*), we focus on whether the policies differentially affected institutions which were more reliant on FX funding. The results from the *country-sector* analysis are shown in columns (7) to (9) of Table 11. Column (8) shows that the announcement of swap lines is correlated with a significant reduction in the spreads of banks more reliant on US$ funding when simultaneously controlling for the economy-wide policies. This is consistent with the swaps working as expected and having a greater effect on banks.

Perhaps more informative given the narrow window over which the US$ swap lines were announced is the *country-sector-time* approach. We modify our standard approach slightly to add additional terms to test if the US$ swap lines "broke-the link" between changes in the VIX and country-spreads when controlling for the FX exposure of the given country-sector. For this purpose, we code US$ swap lines as a policy *level* dummy which takes the value of 1 from the day swap lines were enacted and 0 otherwise. This is a clean test that is possible due to the high frequency of our data and the expectation

[54] The full set of results can be found in an earlier working paper version (see Forbes et al. 2022).

that the US$ swap lines would have an immediate impact on the spreads of the most exposed sectors. The results are shown in columns (7) to (9) of Table 12. The results suggest that swap lines worked primarily through reducing stress in banks with greater US$ exposures, with less impact for corporates with greater US$ exposure (This corresponds to the results in columns (11) to (14) of Table 7, which show a reduction in spreads for banks with US$ exposure, but not corporates, when including the period over which swap lines may have had an effect on CDS spreads).

Our next set of results shifts from assessing the impact of structure-specific policies to bank-based policies. This builds on the results in the last section that banks with certain exposures (to NBFI funding and dollar funding) tended to be more vulnerable during the *Covid Shock*, with more mixed results on whether corporates with similar exposures were more vulnerable. This focus on bank-based policies is also useful as it can be easier to implement policies targeting banks—which are already highly regulated—rather than broader policies which cover sectors and institutions that are less regulated or subject to regulatory oversight by different institutions. We focus on two types of bank-specific regulations (defined above): the broad category of *Prudential Regulations* and the narrower policy of changes in *Macroprudential Buffers.* We also use the same time period and methodology as used to analyze the *NBFI policies* and *Market-Based Measures* (instead of the shorter window used for the US$ swap lines).

The results for changes in *Prudential Regulations* using the *country-sector* and *country-sector-time* approach are reported in columns (10) to (12) of Tables 11 and 12, respectively. Results for the *Macroprudential Buffers* are very similar, so we do not include the additional results. Changes in *Prudential Regulations* (and *Macroprudential Buffers*) appear to reduce the CDS spreads for banks and corporates—as would be expected—but this effect is rarely significant. This lack of a significant relationship between *Prudential Regulations* (and *Macroprudential Buffers*) and the resilience of banks or corporates during the *Covid Shock* is a sharp contrast to the consistently significant relationship with *NBFI policies* (and to a lesser extent some *market-based policies* and *US$ swaps*). This suggests that these policies targeting banks were less effective than the structure-specific policies at reducing stress related to the vulnerabilities that are a focus of this analysis.

As a final set of tests, we have replicated the analysis in Tables 11 and 12, but instead of testing for the impact of sector-specific or bank-focused policies, tested for the impact of the five economy-wide policies. In each case, we estimated the impact of these policies on each sector overall, and then for each sector based on the exposure to NBFIs or US dollars (as done above). The resulting estimates (not reported) show no consistent patterns and do not provide notable evidence that the economy-wide policies significantly reduced stress specifically related to NBFI or US dollar exposures. This does not imply that these economy-wide policies had no impact, as they likely supported the economy in other important ways. Instead, the results suggest that these economy-wide policies did not reduce the specific forms of stress captured by CDS markets related to exposure to NBFIs or US dollar funding during the *Covid Shock*.

To summarize, the results in this section show that some structure-specific policies were effective at alleviating the specific forms of financial stress identified earlier in the paper. More specifically, policies aimed at supporting NBFIs significantly reduced the stress experienced by banks (and for corporates in some specifications) that were more reliant on NBFI funding. New US$ swap lines also significantly reduced the stress related to FX funding by banks. Moreover, policies aimed at supporting market-based financial intermediation reduced the stress experienced by banks that were more reliant on NBFI funding in some specifications (namely those utilizing the time-series dimension), but with more mixed results.

These structure-specific policies appeared to be more effective at reducing the forms of stress identified in this paper than policies easing general regulations on banks or that focused on supporting the broader economy. These structure-specific policies also had significant effects even after controlling for a range of economy-wide policies (such as reducing interest rates, asset-purchase programs, liquidity support policies, and fiscal policy), suggesting that the economy-wide policies may not have mitigated the specific forms of stress related to NBFI and US$ exposures in the banking sector, even if they supported the economy through other channels.

VII. Conclusions

Financial market volatility increased sharply in March 2020, with many measures of financial stress jumping to their highest levels since the 2008/9 Global Financial Crisis (or even worse). This paper focuses on one aspect of this stress—changes in CDS spreads for sovereigns, corporates, and banks. While these measures jumped sharply in March 2020, there was a large variation in the vulnerability of different countries and sectors. The paper provides evidence on how different funding structures were related to these different fragilities, and which policy responses helped mitigate these structural vulnerabilities.

We find that the source and currency of funding were significantly correlated with resilience during the *Covid Shock* in March 2020, with more mixed evidence on the role of the instrument and counterparty location of funding. More specifically, banks with a higher share of funding from household deposits were significantly more resilient, and banks that relied more on non-bank financial institutions (NBFIs) were less resilient. Banks, and to some extent corporates, with a higher share of funding in US$ were also significantly less resilient. In contrast, there is only weak evidence on whether funding through loans (instead of debt markets) was associated with resilience, and no consistent evidence that funding domestically (instead of cross-border) was related to resilience for either banks or corporates.

These results support previous literature on the potential vulnerabilities from different funding structures, but provide the first evidence of how these vulnerabilities matter across sectors. They also provide new granularity on the relative importance of different vulnerabilities—such as whether borrowing in dollars is more/less risky than borrowing from abroad. These results are also one of the first tests of whether the macroprudential reforms adopted over the last decade improved resilience in different sectors to a severe risk-off shock, and whether the corresponding changes in funding structures and forms of intermediation (such as the growth of “shadow” banking) may have increased vulnerabilities in unexpected ways.

The key findings have important implications for the priorities of future policy reforms. While many of the macroprudential reforms adopted since the 2008/9 Global Financial Crisis increased the resilience of banks, they also shifted more financial intermediation from banks to NBFIs, and the results in this paper suggest that entities with a larger share of funding from NBFIs (especially dollar funding) were less resilient to the *Covid Shock*. This supports policy efforts to widen the perimeter for macroprudential regulation to include not just banks, but segments of the NBFI sector which contributed to these vulnerabilities. The results also support efforts in some countries to reduce reliance on foreign currency funding, as this appears to impact resilience in both the banking and corporate sectors.

Closely related, the results provide some evidence that the currency of the funding was more important than the nationality of the counterparty (even though they are highly correlated) for the resilience of corporates—and especially banks—to the *Covid Shock*. More specifically, when banks (and to some extent corporates) had a higher share of funding in dollars, they generally experienced significantly more financial stress. In contrast, there is less evidence on whether a higher share of funding from abroad was associated with greater vulnerability (when controlling simultaneously for currency exposures). This has important implications for how to reduce vulnerabilities in the future. The results suggest that regulations such as capital controls (that focus on the residency of the parties to the transaction) would be less effective than macroprudential FX regulations (which focus on the currency of the transaction) for increasing resilience.[55]

The paper also goes a step further to analyze which policy responses were most effective in mitigating the financial stress around these two key vulnerabilities: funding from NBFIs and in foreign currency. The results suggest that structure-specific policies (especially those targeting NBFIs and US$ swap lines) were most effective at alleviating these specific forms of financial stress in banks. These targeted policies had significant effects even after controlling for a range of macroeconomic policies aimed at supporting the broader economy—such as lower interest rates, asset purchases, measures supporting market liquidity, and fiscal stimulus. These structure-specific policies also appeared to be more effective at reducing these specific forms of stress than policies focused on supporting banks more broadly (e.g., adjusting prudential regulations or macroprudential buffers). This raises an important question: when key vulnerabilities contributing to financial stress can be identified and there are not yet strong spillovers to the broader economy, could authorities rely on policies addressing these specific vulnerabilities in lieu of easing broader regulations or other forms of support?

The establishment of more targeted policies will take time and require answering a number of difficult questions. How should these policies be aligned with existing regulations to create a level-playing field for different forms of intermediation? If the growth of the NBFI sector is partly driven by tighter regulations on banks, would regulations targeting other financial intermediaries generate their own leakages? And lastly, what is the right balance for policymakers between costly *ex ante* interventions (such as more targeted prudential frameworks) whose benefits may be uncertain at the time of implementation, and *ex post* interventions, which could prove even more distortionary by generating moral hazard and a greater buildup of risks in vulnerable sectors? The answers to these questions could provide policymakers with a richer toolset to tackle complex crisis situations, such as when the economy is repeatedly hit by adverse shocks or when financial and macroeconomic objectives appear in conflict.

[55] Also see Ahnert et al. (2021) for similar implications.

References

Acharya, Viral, Robert Engle, and Sascha Steffen. (2021). "What Explains the Crash of Bank Stock Prices during Covid-19?" Unpublished mimeo. Available at: https://abfer.org/media/abfer-events-2021/annual-conference/papers-immb/AC21P1058_What-explains-the-crash-of-bank-stock-prices-during-COVID-19.pdf

Ahnert, Toni, Kristin Forbes, Christian Friedrich, and Dennis Reinhardt. (2021). "Macroprudential FX Regulations: Shifting the Snowbanks of FX Vulnerability?" *Journal of Financial Economics* 140:145-174.

Alam, Zohair, Adrian Alter, Jesse Eiseman, Gaston Gelos, Heedon Kan, Machiko Narita, Erlend Nier, and Naixi Wang. (2019). "Digging Deeper: Evidence on the Effects of Macroprudential Policies from a New Database." *IMF Working Paper No. 19/66.*

Aldasoro, Inaki, Wenqian Huang, and Esti Kemp. (2020). "Cross-border Links between Banks and Non-bank Financial Institutions." *BIS Quarterly Review,* September, pages 61-74.

Alfaro, Laura, Mauricio Calani, and Liliana Varela. (2021). "Currency Hedging: Managing Cash Flow Exposure." *NBER Working Paper No. 28910*.

Aramonte, Siro, Andreas Schrimpf, and Hyun Song Shin. (2022). "Non-bank Financial Intermediaries and Financial Stability." *CEPR Discussion Papers No 16962*.

Bank for International Settlements (BIS). (2021). "International Banking and Financial Market Developments." *Quarterly Review*, June.

Beck, Thorsten and Jan Keil. (2021). "Are Banks Catching Corona? Effects of COVID on Lending in the U.S." *CEPR Discussion Paper No. 15869*.

Berger, Allen N. and Asli Demirgüç-Kunt. (2021). "Banking Research in the Time of COVID-19." *Journal of Financial Stability* 57(C).

Berndt, Antje, Rohan Douglas, Darrell Duffie and Mark Ferguson. (2018). "Corporate Credit Risk Premia." *Review of Finance* 22(2, March): 419-454.

Caparusso, John and Bryan Hardy. (2022). "Bank Funding: Evolution, Stability and the Role of Foreign Offices." *BIS Quarterly Review,* September.

Carstens, Agustín. (2021) "Non-bank Financial Sector: Systemic Regulation Needed." *BIS Quarterly Review*, December, pages 1-6.

Cerutti, Eugenio, Stijn Claessens, and Luc Laeven. (2017). "The Use and Effectiveness of Macroprudential Policies: New Evidence." *Journal of Financial Stability* 28: 203-224.

Cesa-Bianchi, Ambrogio and Fernando Eguren-Martin. (2021). "Dash for Dollars." *CEPR Discussion Paper No. 16415*.

Chari, Anusha. (2022). "Global Risk, Non-Bank Financial Intermediation, and Emerging Market Vulnerabilities". Available at SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4224722.

Chari, Anusha, Karlye Dilts Stedman, and Kristin Forbes. (2022). "Spillovers at the Extremes: The Macroprudential Stance and Vulnerability to the Global Financial Cycle." *Journal of International Economics* 136 (May):103582.

Chari, Anusha, Karlye Dilts Stedman, and Christian Lundblad. (2020). "Capital Flows in Risky Times: Risk-on/Risk-off and Emerging Market Tail Risk." *NBER Working Paper 27927.* October.

Chen, David and Christian Friedrich. (2021). "The Countercyclical Capital Buffer and International Bank Lending: Evidence from Canada." *Bank of Canada Staff Working Paper No. 21-61*.

Claessens, Stijn, Giulio Cornelli, Leonardo Gambacorta, Francesco Manaresi, and Yashushi Shiina. (2021). "Do Macroprudential Policies Affect Non-bank Financial Intermediation?" *BIS Working Paper No. 927*.

Czech, Robert, Bernat Gual-Ricart, Joshua Lillis, and Jack Worlidge. (2021). "The Role of Non-Bank Financial Intermediaries in the 'Dash for Cash' in Sterling Markets." *Bank of England Financial Stability Paper No. 47*.

Daehler, Timo, Joshua Aizenman, and Yothin Jinjarak. (2020). "Emerging Markets Sovereign Spreads and Country-Specific Fundamentals During Covid-19." *NBER Working Paper No. 27903.*

Demirgüç-Kunt, Asli, Alvaro Pedraza, and Claudia Ruiz-Ortega. (2021). "Banking Sector Performance during the COVID-19 Crisis." *Journal of Banking & Finance 133(C)*.

Diamond, Douglas W. and Philip H. Dybvig. (1983). "Bank Runs, Deposit Insurance, and Liquidity." *Journal of Political Economy* 91(3): 401-419.

Eguren-Martin, Fernando, Mark Joy, Claudia Maurini, Alessandro Moro, Valerio Nispi Landi, Alessandro Schiavone and Carlos van Hombeeck. (2020). "Capital Flows During the Pandemic: Lessons or a More Resilient International Financial Architecture." *Banca d'Italia Occasional Paper No. 589.*

Eisfeldt, Andrea, Bernard Herskovic, Sriram Rajan, and Emil Siriwardane. (2022). "OTC Intermediaries." *The Review of Financial Studies* (forthcoming).

English, William, Kristin Forbes, and Angel Ubide. (2021). "Monetary Policy and Central Banking in the Covid Era." CEPR e-book. Available at:
https://voxeu.org/content/monetary-policy-and-central-banking-covid-era

Eren, Egemen and Philip Wooldridge. (2021). "Non-bank Financial Institutions and the Functioning of Government Bond Markets." *BIS Working Paper No. 119*.

Eren, Egemen, Andreas Schrimpf, and Vladyslav Sushko. (2020a). "US Dollar Funding Markets during the Covid-19 Crisis – The Money Market Fund Turmoil." *BIS Bulletin No. 14.*

Eren, Egemen, Andreas Schrimpf, and Vladyslav Sushko. (2020b). "US Dollar Funding Markets during the Covid-19 Crisis – The International Dimension." *BIS Bulletin No. 15*.

Falato, Antonio, Itay Goldstein, and Ali Hortaçsu. (2020). "Financial Fragility in the COVID-19 Crisis: The Case of Investment Funds in Corporate Bond Markets." *NBER Working Paper No. 27559.*

Financial Stability Board (FSB). (2020a). "Holistic Review of the March Market Turmoil." November. Available at: https://www.fsb.org/wp-content/uploads/P171120-2.pdf

Financial Stability Board (FSB). (2020b). "Global Monitoring Report on Non-Bank Financial Intermediation." December. Available at: https://www.fsb.org/wp-content/uploads/P161220.pdf

Forbes, Kristin. (2021). "The International Aspects of Macroprudential Policy." *Annual Review of Economics* 13(Aug): 203-228.

Forbes, Kristin, Christian Friedrich, and Dennis Reinhardt. (2022). "Stress Relief? Financial Structures and Resilience to the Covid Shock." *Bank of England Staff Working Paper No. 1,003.* (November).

Galati, Gabriele and Richhild Moessner. (2013). "Macroprudential Policy – A Literature Review." *Journal of Economic Surveys* 27(5): 846-878.

Gertler, Mark, Nobuhiro Kiyotaki, and Andrea Prestipino. (2016). "Wholesale Banking and Bank Runs in Macroeconomic Modeling of Financial Crises," Handbook of Macroeconomics, in: J. B. Taylor and Harald Uhlig (ed.), *Handbook of Macroeconomics* 1 (2), Elsevier, Chapter 0: 1345-1425.

Giese, Julia and Andy Haldane. (2020). "COVID-19 and the Financial System: A Tale of Two Crises." *Oxford Review of Economic Policy* 36(Supplement): 200-214.

Goldberg, Linda and Fabiola Ravazzolo. (2021). "The Fed's international Dollar Liquidity Facilities: New Evidence on Effects." *Federal Reserve Bank of New York, Staff Report No. 997.*

Haddad, Valentin, Alan Moreira, and Tyler Muir. (2021). "When Selling Becomes Viral: Disruptions in Debt Markets in the COVID-19 Crisis and the Fed's Response." *The Review of Financial Studies* 34(11): 5309-5351.

Hasan, Iftekhar, Miriam Marra, Thomas Y. To, Eliza Wu, and Gaiyan Zhang, 2023. "COVID-19 Pandemic and Global Corporate CDS Spreads," *Journal of Banking & Finance*, 147(C).

Hofmann, Boris, Ilhyock Shim, and Hyun Song Shin. (2020). "Emerging Market Economy Exchange Rates and Local Currency Bond Markets Amid the Covid-19 Pandemic." *BIS Bulletin No. 5*.

Hofmann, Boris, Nikhil Patel, and Steve Pak Yeung Wu. (2022). "Original Sin Redux: a Model-based Evaluation." *BIS Working Paper No. 1004*.

Keller, Lorena. (2019). “Capital Controls and Risk Misallocation: Evidence from a Natural Experiment.” Unpublished mimeo. Available at: https://rodneywhitecenter.wharton.upenn.edu/wp-content/uploads/2019/12/10-19.Keller.pdf

Kirti, Divya, Yang Liu, Soledad Martinez Peria, Prachi Mishra, and Jan Strasky. (2022). “Tracking Economic and Financial Policies during COVID-19: An Announcement-Level Database.” *IMF Working Paper No. 22/114*.

McGuire, Patrick and Goetz von Peter. (2016). “The Resilience of Banks' International Operations.” *BIS Quarterly Review*, 6 March 2016.

Mrkaic, Mico, Minsuk Kim, and Rui Mano. (2020). “Do FX Interventions Lead to Higher FX Debt? Evidence from Firm-Level Data.” *IMF Working Paper No. 20/197*.

Organisation for Economic Co-operation and Development (OECD). (2020). “Collection of Data on Non-bank Financial Intermediation and Other Relevant Trends in the Financial World in the National Accounts.” Available at: https://www.oecd.org/statistics/data-collection/Guidelines-on-Non-Bank-Financial-Intermediation.pdf

Shin, Hyun Song. (2009). “Reflections on Northern Rock: The Bank Run That Heralded the Global Financial Crisis.” *Journal of Economic Perspectives* 23(1): 101-119.

Shin, Hyun Song. (2013). “The Second Phase of Global Liquidity and its Impact on Emerging Economies.” *Proceedings*, Federal Reserve Bank of San Francisco. November, pages 1-10.

Stein, Jeremy. (2013). “Overheating in Credit Markets: Origins, Measurement, and Policy Responses.” Speech at the "Restoring Household Financial Stability after the Great Recession: Why Household Balance Sheets Matter" research symposium by Governor Jeremy C. Stein on February 07, 2013. Available at: https://www.federalreserve.gov/newsevents/speech/stein20130207a.htm

Temesvary, Judit and Andrew Wei. (2021). “Domestic Lending and the Pandemic: How Does Banks’ Exposure to Covid-19 Abroad Affect Their Lending in the United States?” Board of Governors of the Federal Reserve System (U.S.), *Finance and Economics Discussion Series Paper No. 2021-056r1*.

Vissing-Jorgensen, Annette. (2021). “The Treasury Market in Spring 2020 and the Response of the Federal Reserve.” *NBER Working Paper No. 29128*.

Table 1
Financial Intermediation and Internationalization: Variables, Channels and Correlations

Sector	Variable	Channel in Figure 4	Expected relation with Covid stress[1]	Correlation and Significance[2]
Intermediation				
Banks	*Household liabilities/total liabilities*	1/(1+2+3)	-	-1.389**
Source				
	Bank liabilities/total liabilities	2/(1+2+3)	?	0.460
	NBFI liabilities / total liabilities	3/(1+2+3)	+	2.573**
Instrument	*Loans / total liabilities*	(1+2a+3a)/ (1+2+3)	-	-1.85***
	NBFI loans / total liabilities to NBFIs	3a/3	-	0.47
Corporates	*Bank liabilities / total liabilities*	4/(4+5)	-	-0.582
Source				
	NBFI liabilities[3] / total liabilities	5/(4+5)	+	0.582
Instrument	*Bank loans / total liabilities to banks*	4a/4	-	-0.694
Internationalization				
Banks	*US$ liabilities / total liabilities[4]*	I/(I+II)	+	0.719
Currency				
Counterparty location	*Cross-border liabilities / total liabilities*	I/(I+II)	+	0.92
Corporates	*US$ liabilities / total liabilities[4]*	III/(III+IV)	+	1.02*
Currency				
Counterparty location	*Cross-border liabilities / total liabilities*	III/(III+IV)	+	0.197

Notes: See Appendix B for detailed definitions, sources and sample statistics for each variable. (1) A "+" sign indicates more stress, i.e., a greater increase in CDS spreads. A "?" signifies that theory suggests channels so that the relationship could go in either direction, or is neutral relative to the other variables. (2) *, **, and *** indicates significance at the 10%, 5%, and 1% levels, respectively. (3) Data on NBFI liabilities of corporates is not available, so this is calculated as total liabilities less claims from banks, and therefore perfectly correlated with bank liabilities/total liabilities. (4) This is international debt issuance by countries' nationals (and not just residents) and therefore includes issuance by offshore affiliates.

Table 2 - Financial *Intermediation* and Stress: *Country-sector* Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Banks' HH Liabilities*sector_bank	-1.56***				-2.35***					
	(0.48)				(0.74)					
Banks' Bank Liabilities*sector_bank		1.90**			-0.67	0.29				
		(0.77)			(0.88)	(1.01)				
Banks' NBFI Liabilities*sector_bank			2.72***			2.47*	2.67**			
			(0.91)			(1.35)	(0.96)			
Corporates' NBFI Liabilities*sector_corp				0.36	0.57	0.37	0.36			
				(0.51)	(0.47)	(0.45)	(0.44)			
Loan Share of Banks' All Sector Liabilities*sector_bank								-2.04**		-1.44*
								(0.74)		(0.82)
Loan Share of Corporates' Bank Liabilities*sector_corp									-0.36	-0.37
									(2.58)	(2.48)
sector_bank	0.10	-0.79***	-0.69***	-0.40***	0.50	-0.80***	-0.76***	1.38*	-0.48***	0.73
	(0.20)	(0.19)	(0.24)	(0.13)	(0.47)	(0.19)	(0.19)	(0.68)	(0.14)	(0.68)
sector_corp	-0.33**	-0.31*	-0.32*	-0.47	-0.57**	-0.48*	-0.47*	-0.32*	-0.16	-0.16
	(0.13)	(0.18)	(0.18)	(0.27)	(0.22)	(0.24)	(0.24)	(0.18)	(2.23)	(2.14)
New Covid Cases per 100k*sector_bank	0.02	-0.02	0.01	0.02	0.03	0.03	0.03	-0.01	0.05	0.04
	(0.03)	(0.06)	(0.06)	(0.04)	(0.02)	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)
New Covid Cases per 100k*sector_corp	0.13**	0.12*	0.13*	0.11*	0.11	0.12*	0.12*	0.12*	0.17**	0.17**
	(0.06)	(0.07)	(0.07)	(0.06)	(0.07)	(0.06)	(0.06)	(0.07)	(0.08)	(0.07)
Observations	*56*	*66*	*66*	*56*	*54*	*56*	*56*	*66*	*55*	*55*
R-squared	*0.77*	*0.65*	*0.65*	*0.69*	*0.76*	*0.74*	*0.74*	*0.64*	*0.69*	*0.71*
Number Countries	*21*	*25*	*25*	*21*	*20*	*21*	*21*	*25*	*21*	*21*
Adjusted R-squared	*0.585*	*0.366*	*0.361*	*0.424*	*0.521*	*0.482*	*0.499*	*0.356*	*0.429*	*0.443*

Notes: The table shows the estimated parameter values from a panel regression of equation (2) testing the relationship between different forms of financial *intermediation* (the funding source or instrument) and financial stress. All columns include country and sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively). Standard errors are clustered at the country level. The dependent variable measuring financial stress is the log change in sector-specific CDS during the *Covid Shock* (Jan 1 to Mar 23, 2020). See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 3 - Financial *Intermediation* and Stress: *Country-sector-time* Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Banks' HH Liabilities*sector_bank*Δvix	-0.28**				-0.43***					
	(0.10)				(0.14)					
Banks' Bank Liabilities*sector_bank*Δvix		0.17			-0.22	-0.06				
		(0.13)			(0.19)	(0.17)				
Banks' NBFI Liabilities*sector_bank*Δvix			0.45**			0.48**	0.44**			
			(0.18)			(0.23)	(0.20)			
Corporates' NBFI Liabilities*sector_corp*Δvix				-0.03	0.00	-0.03	-0.02			
				(0.08)	(0.10)	(0.08)	(0.07)			
Banks' HH Liabilities*sector_bank	-0.02**				-0.04***					
	(0.01)				(0.01)					
Banks' Bank Liabilities*sector_bank		0.02			-0.01	0.00				
		(0.01)			(0.01)	(0.01)				
Banks' NBFI Liabilities*sector_bank			0.03*			0.03	0.03*			
			(0.02)			(0.02)	(0.02)			
Corporates' NBFI Liabilities*sector_corp				0.01	0.02**	0.01*	0.01*			
				(0.01)	(0.01)	(0.01)	(0.01)			
Loan Share of Banks' All Sector Liabilities*sector_bank*Δvix								-0.11		-0.03
								(0.14)		(0.18)
Loan Share of Corporates' Bank Liabilities*sector_bank*Δvix									-0.07	-0.07
									(0.41)	(0.41)
Loan Share of Banks' All Sector Liabilities*sector_bank								-0.04***		-0.03***
								(0.01)		(0.01)
Loan Share of Corporates' Bank Liabilities*sector_bank									0.00	0.00
									(0.03)	(0.03)
New Covid Cases per 100k (daily)*sector_bank	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
New Covid Cases per 100k (daily)*sector_corp	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fixed effects					Country-time, Sector-time					
Observations	*3,136*	*3,696*	*3,696*	*3,136*	*3,024*	*3,136*	*3,136*	*3,696*	*3,080*	*3,080*
R-squared	*0.74*	*0.71*	*0.71*	*0.73*	*0.74*	*0.74*	*0.74*	*0.71*	*0.72*	*0.72*
Number	*21*	*25*	*25*	*21*	*20*	*21*	*21*	*25*	*21*	*21*
Adjusted R-squared	*0.538*	*0.498*	*0.501*	*0.532*	*0.542*	*0.535*	*0.536*	*0.499*	*0.510*	*0.511*

Notes: The table shows the estimated parameter values from a panel regression of equation (3) testing the relationship between different forms of financial *intermediation* (the funding source or instrument) and financial stress. All columns include country-time and sector-time fixed effects; *sector_bank* and *sector_corp* are bank and corporate sectoral dummies respectively. Standard errors are clustered at the country level. The dependent variable measuring financial stress is the daily log change in CDS. The sample period is Jan 1 to Mar 23, 2020. See Appendix B for detailed definitions, sources and ample statistics for each variable. VIX interactions are shown in bold.

Table 4 - *Internationalization* and Stress: *Country-sector* Results

	(1)	(2)	(3)	(4)	(5)
Banks' US$ Liabilities*sector_bank	2.18**				2.40***
	(0.80)				(0.63)
Banks' Cross-border Liabilities*sector_bank		1.80***			0.97
		(0.61)			(0.63)
Corporates' US$ Liabilities*sector_corp			0.37		2.16**
			(1.02)		(0.77)
Corporates' Cross-border Liabilities*sector_corp				-0.00	-0.28
				(0.37)	(0.35)
sector_bank	-0.72***	-0.79***	-0.37*	-0.31	-0.93***
	(0.15)	(0.16)	(0.19)	(0.19)	(0.13)
sector_corp	-0.30*	-0.32*	-0.37*	-0.18	-0.43**
	(0.18)	(0.18)	(0.20)	(0.16)	(0.17)
Fixed effects	Country, Sector				
New Covid Cases per 100k *Sector Dummies	Included				
Observations	*66*	*66*	*66*	*62*	*62*
R-squared	*0.66*	*0.66*	*0.61*	*0.60*	*0.73*
Number	*25*	*25*	*25*	*23*	*23*
Adjusted R-squared	*0.392*	*0.377*	*0.295*	*0.284*	*0.477*

Notes: The table shows the estimated parameter values from a panel regression of equation (2) testing the relationship between different forms of financial *internationalization* (the funding currency and counterparty location, i.e., whether the funding is cross-border or domestic) and financial stress. All columns include country and sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively) Standard errors are clustered at the country level. The dependent variable measuring financial stress is the log change in sector-specific CDS over the *Covid Shock* (Jan 1 to Mar 23, 2020). See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 5 - *Internationalization* and Stress: *Country-sector-time* Results

	(1)	(2)	(3)	(4)	(5)
Banks' US$ Liabilities*sector_bank*Δvix	0.30***				0.16
	(0.08)				(0.13)
Banks' Cross-border Liabilities*sector_bank*Δvix		0.30**			0.26
		(0.11)			(0.17)
Corporates' US$ Liabilities*sector_corp*Δvix			-0.18		-0.06
			(0.13)		(0.14)
Corporates' Cross-border Liabilities*sector_corp*Δvix				0.01	0.10
				(0.06)	(0.08)
Banks' US$ Liabilities*sector_bank	0.03*				0.03**
	(0.01)				(0.01)
Banks' Cross-border Liabilities*sector_bank		0.02			0.00
		(0.01)			(0.01)
Corporates' US$ Liabilities*sector_corp			0.00		0.02*
			(0.01)		(0.01)
Corporates' Cross-border Liabilities*sector_corp				0.00	-0.00
				(0.00)	(0.01)
Fixed effects	Country-time, Sector-time				
New Covid Cases per 100k *Sector Dummies	Included				
Observations	*3,696*	*3,696*	*3,696*	*3,472*	*3,472*
R-squared	*0.71*	*0.71*	*0.71*	*0.72*	*0.72*
Number	*25*	*25*	*25*	*23*	*23*
Adjusted R-squared	*0.502*	*0.502*	*0.497*	*0.514*	*0.521*

Notes: The table shows the estimated parameter values from a panel regression of equation (3) testing the relationship between different forms of financial *internationalization* (the funding currency and counterparty location, i.e., whether the funding is cross-border or domestic) and financial stress. All columns include country-time and sector-time fixed effects; *sector_bank* and *sector_corp* are bank and corporate sectoral dummies respectively. Standard errors are clustered at the country level. The dependent variable measuring financial stress is the daily log change in CDS. The sample period is Jan 1 to Mar 23, 2020. See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 6 – *Intermediation, Internationalization* and Stress: *Country-sector* Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Intermediation and Internationalisation		Sectoral US$ and cross-border splits				Internationalisation Loan Shares		
Banks' US$ Liabilities*sector_bank	1.05	2.67***							
	(1.19)	(0.88)							
Banks' Cross-border Liabilities*sector_bank	0.70	-0.18	0.04						
	(0.77)	(0.74)	(0.90)						
Corporates' US$ Liabilities*sector_corp	2.25***	2.28***	2.22***	2.43***					
	(0.77)	(0.60)	(0.60)	(0.64)					
Corporates' Cross-border Liabilities*sector_corp	-0.18	-0.41	-0.19	-0.22	0.23				
	(0.32)	(0.26)	(0.31)	(0.35)	(0.37)				
Banks' HH Liabilities*sector_bank	-2.19***								
	(0.59)								
Banks' Bank Liabilities*sector_bank	-1.46*								
	(0.82)								
Banks' NBFI Liabilities*sector_bank		2.21**							
		(1.00)							
Corporates' NBFI Liabilities*sector_corp	0.40	0.44	0.39	0.39					
	(0.46)	(0.43)	(0.47)	(0.47)					
Banks' NBFI US$ Liabilities*sector_bank			14.16**	17.21***	13.77*	12.32*			
			(6.31)	(5.16)	(6.64)	(6.82)			
Banks' NBFI XB Liabilities*sector_bank				-2.18	-1.81	-1.41			
				(1.75)	(1.90)	(1.82)			
Corp's Bank US$ Liabilities*sector_corp					8.31***	5.34			
					(2.42)	(3.32)			
Corp's Bank XB Liabilities*sector_corp						2.98			
						(2.54)			
Loan Share of Banks' US$ Liabilities*sector_bank							-0.87*		-0.49
							(0.43)		(0.63)
Loan Share of Corporates' US$ Liabilities*sector_corp							0.75		0.62
							(0.51)		(0.59)
Loan Share of Banks' Cross-border Liabilities*sector_bank								-0.33	-0.45
								(0.45)	(0.51)
Loan Share of Corps's Cross-border Liabilities*sector_corp								0.52	0.14
								(0.32)	(0.47)
sector_bank	0.30	-1.00***	-0.65***	-0.59***	-0.63***	-0.62***	0.19	-0.14	0.20
	(0.35)	(0.17)	(0.16)	(0.14)	(0.13)	(0.14)	(0.39)	(0.35)	(0.42)
sector_corp	-0.82***	-0.77***	-0.77***	-0.80***	-0.77***	-0.76***	-0.83***	-0.47**	-0.82***
	(0.23)	(0.23)	(0.25)	(0.25)	(0.20)	(0.18)	(0.27)	(0.21)	(0.25)
Fixed effects	Country, Sector								
New Covid Cases per 100k *Sector Dummies	Included								
Observations	*54*	*56*	*53*	*53*	*48*	*48*	*49*	*66*	*49*
R-squared	*0.80*	*0.79*	*0.77*	*0.78*	*0.77*	*0.78*	*0.74*	*0.63*	*0.75*
Number	*20*	*21*	*20*	*20*	*18*	*18*	*19*	*25*	*19*
Adjusted R-squared	*0.541*	*0.528*	*0.506*	*0.520*	*0.512*	*0.530*	*0.479*	*0.309*	*0.447*

Notes: The table shows the estimated parameter values from a panel regression of equation (2) testing the relationship between different forms of financial *intermediation* (the funding source or instrument) and/or financial *internationalization* (the funding currency and counterparty location, i.e., whether the funding is cross-border or domestic) and financial stress. All columns include country and sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively). Standard errors are clustered at the country level. The dependent variable measuring financial stress is the log change in sector-specific CDS during the *Covid Shock* (Jan 1 to Mar 23, 2020). See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 7 – Sensitivity Tests: *Country-Sector* Panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Baseline		No Covid Controls		Drop EMEs		Incl. NBFI+USD Assets		24 Feb to 23 March		1 Jan to 30 April		24 Feb to 30 April	
Banks' US$ Liabilities*sector_bank	1.05	2.67***	-0.47	1.88*	1.18	2.84**	6.88**	5.68	0.05	1.86*	1.12	3.48	0.59	2.09
	(1.19)	(0.88)	(1.26)	(0.91)	(1.41)	(0.99)	(3.01)	(3.92)	(1.35)	(0.98)	(2.17)	(2.16)	(1.94)	(1.58)
Banks' Cross-border Liabilities*sector_bank	0.70	-0.18	1.03	-0.03	0.35	-1.08	0.71	0.01	0.09	-1.06	-0.05	-0.67	-0.31	-1.34
	(0.77)	(0.74)	(0.75)	(0.68)	(1.00)	(1.00)	(0.88)	(1.06)	(0.79)	(0.82)	(0.96)	(1.49)	(0.65)	(0.96)
Corporates' US$ Liabilities*sector_corp	2.25***	2.28***	0.98	1.39	2.47**	2.50***	2.49***	2.35***	1.81*	1.99***	2.80***	2.90***	2.81***	3.05***
	(0.77)	(0.60)	(1.08)	(0.90)	(0.93)	(0.71)	(0.74)	(0.56)	(0.89)	(0.62)	(0.79)	(0.86)	(0.88)	(0.82)
Corporates' Cross-border Liabilities*sector_corp	-0.18	-0.41	0.04	-0.25	-0.32	-0.57*	-0.33	-0.56*	-0.18	-0.44	-0.64	-0.99**	-0.80*	-1.12**
	(0.32)	(0.26)	(0.45)	(0.41)	(0.42)	(0.31)	(0.37)	(0.32)	(0.38)	(0.30)	(0.42)	(0.47)	(0.40)	(0.40)
Banks' HH Liabilities*sector_bank	-2.19***		-2.85***		-2.19*		-3.42***		-2.53***		-3.40		-2.42	
	(0.59)		(0.76)		(1.03)		(1.01)		(0.48)		(2.12)		(1.43)	
Banks' Bank Liabilities*sector_bank	-1.46*		-1.93**		-1.46		-3.36***		-1.29		-3.00**		-2.00**	
	(0.82)		(0.78)		(1.06)		(1.15)		(0.94)		(1.37)		(0.94)	
Banks' NBFI Liabilities*sector_bank		2.21**		2.18**		3.25***		2.10**		3.57***		-0.04		1.77
		(1.00)		(1.00)		(0.97)		(0.82)		(0.91)		(2.00)		(1.35)
Corporates' NBFI Liabilities*sector_corp	0.40	0.44	0.74	0.64	-0.02	-0.07	0.45	0.51	0.20	0.16	-0.30	-0.10	-0.13	-0.08
	(0.46)	(0.43)	(0.44)	(0.45)	(0.62)	(0.47)	(0.48)	(0.42)	(0.50)	(0.44)	(0.69)	(0.50)	(0.72)	(0.50)
Banks' NBFI Assets*sector_bank							1.41	-1.03						
							(1.55)	(1.12)						
Banks' USD Assets*sector_bank							-8.06**	-3.52						
							(3.36)	(4.22)						
sector_bank	0.30	-1.00***	0.83*	-0.86***	0.46	-0.82***	1.02*	-0.92***	0.73**	-0.80***	1.11	-0.60**	0.95	-0.44*
	(0.35)	(0.17)	(0.41)	(0.16)	(0.70)	(0.24)	(0.56)	(0.18)	(0.33)	(0.18)	(1.05)	(0.29)	(0.68)	(0.22)
sector_corp	-0.82***	-0.77***	-0.58*	-0.51	-0.48	-0.36	-0.83***	-0.79***	-0.64**	-0.59**	-0.32	-0.32	-0.27	-0.25
	(0.23)	(0.23)	(0.29)	(0.30)	(0.35)	(0.31)	(0.24)	(0.23)	(0.24)	(0.24)	(0.22)	(0.21)	(0.25)	(0.25)
Fixed effects	Country, Sector													
New Covid Cases per 100k *Sector Dummies	Included (except columns 3 + 4)													
Observations	*54*	*56*	*54*	*56*	*45*	*47*	*54*	*56*	*54*	*56*	*51*	*53*	*51*	*53*
R-squared	*0.80*	*0.79*	*0.73*	*0.71*	*0.75*	*0.75*	*0.82*	*0.79*	*0.74*	*0.76*	*0.79*	*0.75*	*0.76*	*0.75*
Number	*20*	*21*	*20*	*21*	*16*	*17*	*20*	*21*	*20*	*21*	*19*	*20*	*19*	*20*
Adjusted R-squared	*0.541*	*0.528*	*0.430*	*0.400*	*0.401*	*0.423*	*0.548*	*0.506*	*0.408*	*0.467*	*0.495*	*0.444*	*0.428*	*0.444*

Notes: The table shows the estimated parameter values from panel regressions of equation (2) testing the relationship between financial stress and different forms of financial *intermediation* and *internationalization* using a country-sector approach. All columns include country and sector fixed effects (in the form of bank and corporate sectoral dummies, *sector_bank* and *sector_corp,* respectively). All columns except columns (3) and (4) also include interactions of the sector dummies and Covid cases. Standard errors are clustered at the country level. The dependent variable measuring financial stress is the log change in sector-specific CDS during the *Covid Shock* (Jan 1 to Mar 23, 2020), except in columns (9) through (14), which use the dates specified at the top. See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 8 – Sensitivity Tests: *Country-Sector-Time* Panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Baseline		No Covid controls		Incl. NBFI+USD Assets		RORO instead of VIX		Country specific MSCI Vol		Weekly data (to 17 March)		Weekly data (to 17 March, lagged VIX)	
Banks' US$ Liabilities*sector_bank*Δvix	-0.09	0.26	-0.10	0.25	-0.09	-0.17	-0.00	0.01	0.34	0.11	-0.71	0.30	0.27	0.87*
	(0.31)	(0.27)	(0.31)	(0.27)	(0.66)	(0.61)	(0.02)	(0.02)	(0.35)	(0.24)	(0.44)	(0.46)	(0.39)	(0.42)
Banks' Cross-border Liabilities*sector_bank*Δvix	0.31	0.10	0.30	0.10	0.35	0.23	0.01	-0.01	-0.24	-0.67**	0.62**	0.15	-0.26	-0.49*
	(0.21)	(0.22)	(0.21)	(0.22)	(0.21)	(0.23)	(0.01)	(0.01)	(0.25)	(0.25)	(0.27)	(0.32)	(0.29)	(0.26)
Corporates' US$ Liabilities*sector_corp*Δvix	-0.11	-0.08	-0.11	-0.09	-0.12	-0.11	0.00	0.00	0.18	-0.04	-0.04	0.13	-0.08	0.10
	(0.22)	(0.17)	(0.22)	(0.18)	(0.22)	(0.16)	(0.01)	(0.01)	(0.32)	(0.25)	(0.32)	(0.29)	(0.30)	(0.23)
Corporates' Cross-border Liabilities*sector_corp*Δvix	0.13	0.08	0.13	0.08	0.12	0.10	0.00	0.00	-0.02	0.02	0.17	0.04	0.02	-0.05
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)	(0.00)	(0.00)	(0.14)	(0.13)	(0.13)	(0.17)	(0.12)	(0.12)
Banks' HH Liabilities*sector_bank*Δvix	-0.38**		-0.37**		-0.33**		-0.02**		-0.22**		-1.24***		-1.08***	
	(0.13)		(0.13)		(0.16)		(0.01)		(0.09)		(0.19)		(0.26)	
Banks' Bank Liabilities*sector_bank*Δvix	-0.34*		-0.34*		-0.31		-0.02		0.15		-0.83**		-0.21	
	(0.18)		(0.19)		(0.23)		(0.01)		(0.22)		(0.35)		(0.36)	
Banks' NBFI Liabilities*sector_bank*Δvix		0.29*		0.29*		0.29*		0.03***		1.10**		1.02***		1.54***
		(0.14)		(0.15)		(0.16)		(0.01)		(0.39)		(0.30)		(0.29)
Corporates' NBFI Liabilities*sector_corp*Δvix	0.00	0.00	-0.00	-0.00	0.00	0.01	-0.01	-0.01*	-0.06	-0.04	0.20*	0.17*	0.19	0.11
	(0.11)	(0.09)	(0.11)	(0.09)	(0.12)	(0.10)	(0.01)	(0.00)	(0.10)	(0.08)	(0.11)	(0.09)	(0.14)	(0.11)
Banks' NBFI Assets*sector_bank*Δvix					-0.13	-0.32								
					(0.31)	(0.25)								
Banks' USD Assets*sector_bank*Δvix					0.02	0.46								
					(0.84)	(0.71)								
Fixed effects	Country-time, Sector-time													
Funding Structures * Sector Dummies	Included													
New Covid Cases per 100k *Sector Dummies	Included (except columns 3 + 4 + 5)													
Observations	*3,024*	*3,136*	*3,024*	*3,136*	*3,024*	*3,136*	*3,078*	*3,192*	*2,907*	*3,021*	*540*	*560*	*540*	*560*
R-squared	*0.74*	*0.74*	*0.74*	*0.74*	*0.74*	*0.74*	*0.74*	*0.74*	*0.74*	*0.74*	*0.89*	*0.89*	*0.86*	*0.86*
Number	*20*	*21*	*20*	*21*	*20*	*21*	*20*	*21*	*19*	*20*	*20*	*21*	*20*	*21*
Adjusted R-squared	*0.542*	*0.537*	*0.541*	*0.535*	*0.540*	*0.537*	*0.541*	*0.539*	*0.543*	*0.542*	*0.805*	*0.797*	*0.740*	*0.743*

Notes: The table shows the estimated parameter values from panel regressions of equation (3) testing the relationship between financial stress and different forms of financial *intermediation* and *internationalization* using a country-sector-time approach. All columns include country-time and sector-time fixed effects (with *sector_bank* and *sector_corp* the bank and corporate sectoral dummies, respectively). All columns except columns (3) to (4) also include interactions of the sector dummies and Covid cases; in column (5) we dropped Covid cases – which are insignificant in our baseline *country-sector-time results* – to allow for clustering at the country level due to constraints on the degree of freedom linked to the number of countries and variables. Standard errors are clustered at the country level. The sample period is Jan 1 to Mar 23, 2020 in columns (1) to (6) coupled with the daily log change in CDS spreads as the dependent variable. Columns (7)-(8) use the RORO index from Chari et al. (2020) instead of the VIX, and columns (9) -(10) use country-specific equity market volatility instead of the VIX. Columns (11) to (14) use weekly data up to 17 March (i.e., all complete weeks during the *Covid Shock* period). In weekly specifications, the dependent variable is the weekly log change in CDS spreads. See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 9 – NBFI Policies: *Country-Sector* Panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NBFI Policies	-0.03**					-0.05**		
	(0.01)					(0.02)		
NBFI Policies*sector_bank		-0.03	0.13**		0.13*		0.26***	
		(0.02)	(0.06)		(0.06)		(0.07)	
NBFI Policies*sector_corp		-0.09***		-0.10	-0.10			-0.05
		(0.03)		(0.07)	(0.07)			(0.20)
Banks' NBFI Liabilities*sector_bank			0.63		2.15		2.78***	
			(0.65)		(1.54)		(0.75)	
NBFI Policies*Banks' NBFI Liabilities*sector_bank			-0.69**		-0.92***		-1.03***	
			(0.25)		(0.32)		(0.24)	
Corporates' NBFI Liabilities*sector_corp				-0.66	-0.67			-0.37
				(0.50)	(0.52)			(1.36)
NBFI Policies*Corporates' NBFI Liabilities*sector_corp				0.04	0.04			-0.04
				(0.13)	(0.13)			(0.30)
Policy rate cuts						0.08		
						(0.11)		
Asset Purchases						-1.71*		
						(0.95)		
Fiscal Policy						0.29		
						(0.58)		
Market Liquidity Policy						-0.05		
						(0.04)		
Prudential regulations						0.03**		
						(0.01)		
Policy rate cuts*sector_bank (col 7)/sector_corp (col 8)							0.00	-0.05
							(0.23)	(0.29)
Asset Purchases*sector_bank (col 7)/sector_corp (col 8)							8.71***	-4.91
							(2.18)	(3.24)
Fiscal Policy*sector_bank (col 7)/sector_corp (col 8)							-2.02	-0.19
							(1.33)	(1.75)
Market Liquidity Policy*sector_bank (col 7)/sector_corp (col 8)							-0.04	-0.08
							(0.04)	(0.07)
Prudential regulations*sector_bank (col 7)/sector_corp (col 8)							-0.09**	0.02
							(0.04)	(0.03)
sector_bank	-0.18***	-0.04	-0.13	-0.09	-0.40	-0.18***	0.10	-0.06
	(0.06)	(0.09)	(0.13)	(0.16)	(0.35)	(0.06)	(0.16)	(0.16)
sector_corp	-0.09	0.24***	0.10	0.48***	0.51***	-0.09	0.09	0.46
	(0.09)	(0.08)	(0.11)	(0.15)	(0.16)	(0.09)	(0.11)	(0.54)
New Covid Cases per 100k	0.04**					0.04*		
	(0.02)					(0.02)		
New Covid Cases per 100k*sector_bank		-0.00	-0.10*	-0.02	-0.04		-0.17***	-0.03
		(0.04)	(0.05)	(0.03)	(0.03)		(0.04)	(0.03)
New Covid Cases per 100k*sector_corp		0.01	-0.07**	0.02	0.03		-0.07**	0.02
		(0.04)	(0.03)	(0.04)	(0.04)		(0.03)	(0.04)
Constant	0.20***					0.08		
	(0.06)					(0.10)		
Fixed effects	None	Country	Country	Country	Country	None	Country	Country
Observations	*61*	*61*	*61*	*53*	*53*	*61*	*61*	*53*
R-squared	*0.14*	*0.68*	*0.61*	*0.67*	*0.73*	*0.22*	*0.68*	*0.71*
Number Countries	*23*	*23*	*23*	*20*	*20*	*23*	*23*	*20*
Adjusted R-squared	*0.0825*	*0.391*	*0.242*	*0.344*	*0.399*	*0.0837*	*0.272*	*0.283*

Notes: The table shows the estimated parameter values from a panel regression of equations (4) to (6). All columns include sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively). The inclusion of other fixed effects is indicated at the bottom of the table. Standard errors are clustered at the country level. The dependent variable measuring financial stress is the log change in sector-specific CDS during from March 10 to 30 April, 2020). See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 10 – NBFI Policies: *Country-Sector-Time* Panel

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NBFI Policies	-0.01***					-0.01***		
	(0.00)					(0.00)		
NBFI Policies*sector_bank		-0.02***	0.03***		0.02*		0.03***	
		(0.01)	(0.01)		(0.01)		(0.01)	
NBFI Policies*sector_corp		-0.03***		0.01	0.00			0.01
		(0.01)		(0.01)	(0.01)			(0.01)
Banks' NBFI Liabilities*sector_bank			0.02*		0.02*		0.02*	
			(0.01)		(0.01)		(0.01)	
NBFI Policies*Banks' NBFI Liabilities*sector_bank			-0.32***		-0.35***		-0.32***	
			(0.05)		(0.06)		(0.05)	
Corporates' NBFI Liabilities*sector_corp				0.01**	0.01**			0.01**
				(0.00)	(0.00)			(0.00)
NBFI Policies*Corporates' NBFI Liabilities*sector_corp				-0.05***	-0.05***			-0.05***
				(0.02)	(0.02)			(0.02)
Policy rate cuts						0.01		
						(0.01)		
Asset Purchases						0.94***		
						(0.23)		
Fiscal Policy						0.20**		
						(0.08)		
Market Liquidity Policy						0.02		
						(0.01)		
Prudential regulations						0.00		
						(0.00)		
Policy rate cuts*sector_bank (col 7)/sector_corp (col 8)							0.05*	-0.01
							(0.02)	(0.03)
Asset Purchases*sector_bank (col 7)/sector_corp (col 8)							0.08	0.47*
							(0.28)	(0.27)
Fiscal Policy*sector_bank (col 7)/sector_corp (col 8)							0.32**	-0.19
							(0.14)	(0.17)
Market Liquidity Policy*sector_bank (col 7)/sector_corp (col 8)							0.03	0.00
							(0.02)	(0.01)
Prudential regulations*sector_bank (col 7)/sector_corp (col 8)							0.00	0.00
							(0.01)	(0.01)
Banks' NBFI Liabilities*sector_bank*Δvix			0.46**		0.48**		0.49**	
			(0.19)		(0.23)		(0.19)	
Corporates' NBFI Liabilities*sector_corp*Δvix				0.02	0.03			0.02
				(0.07)	(0.07)			(0.07)
New Covid Cases per 100k(daily)*sector_bank	-0.00**	0.00*	0.00	0.00	0.00	-0.00***	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
New Covid Cases per 100k(daily)*sector_corp	-0.00***	-0.00	-0.00	-0.00	-0.00	-0.00***	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fixed effects	Ctry, Sec	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry, Sec	Ctry-time, Sec-time	Ctry-time, Sec-time
Observations	*5,444*	*5,444*	*5,316*	*4,644*	*4,644*	*5,444*	*5,316*	*4,644*
R-squared	*0.01*	*0.71*	*0.71*	*0.73*	*0.74*	*0.03*	*0.71*	*0.73*
Number Countries	*24*	*24*	*24*	*21*	*21*	*24*	*24*	*21*
Adjusted R-squared	*0.00901*	*0.495*	*0.497*	*0.532*	*0.539*	*0.0268*	*0.499*	*0.532*

Notes: The table shows the estimated parameter values from a panel regression of equations (7) to (9). All columns include sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively). The inclusion of other fixed effects is indicated at the bottom of the table. Standard errors are clustered at the country level. The dependent variable measuring financial stress is the daily log change in CDS (from 1 January to 30 April, 2020). See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 11 – All Policies: *Country-Sector* Panel

Policy Variable:	(1)	(2) NBFI Policies	(3)	(4)	(5) Market Based Measures	(6)	(7)	(8) USD Swap Lines	(9)	(10)	(11) Prudential Regulations	(12)
Policy Variable *sector_bank	0.13*	0.26***		0.15	0.16		0.04	0.58*		0.02	0.03	
	(0.06)	(0.07)		(0.14)	(0.19)		(0.09)	(0.33)		(0.03)	(0.03)	
Policy Variable *sector_corp	-0.10		-0.05	-0.11		0.11	-0.62		-0.18	-0.03		0.02
	(0.07)		(0.20)	(0.16)		(0.14)	(1.21)		(1.23)	(0.07)		(0.07)
Banks' NBFI (or USD cols 7-9) Liabilities*sector_bank	2.15	2.78***		-1.14	0.17		-0.33	0.13		1.38	0.50	
	(1.54)	(0.75)		(1.33)	(1.29)		(0.26)	(0.18)		(1.39)	(2.59)	
Policy Variable *Banks' NBFI (or USD cols 7-9) Liabilities*sector_bank	-0.92***	-1.03***		-1.17	-0.95		0.60	-1.76**		-0.34	-0.14	
	(0.32)	(0.24)		(0.83)	(1.25)		(0.54)	(0.79)		(0.22)	(0.33)	
Corporates' NBFI (or USD cols 7-9) Liabilities*sector_corp	-0.67		-0.37	-0.76		-0.60	-3.86		-1.61	0.13		0.57
	(0.52)		(1.36)	(0.57)		(0.50)	(7.00)		(7.99)	(1.42)		(1.00)
Policy Variable *Corporates' NBFI (or USD cols 7-9) Liabilities*sector_corp	0.04		-0.04	0.19		-0.02	4.86		2.61	-0.07		-0.11
	(0.13)		(0.30)	(0.39)		(0.31)	(7.01)		(7.84)	(0.15)		(0.12)
Economy-wide policies * sector_bank		Included			Included			Included			Included	
Economy-wide policies * sector_corp			Included			Included			Included			Included
Fixed effects	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country	Country
New Covid Cases per 100k *Sector Dummies		Included			Included			Included			Included	
Observations	*53*	*61*	*53*	*53*	*61*	*53*	*64*	*64*	*64*	*53*	*61*	*53*
R-squared	*0.73*	*0.68*	*0.71*	*0.59*	*0.62*	*0.70*	*0.59*	*0.55*	*0.68*	*0.66*	*0.62*	*0.69*
Number Countries	*20*	*23*	*20*	*20*	*23*	*20*	*24*	*24*	*24*	*20*	*23*	*20*
Adjusted R-squared	*0.399*	*0.272*	*0.283*	*0.0822*	*0.123*	*0.258*	*0.142*	*-0.0217*	*0.278*	*0.232*	*0.148*	*0.270*

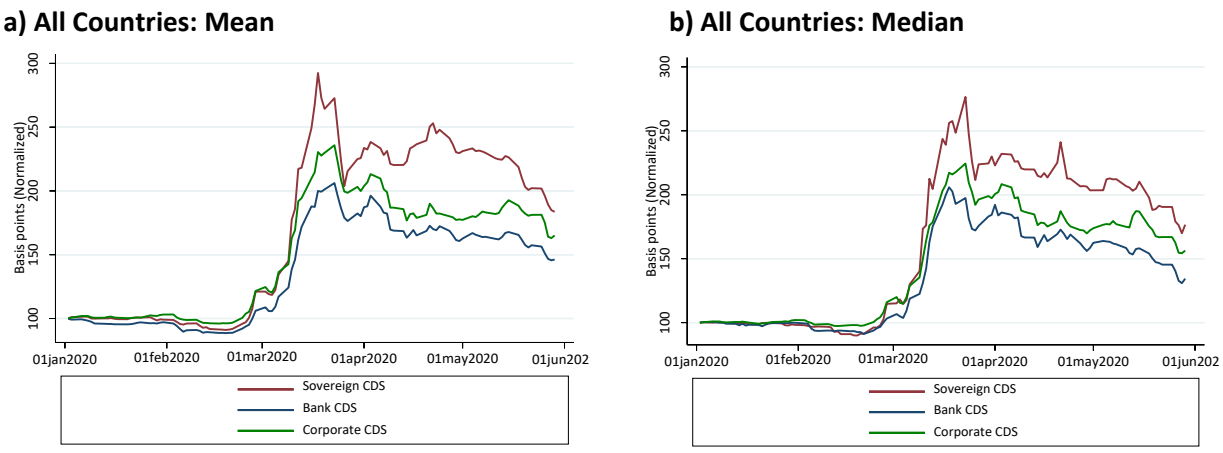
Notes: The table shows the estimated parameter values from a panel regression of equations (4) to (6). The top row indicates which Policy Variable is used in the respective interaction terms. All columns include sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively). The inclusion of other fixed effects is indicated at the bottom of the table. Standard errors are clustered at the country level. The dependent variable measuring financial stress is the log change in sector-specific CDS during from March 10 to 30 April, 2020 except for columns (7) to (9) where the period is March 10 to 30 March, 2020. See Appendix B for detailed definitions, sources and sample statistics for each variable.

Table 12 – All Policies: *Country-Sector-Time* Panel

Policy Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	NBFI Policies			Market Based Measures			USD Swap Lines (Level)			Prudential Regulations		
Policy Variable *sector_bank	0.02*	0.03***		0.04***	0.04***		0.12	0.24***		0.01	0.02	
	(0.01)	(0.01)		(0.01)	(0.01)		(0.09)	(0.08)		(0.01)	(0.01)	
Policy Variable *sector_corp	0.00		0.01	0.00		-0.00	-0.11		-0.11	0.02		0.02
	(0.01)		(0.01)	(0.01)		(0.01)	(0.07)		(0.07)	(0.03)		(0.02)
Banks' NBFI (or USD cols 7-9) Liabilities*sector_bank	0.02*	0.02*		0.02	0.02		0.38***	0.43***		0.02	0.02*	
	(0.01)	(0.01)		(0.01)	(0.01)		(0.11)	(0.12)		(0.02)	(0.01)	
Policy Variable *Banks' NBFI (or USD cols 7-9) Liabilities*sector_bank	-0.35***	-0.32***		-0.28***	-0.28**		-0.57*	-0.77**		-0.07	-0.14*	
	(0.06)	(0.05)		(0.09)	(0.10)		(0.29)	(0.31)		(0.05)	(0.08)	
Corporates' NBFI (or USD cols 7-9) Liabilities*sector_corp	0.01**		0.01**	0.01		0.01	-0.09		-0.30	0.01		0.01
	(0.00)		(0.00)	(0.00)		(0.00)	(0.19)		(0.18)	(0.01)		(0.01)
Policy Variable *Corporates' NBFI (or USD cols 7-9) Liabilities*sector_corp	-0.05***		-0.05***	0.00		0.01	0.12		0.31	-0.03		-0.04
	(0.02)		(0.02)	(0.02)		(0.02)	(0.32)		(0.29)	(0.04)		(0.04)
Banks' NBFI (or USD cols 7-9) Liabilities*sector_bank*Δvix	0.48**	0.49**		0.45*	0.46**		Above	Above		0.45**	0.45**	
	(0.23)	(0.19)		(0.22)	(0.18)					(0.21)	(0.18)	
Corporates' NBFI (or USD cols 7-9) Liabilities*sector_corp*Δvix	0.03		0.02	0.01		0.01	Above		Above	0.01		0.01
	(0.07)		(0.07)	(0.07)		(0.07)				(0.07)		(0.07)
Economy-wide policies * sector_bank		Included			Included			Included			Included	
Economy-wide policies * sector_corp			Included			Included			Included			Included
Fixed effects	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time	Ctry-time, Sec-time
New Covid Cases per 100k *Sector Dummies		Included			Included			Included			Included	
Observations	*4,644*	*5,316*	*4,644*	*4,644*	*5,316*	*4,644*	*3,904*	*3,904*	*3,904*	*4,644*	*5,316*	*4,644*
R-squared	*0.74*	*0.71*	*0.73*	*0.73*	*0.71*	*0.73*	*0.72*	*0.72*	*0.72*	*0.73*	*0.71*	*0.73*
Number Countries	*21*	*24*	*21*	*21*	*24*	*21*	*24*	*24*	*24*	*21*	*24*	*21*
Adjusted R-squared	*0.539*	*0.499*	*0.532*	*0.534*	*0.499*	*0.530*	*0.517*	*0.520*	*0.512*	*0.532*	*0.498*	*0.531*

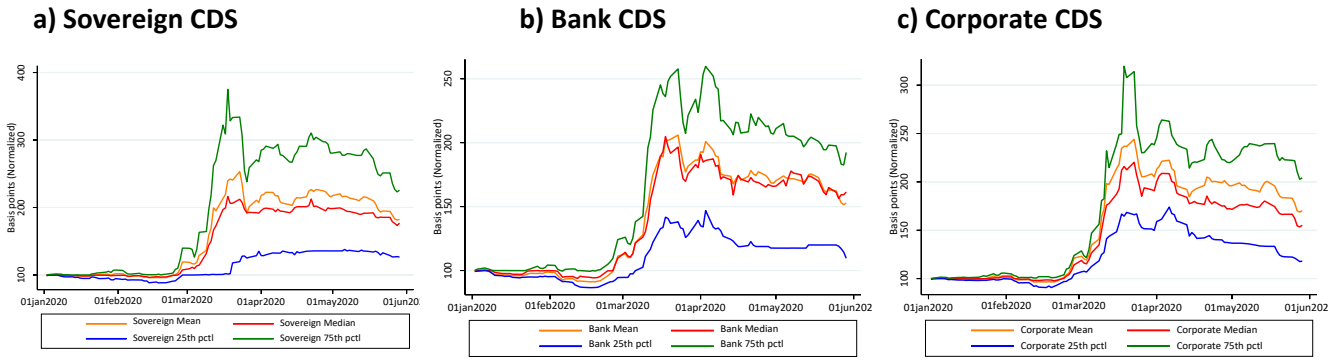
Notes: The table shows the estimated parameter values from a panel regression of equations (7) to (9). The top row indicates which Policy Variable is used in the respective interaction terms. In columns (7) to (9) all coefficients shown are interacted with Δvix; and the same terms not interacted with Δvix are included in the regression but results are not shown (please refer to Table 15 in Forbes et al., 2022, for the full results). All columns include sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively). The inclusion of other fixed effects is indicated at the bottom of the table. Standard errors are clustered at the country level. The dependent variable measuring financial stress is the daily log change in CDS from 1 January to 30 April, 2020 except for columns (7) to (9) where the period is January 1 to 30 March, 2020. See Appendix B for detailed definitions, sources and sample statistics for each variable.

Figure 1
Comparing CDS across Sectors and Country Groups



Notes: Each graph shows the mean or median CDS across countries, with each series normalized to 100 in Jan 1, 2020. The sample for "All Countries" is all countries with CDS data for each of the three sectors (*Sovereign, Bank* and *Corporate*). Underlying data on individual CDS is from Refinitiv, compiled and collapsed as described in Section III and Appendix A. See Appendix Table A1 for country coverage and sample size for each sector.

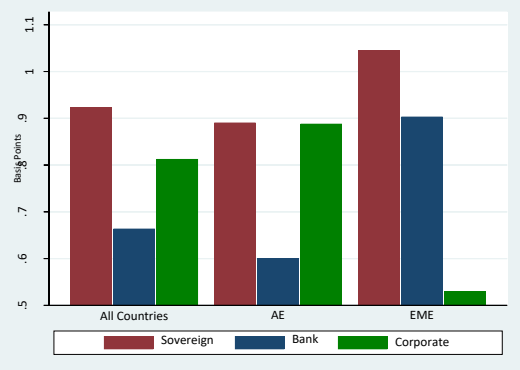
Figure 2
CDS by Sector: Means, Medians and Distribution



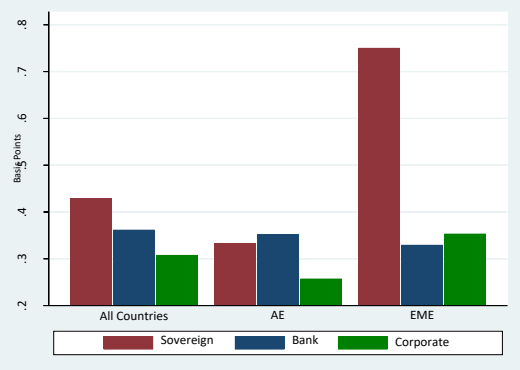
Notes: These graphs show the mean, median, and 25th and 75th values in the distribution for the CDS for three sectors: *Sovereigns*, *Banks*, and *Corporates*. Each series is normalized to 100 in Jan 1, 2020. The sample includes countries with data for at least one of the three sectors. Underlying data on individual CDS is from Refinitiv, compiled and collapsed as described in Section III and Appendix A. See Appendix Table A1 for country coverage and sample size for each sector.

Figure 3
Peak Stress by Sector and Country

a) Mean of *Peak Stress*

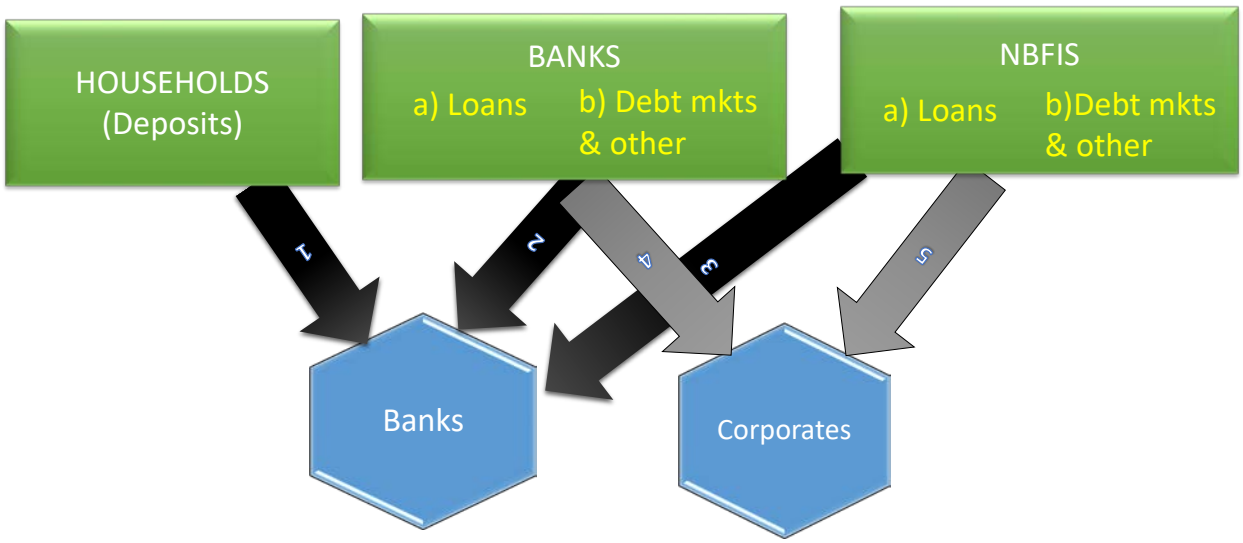


b) Standard Deviation of *Peak Stress*



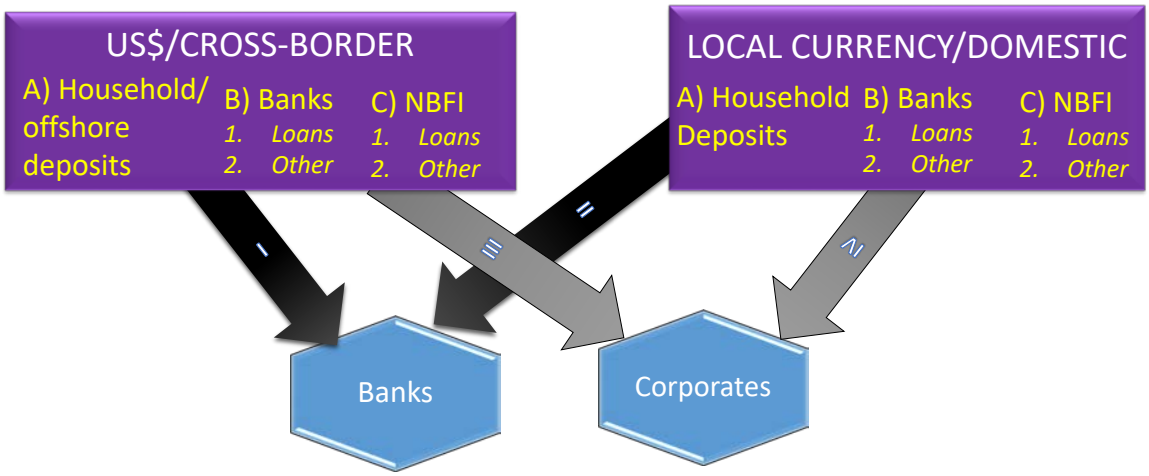
Notes: These graphs show the mean and standard deviation of *Peak Stress* experienced by each sector, with *Peak Stress* defined as the log change in CDS from Jan 1, 2020 through March 23, 2020. The sample only includes countries with data for all three sectors. Underlying data on individual CDS is from Refinitiv, compiled and collapsed as described in Section III and Appendix A. See Appendix Table A1 for country coverage and sample size for each sector.

Figure 4a: Forms of Financial Intermediation



Note: Figure shows the various forms of financial intermediation for the bank and corporate sectors (at the bottom). Funding can come from three sources: households, banks and non-bank financial institutions (NBFIs). Funding from these sources is via different instrument types: deposits, loans, or debt markets and other. The numbers indicate the flows from the different funding sources, and these can be combined with the letters to classify different instrument types from different sources.

Figure 4b: Forms of Financial Internationalization

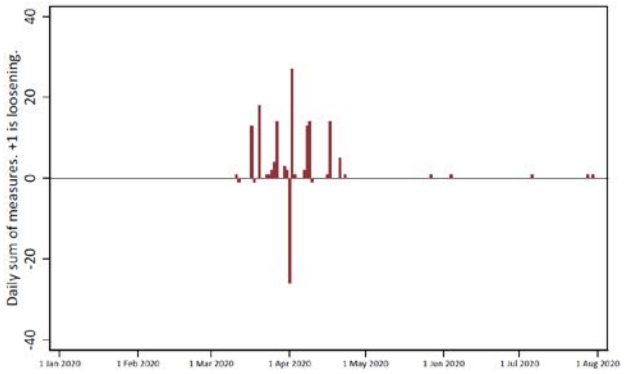


Note: Figure shows the various forms of financial internationalization for the bank and corporate sectors (at the bottom). Funding can be divided into that from US dollars (US$) versus local currency, or differentiated as cross-border versus domestic sources. Funding from these sources is via different instrument types: deposits, loans, or debt markets and other. The Roman numerals indicate the flows from the different funding sources, and these can be combined with the letters and numbers to classify different instrument types from different sources.

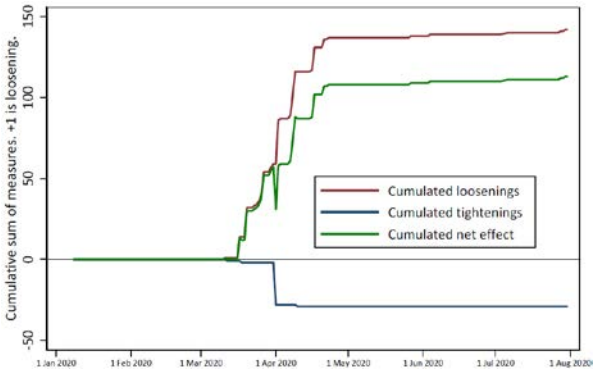
Figure 5: Policy Responses during the Covid Shock: Daily and Cumulative Actions

Panel A: NBFI Policies (Structure-Specific policy)

a) Daily Actions

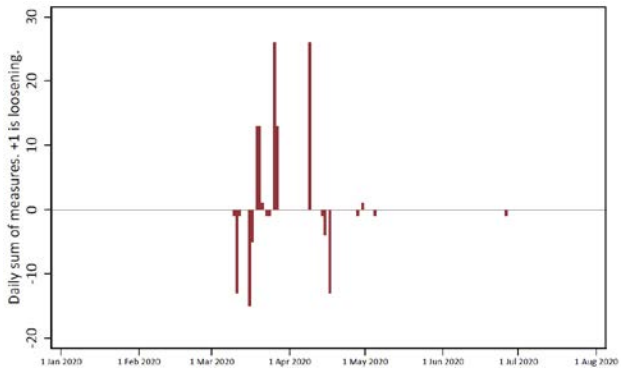


b) Cumulative Actions

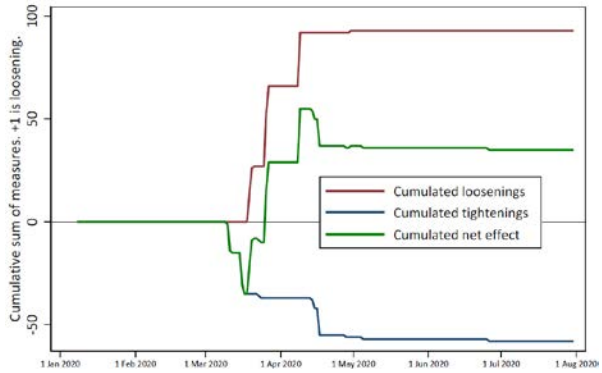


Panel B: Market-Based Measures (Structure-Specific policy)

a) Daily Actions

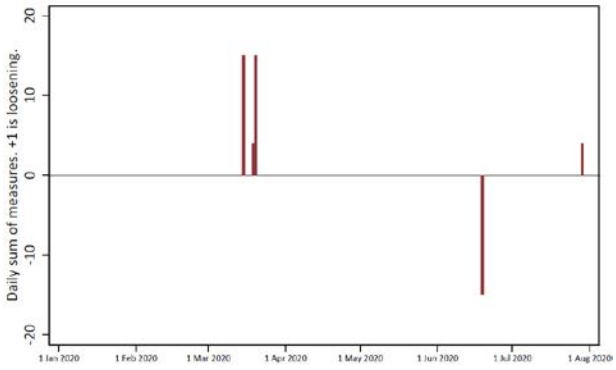


b) Cumulative Actions

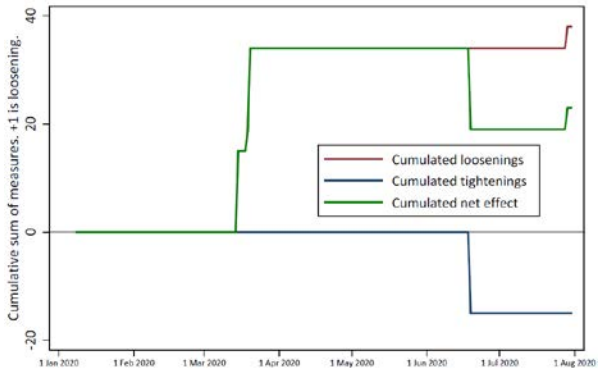


Panel C: US$ Swap Lines (Structure-Specific policy)

a) Daily Actions

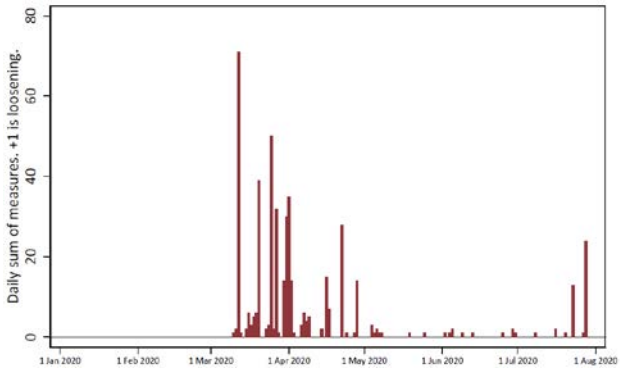


b) Cumulative Actions

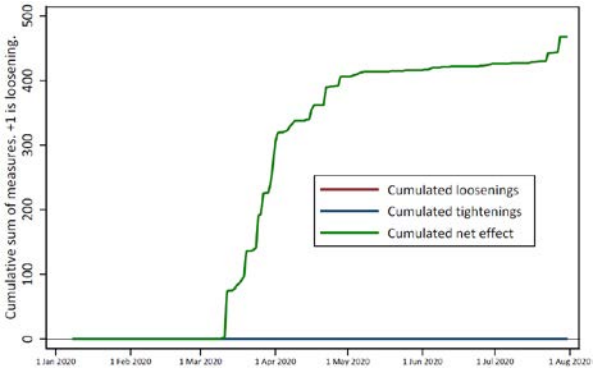


Panel D: Prudential Regulation (Bank-Specific Policy or Economy-Wide Policy)

a) Daily Actions

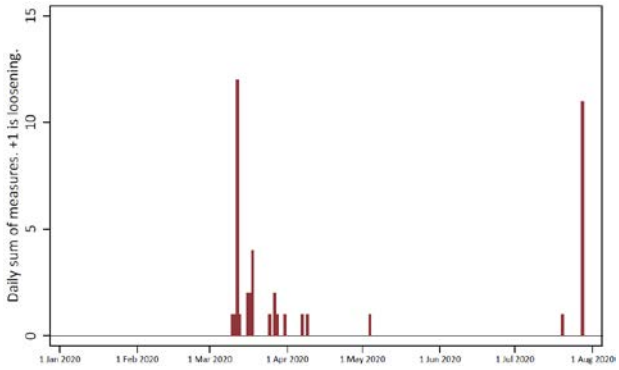


b) Cumulative Actions

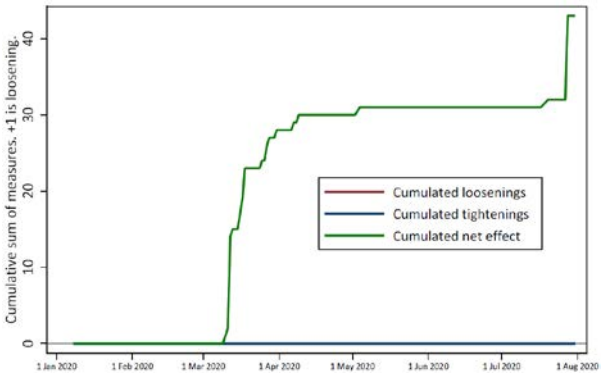


Panel E: Macroprudential Buffers (Bank-Specific Policy)

a) Daily Actions

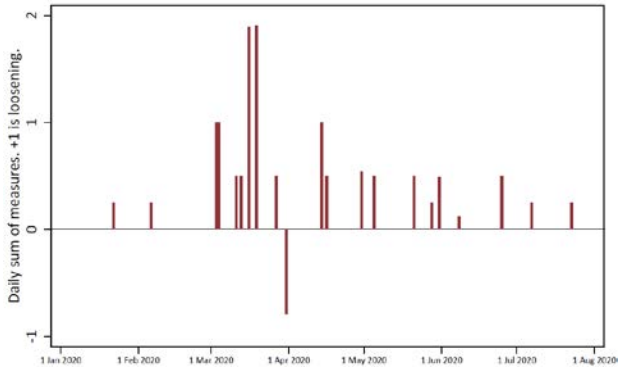


b) Cumulative Actions

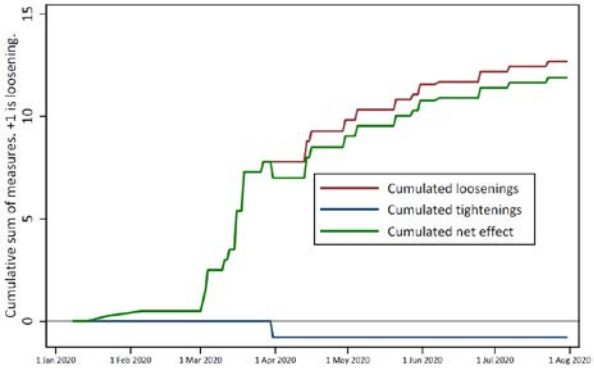


Panel F: Policy Rate Changes (Economy-Wide Policy)

a) Daily Actions

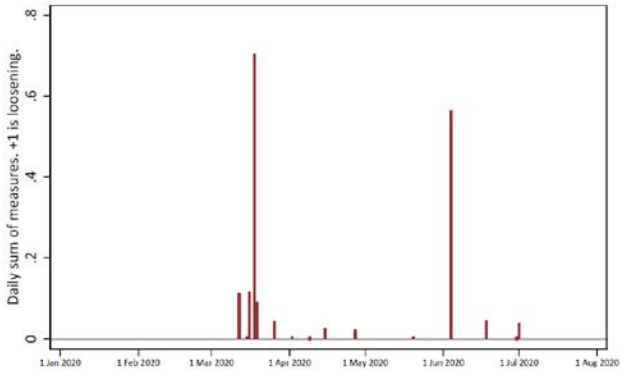


b) Cumulative Actions

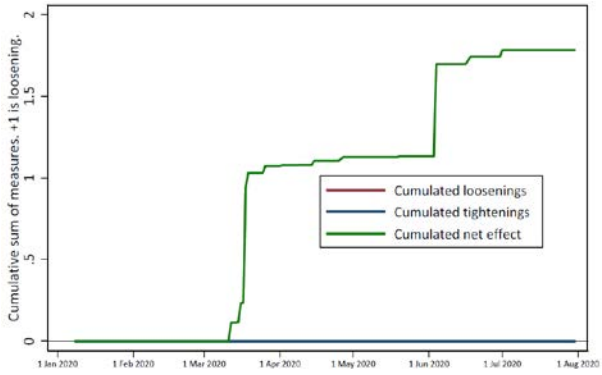


Panel G: Asset Purchases (Economy-Wide Policy)

a) Daily Actions

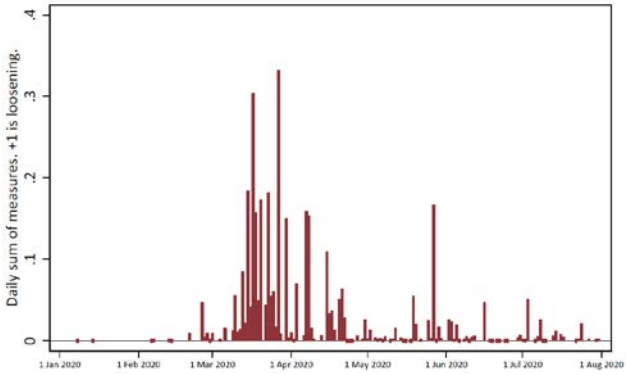


b) Cumulative Actions

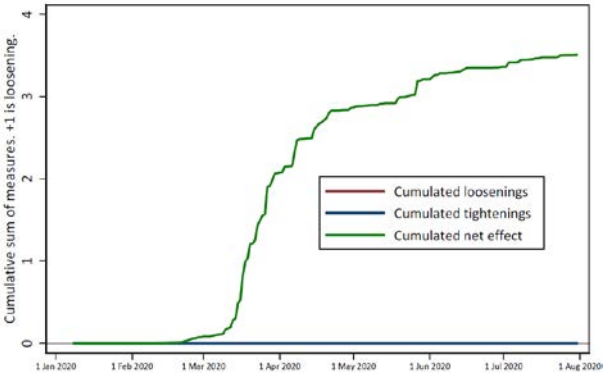


Panel H: Fiscal Policy (Economy-Wide Policy)

a) Daily Actions

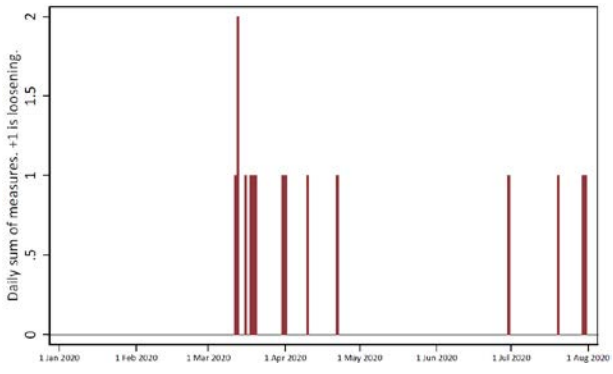


b) Cumulative Actions

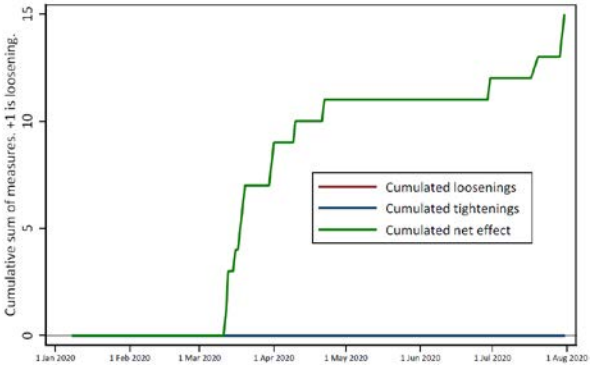


Panel I: Market Liquidity Policy (Economy-Wide Policy)

a) Daily Actions



b) Cumulative Actions



Note: The left-hand side charts show the policy actions on a *daily basis*. The right-hand side charts show the *cumulative policy actions over time*. An increase corresponds to a policy loosening and a decrease to a tightening. The sample ranges from 1 January 2020 to 31 July 2020 and covers the following countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Italy, Japan, Malaysia, Netherlands, Philippines, Portugal, Saudi Arabia, South Africa, South Korea, Spain, Sweden, Switzerland, and the United Kingdom.

Appendix A - CDS Data: Compilation and Categorization across Sectors

This section describes the process of downloading, cleaning, extracting, categorizing, and constructing the final CDS series that are used in the paper. It ends with some summary statistics of country-sector coverage in the final dataset.

Download: To compile data on CDS for a broad range of countries, sectors, and companies, we begin by downloading all available daily CDS data from Refinitiv via Datastream between October 21, 2020, and November 2, 2020, covering the window from January 1, 2020, through October 20, 2020. We include daily price data, as well as information on seniority, term length, and entity (when available).

Clean the dataset: To clean the dataset, we drop any CDS meeting the following criteria. (A * indicates it was dropped later in the cleaning process.)

- Inactive (labelled as "Dead" by Refinitiv)
- Duplicates (labelled as "Duplicate" by Refinitiv)
- Relate to indices instead of individual entities
- Do not refer to a specific market/country:
    - "Eastern Europe (Oxford Econ Industry)", "Oil Exporting Countries", "Other African", "Other Asian", "Other Australasian", "Other Caribbean", "Other Central America", "Other Western European", "International"
- Do not have a company name (18 cases)*
- From central banks (3 cases)*
- Where the company cannot be identified because the company name is too short or too generic (12 cases)*
- Non-traded. To exclude CDS that appear to be non-traded, we use three criteria. First, we exclude any CDS with no price data. Second, we exclude CDS that have zero standard deviation over the sample period (1 January 2020-31 May 2020). Finally, we exclude CDS with constant prices for the first 15 trading days at the start of the sample. If there is a period of more than 15 days when there is no change in the daily price (other than the start of the sample), however, the CDS can still be included in the sample, but is marked as missing after the price stays constant for 15 days

Extract provided information: For each remaining CDS series, we extract the following information.

- Seniority information
    - Senior vs. Subordinated; a few cases carry the classifications: PREF and SEC
- Term length
    - Ranges from 0 years to 30 years
- Entity information
    - (A) Banks, (B) Sovereigns, (C) Extended Government, (D) Non-bank Financials, (E) Corporates

Extract Entity Information—Overview: Next, we classify each of the CDS into five groups: *Sovereigns, Banks, Other Financials, Extended Government,* and *Corporates* (the residual). This classification is not always straightforward, and therefore to put CDS into each of these groups we employ four complementary approaches.

- ***Refinitiv info:*** Refinitiv provides information on entities for a limited set of CDS through its data explorer. The main advantage of this approach is that the entity information is readily available. A disadvantage of this approach is that this information is only available for a (small) subset of entities and in some cases does not agree with our own classification (e.g., for some of the non-bank financials).
- ***Pre-specified list:*** This approach identifies entities based on a comparison of the company name in the CDS data with a pre-specified list of entity names that we obtain from public sources (such as lists of bank and insurance companies by country). An entity is identified if there is a perfect match between (parts of) the company name in the CDS data and the name entry in the pre-specified list. The main advantage of this approach is that well-known entities are identified, even though their names may not reveal the entity type (e.g., a bank that does not carry the term "Bank" in its name). Disadvantages are that this approach requires comprehensive external inputs (e.g., list of banks, insurance companies, sovereigns, etc.) and that it relies on an exact match (i.e., if any of the names contain a typo or they are written in an unusual way, they will not be matched).
- ***Generic text search:*** This approach identifies entities based on generic name stubs that are usually associated with this type of entity. In particular, the approach checks whether a stub (e.g., "bank" in various languages) is contained anywhere in the CDS name. The advantage of this approach is that lesser known entities can be identified as well. The main disadvantage is that certain stubs occur naturally in company names unrelated to the entity type and thus entity can be misclassified. Moreover, entities could have names in a language that was not part of our stubs.
- ***Visual inspection of the residual file:*** The last approach is based on a visual inspection of the residual file of non-identified entities. This approach is based on a manual Google search of each company name in the residual file and a determination of the entity type based on the returned search result.

Extract Entity Information—Details by Sector: Details on how each of these classifications protocols was applied by sector are listed below.

(A) Banks: The identification of banks is based on the following criteria. (A CDS is classified as belonging to the category of Banks if it is classified under any of these approaches.)

- ***1) Refinitiv info:*** Banks that have been identified by Refinitiv (category "Banks")
- ***2) Pre-specified list:*** The universe of company names in the CDS data is checked against a list of pre-specified bank names obtained from external sources. If there is an exact match of all characters in the list of pre-specified bank names and the company name in the CDS data (or a subset of the company name), then the CDS is identified as belonging to a bank.
    - The list of pre-specified bank names includes the largest 120 banks by asset size world-wide[56] and a sample of 5000 international bank names[57]
    - To increase the probability of a match, we make the following modifications to the pre-specified list of bank names:
        - We drop all "." and ","

[56] Source: https://www.relbanks.com/worlds-top-banks/top-world-banks-by-assets-2019; download 27 Oct. 2020.
[57] Source: https://www.globalbrandsmagazine.com/list-of-banks-by-country/; download 27 Oct. 2020.

        - We drop all parentheses, including their content (e.g., abbreviations of the bank name)
        - We drop the following abbreviations of companies' legal entity information: LTD, SA, AG, PLC, CORP
- ***3) Generic text search:*** A text search that searches for the following terms and identifies a CDS as that of a bank when the company name contains this word:
    - *bank, banco, banca, banche, banque, caixa, sparkasse, cassa, bankë, banku, банк, banka, банка, banc, banca, pank, pankki, τραπεζα, bainc, bankas, bancă, breh*
- ***4) Visual inspection of the residual file:*** All banks that were found in the residual file are manually classified as banks (after conducting a Google search that confirms their entity type)

Finally, we manually exclude all Development Banks, ExIm Banks, and Central Banks as well as wrongly identified corporates[58] from the list of banks.

(B) Sovereigns: A CDS is classified as that of a sovereign entity based on the following criteria:

- ***1) Refinitiv info:*** The CDS of sovereigns that have been identified by Refinitiv (category "Sovereigns")
- ***2) Generic text search:*** A text search based on the following search terms:
    - *government, gvt, govt, republic, rep, kingdom, states*
- ***3) Pre-specified list:*** A comparison of the universe of CDS company names with a pre-specified list of country names from the WEO Database.[59]
- ***4) Visual inspection of the residual file:*** The manual addition of a few sovereign CDS found in the residual file

Finally, we exclude all wrongly identified corporates[60] and extended government agencies[61] from the list of sovereigns.

(C) Extended Government: A CDS is classified as that of an extended government entity based on the following criteria:

- ***1) Refinitiv info:*** Use the information contained in the Refinitiv categories "Agency", "Supranational", and "Official & Municipal"
- ***2) Generic text search:*** A text search that used the following terms:
    - *state, province, prefectur, city*
- ***3) Pre-specified list:*** All Development Banks and Export–Import (ExIm) Banks that were identified in the process of conducting the sovereign identification

[58] E.g., "Pepsi Bottl**ing Group**" may be wrongly identified as bank because of "**ING Group**". Moreover, in a few cases, we reclassify a bank as a non-bank financial company (e.g., "Hartford Financial Services").

[59] Since many company names contain a country name as reference to their country of origin, the pre-specified list approach is implemented slightly differently than in the other cases. Conditional on not being identified as a sovereign via Approaches 1 and 2, the names that appear in both the pre-specified list of country names and in the universe of CDS company names are manually classified as sovereigns. This is equivalent to conducting an automatic search for an exact match between the pre-specified list of country names and the universe of CDS company names and excluding the wrongly identified cases by hand afterwards. However, due to the frequent use of country references in company names, this list would be quite large.

[60] E.g., "**Republic** Services INC" may be wrongly identified as sovereign because of the search term "**Republic**".

[61] E.g., "**Govt** of Ontario" may be wrongly identified as sovereign because of the search term "**Govt**".

- ***4) Visual inspection of the residual file:*** The manual addition of a few extended government entities found in the residual file

Finally, we exclude all wrongly identified corporates[62] from the list of extended government entities.

(D) Non-Bank Financials: The identification of non-bank financials is based on the following criteria:

- ***1) Refinitiv info:*** All CDS names from Refinitiv in the category "Non-bank financials" that could be identified as such based on a Google search[63]
- ***2) Pre-specified list:*** A search for an exact match between the universe of CDS company names and a pre-specified list of non-bank financial institutions.[64] To increase the chances of a match, we make the same adjustments to the pre-specified list of names as in the approach to identify banks:
    - We drop all "." and ","
    - We drop all parentheses, including their content (e.g., abbreviations of the bank name)
    - We drop the following abbreviations of companies' legal entity information: LTD, SA, AG, PLC, CORP
- ***3) Generic text search:*** A text search using the following words:
    - *fin, insur, invest, venture, leasing, fund, mutual, hedge, trust, pension, assurance, estate, asset, capital, credit, guaranty, sec, life*
- ***4) Visual inspection of the residual file:*** Manual addition of the non-bank financials entities found in the residual file

Finally, we exclude all wrongly identified corporates[65] from the list of non-bank financials.

(E) Corporates: The identification of corporates differs slightly from the previous cases and is based on the following criteria:

1) ***Refinitiv info:*** Use of all information from the Refinitiv categories "Consumer", "Electric", "Energy", "Gas", "Manufacturing", "Services", "Telephone", and "Transportation"
2) ***Pre-specified list:*** Addition of all corporates that are included in the Refinitiv category "Non-bank Financials" but that belong in the group of corporates[66]
3) ***Other:*** All CDS that are <u>not</u> identified as banks, sovereigns, extended government, non-bank financials
    - Manually checked with a Google search (around 1250 cases that have non-missing and time-varying CDS data)

---

[62] E.g., "**Allstate Corp**" may be wrongly identified as extended government because of the search term "**State**".
[63] This category appears to contain a considerable number of firms that could be considered as non-financial firms. These cases are manually re-classified as corporates.
[64] This list includes the largest global insurance companies (https://www.statista.com/study/40950/top-100-insurance-companies-global/), asset management firms (https://en.wikipedia.org/wiki/List_of_asset_management_firms), and financial services companies (https://en.wikipedia.org/wiki/List_of_largest_financial_services_companies_by_revenue).
[65] E.g., "**Sec**uritas AB" may be wrongly identified as non-bank financial because of the search term "**Sec**".
[66] E.g., even though "Porsche Automobil" is a holding company, based on its clearly defined investment focus on the automotive sector, it fits the corporate classification better than that of a non-bank financial firm.

Extracting Series for Analysis: After classifying each CDS series by sector, we then drop all of the CDS classified as *Extended Government* and *Other Financials* for the remainder of this analysis. These groups include a mix of entities that vary across countries, are hard to compare and classify, and involve different degrees of government backing (especially for *Extended Government*).[67] Also, only a small subset of mostly advanced economies have information for *Other Financials,* which would severely limit the sample size for our analysis.

Finally, for some entities with several CDS series (such as a country or company that has issued CDS of different currencies, maturities or legal characteristics), we create a composite measure that balances standardization with maximizing coverage. More specifically, we use CDS denominated in US$ with four to six year maturities, and if more than one CDS is available that meets these criteria, we collapse the observations by taking the country-sector-date mean. If a country-sector combination does not have any CDS meeting these criteria, we use CDS with one to three year maturities instead (collapsing any CDS within this group if more than one is available).

Characteristics of Data Base: After completing the data compilation process outlined above, we have information on 2,532 CDS series, covering 68 different countries.[68] When these CDS are broken down by sector, we have 127 CDS for *Sovereigns*, 396 for *Banks,* and 2009 for *Corporates*.

Finally, we create a composite measure at the country-sector level. This yields country-sector data for 61 countries with data on *Sovereigns*, 32 with data on *Banks*, and 40 with data on *Corporates*. Coverage for *Sovereigns* and *Corporates* includes a mix of Advanced Economies (AEs) and Emerging Market Economies (EMEs), while the data for *Banks* is predominantly for AEs. Appendix Table A1 lists each of the countries in the CDS sample, with the number of CDS series for each of the sectors.

[67] The *Extended Government* group includes agency, "supranational" and municipal debt, ranging from states to provinces to prefectures to cities, as well as development banks and export-import banks. *Other Financials* includes a range of non-bank financial institutions—such as insurance companies, property companies, credit card/payment service providers, and the capital/financing arms of corporations. It has minimal coverage of the hedge funds, money market funds, mutual funds, broker dealers, etc., which are important segments of the non-bank financial sector in most countries.

[68] It should be noted that the CDS series themselves are composite measures of all the traded and reported CDS contracts that fall in the same category (e.g., US$ denomination, 5-year maturity). Hence, even a single CDS series can represent a large sample of individual CDS contracts.

Appendix Table A1
Country and Sectoral Coverage in CDS Sample

Country	*Sovereign*	*Bank*	*Corporate*	*Total*
Argentina	2	0	0	2
Australia	3	29	41	73
Austria	3	6	2	11
Bahrain	2	0	0	2
Belgium	4	6	1	11
Bermuda	0	2	18	20
Brazil	2	7	12	21
Canada	0	7	55	62
Cayman Islands	0	0	4	4
Channel Islands	0	0	1	1
Chile	2	0	2	4
China	2	5	0	7
Colombia	2	1	0	3
Croatia	2	0	0	2
Cyprus	2	0	0	2
Czech Republic	1	0	0	1
Denmark	2	6	9	17
Dominican Republic	1	0	0	1
Egypt	3	0	0	3
Finland	4	0	19	23
France	2	15	93	110
Germany	3	31	82	116
Greece	4	2	5	11
Guatemala	1	0	0	1
Hong Kong	2	2	11	15
Hungary	2	0	0	2
Iceland	1	0	0	1
India	1*	18	7	26
Indonesia	1	0	0	1
Iraq	1	0	0	1
Ireland	4	0	2*	6
Israel	2	0	5	7
Italy	3	28	20	51
Jamaica	1	0	0	1
Japan	4	13	54	71
Latvia	2	0	0	2
Lithuania	1	0	0	1
Luxembourg	0	0	12	12
Malaysia	1	0	4	5

Country	*Sovereign*	*Bank*	*Corporate*	*Total*
Mexico	1	0	12	13
Morocco	2	0	0	2
Netherlands	3	16	41	60
New Zealand	0	0	2	2
Norway	3	0	6	9
Pakistan	3*	0	0	3
Peru	2	0	0	2
Philippines	2	0	2*	4
Poland	2	0	0	2
Portugal	4	2	6	12
Romania	2	0	0	2
Russia	2	5	2	9
Saudi Arabia	2	1	0	3
Serbia and Montenegro	1*	0	0	1
Singapore	0	9	4	13
Slovakia	2	0	0	2
Slovenia	2	0	0	2
South Africa	2	0	1	3
South Korea	2	15	18	35
Spain	3	23	26	52
Sweden	3	11	32	46
Switzerland	0	9	28	37
Taiwan	0	4	2	6
Thailand	2	0	0	2
Turkey	2	2	0	4
United Kingdom	4	52	156	212
United States	0	69	1212	1281
Uruguay	2	0	0	2
Vietnam	1*	0	0	1
Total	**127**	**396**	**2009**	**2532**

Note: Table lists the number of CDS series for each country by sector (*Sovereign, Bank* and *Corporate*). Underlying data on individual CDS is from Refinitiv, compiled and collapsed as described in Section III and Appendix A. Entries with stars (*) indicate that CDS with shorter maturities between 1 and 3 years have been used to calculate the composite measure at the country-sector level.

Appendix B – Summary Statistics and Data on Funding Structures and Stress

Table B1: Data for Funding Structures: *Intermediation* and *Internationalization*

Sector	Variable	Construction/Sources	Mean	Med.	S.D	Obs.
Intermediation						
Banks						
Source	*Household liabilities/total liabilities*	Bank's liabilities vis-à-vis households divided by total liabilities from all sources. Domestic and - where available - foreign sources. All instruments. Source: BIS International Banking Statistics (IBS)	0.31	0.291	0.113	56
	Bank liabilities/total liabilities	Bank's liabilities vis-à-vis other banks divided by total liabilities from all sources. Domestic and foreign sources. All instruments. Source: BIS IBS	0.253	0.25	0.105	66
	NBFI liabilities / total liabilities	Bank's liabilities vis-à-vis NBFIs divided by total liabilities from all sources. Domestic and foreign sources. All instruments. Source: BIS IBS	0.127	0.091	0.076	66
Instrument	*Loans / total liabilities to banks*	Loans and deposits from all sectors as share of funding in all instruments from all sectors. Domestic and foreign sources. Source: BIS IBS	0.821	0.821	0.102	66
	NBFI loans / total liabilities to NBFIs	Loans and deposits from NBFIs as share of funding in all instruments from NBFIs. Domestic and foreign sources. Source: BIS IBS	0.72	0.675	0.183	49
Corporates						
Source	*Bank liabilities / total liabilities*	Claims by local and cross-border banks on corporates (BIS IBS Locational banking stats (LBS) and consolidated stats (CBS) where LBS not available) divided by total credit extended to corporates from all sources (from BIS long time series for domestic credit).	0.491	0.441	0.189	56
	NBFI liabilities[3] / total liabilities	1 minus the previous measure.	0.509	0.559	0.189	56
Instrument	*Bank loans/total liabilities to banks*	Loans and deposits from banks as share of all instruments from banks. Source: BIS IBS	0.899	0.901	0.046	55
Internationalization						
Banks						
Currency	*US$ liabilities / total liabilities[4]*	Local US$ liabilities from all sectors plus US$ loans from cross-border sources + US$ international debt issuance by private banks (nationality basis) divided by total liabilities calculated in the same way for all currencies. Source: BIS IBS and BIS International Debt Statistics (IDS).	0.135	0.108	0.101	66
Counterparty location	*Cross-border liabilities / total liabilities*	Liabilities from cross-border sources divided by total liabilities. Source: BIS IBS.	0.253	0.241	0.137	66
Corporates						
Currency	*US$ liabilities / total liabilities[4]*	Local US$ claims by banks on corporates plus US$ loans from cross-border banks to corporates + US$ international debt issuance by corporates (nationality basis) [A] divided by total liabilities calculated in the same way for all currencies or – if not available - by total credit extended to corporates from all sources. Source: BIS IBS, BIS IDS and BIS long time series for domestic credit.	0.126	0.087	0.094	66
Counterparty location	*Cross-border liabilities / total liabilities*	Claims by cross-border banks on corporates + international debt issuance of corporates (residency basis) [B] divided by total credit extended to corporates from all sources. Source: BIS IBS, BIS IDS and BIS long time series for domestic credit.	0.179	0.143	0.144	62
Intermediation and Internationalization						
Banks						
Source/ currency	*US$ bank liabilities/total liabilities[4]*	Banks' US$ liabilities vis-à-vis other banks divided by total liabilities from all sources. Domestic and foreign sources. All instruments Source: BIS IBS.	0.058	0.051	0.042	66
	US$ NBFI liabilities / total liabilities[4]	Banks' US$ liabilities vis-à-vis NBFIs divided by total liabilities from all sources. Domestic and foreign sources. All instruments Source: BIS IBS	0.017	0.009	0.016	63
Source / counterparty location	*Bank cross-border liabilities / total liabilities*	Banks' cross-border liabilities vis-à-vis other banks divided by total liabilities from all sources. All instruments. Source: BIS IBS	0.138	0.11	0.061	66

	NBFI cross-border liabilities / total liabilities	Banks' cross-border liabilities vis-à-vis NBFIs divided by total liabilities from all sources. Source: BIS IBS	0.041	0.03	0.037	66
Instrument / currency	*Loans / US$ liabilities*	Local and cross-border US$ loans from all sectors divided by total US$ liabilities (i.e., in loan and other debt instruments). Source: BIS IBS	0.733	0.746	0.14	66
Instrument / counterparty location	*Loans / cross-border liabilities*	Loans from cross-border sources divided by all liabilities from cross-border sources (both from all sectors). Source: BIS IBS	0.702	0.734	0.188	66
Corporates						
Source / currency	*US$ bank liabilities/total liabilities*[4]	US$ claims by local and cross-border banks on corporates divided by total credit extended to corporates from all sources. Source: BIS IBS and BIS long time series for domestic credit	0.037	0.023	0.032	48
Source / counterparty location	*Cross-border bank liabilities/ total liabilities*	Claims by cross-border banks on corporates divided by total credit extended to corporates from all sources. Source: BIS IBS and BIS long time series for domestic credit	0.061	0.055	0.037	62
Instrument / currency	*Loans / US$ liabilities*[4]	Local US$ loans by banks on corporates plus US$ loans from cross-border banks to corporates divided by total corporate US$ liabilities [see [A] above]. Source: BIS IBS and IDS.	0.442	0.44	0.18	49
Instrument / counterparty location	*Loans / cross-border liabilities*	Loans by cross-border banks on corporates divided by total liabilities from cross-border sources [see [B] above]. Source: BIS IBS and IDS.	0.314	0.287	0.195	66

Table B2 – Additional Data and Summary Statistics

Variable	Construction/Sources	Means	Median	S.D.	Obs.
Country-sector approach (equation (2))					
Stress	Log change in CDS over the *Covid Shock* (from 1 January to 23 March). Sources: See Appendix A	0.812	0.823	0.418	66
New covid cases per 100k	Average cases in the two weeks between 10 March and 23 March. Source: Haver.	1.598	1.292	1.739	66
Country-sector-time approach (equation (3))					
Stress	Log change in daily CDS. Sources: See Appendix A	0.014	0.001	0.047	3,696
New covid cases per 100k	Daily Covid cases per 100 thousand inhabitants. Source: Haver.	0.275	0	0.892	3,696
Δvix	Daily growth rate in VIX. Source: Datastream.	0.039	0.002	0.147	3,696
RORO index	Risk-on-risk-off index (Chari et al., 2020). Daily index includes: ICE BofA BBB Corporate Index Option-Adjusted Spread for the United States and the Euro Area; Moody's BAA corporate bond yield relative to that for 10-year Treasuries; daily returns on the S&P 500, STOXX 50, and MSCI Advanced Economies Index; option implied volatilities from the VIX and the VSTOXX; G-spread on 2-, 5-, and 10-year Treasuries; TED spread; 3-month LIBOR-OIS spread; bid-ask spread on 3-month Treasuries; trade-weighted US Dollar Index; and the spot gold price change. Each of these components of the index are normalized such that positive changes in the index imply risk-off behavior, and their respective historical standard deviations scale the normalized changes. Then the first principal component is extracted and used to compute the z-score, which serves as the RORO measure.	0.932	0.041	2.728	3,762
ΔCountry-specific equity (MSCI) volatility	Daily growth rate in (realized) volatility of country-specific stock returns, measured based on the MSCI country indices. Volatility is calculated as the standard deviation of daily returns over rolling 22-working day (i.e. 1 month) periods on a daily measure.	0.034	0.006	0.105	3,591

Appendix C – Additional Analysis

Table C1 – Sectoral dummies and Covid controls

	(1)	(2)	(3)	(4)	(5)	(6)
sector_bank	-0.31***		-0.37***	-0.19		-0.37*
	(0.09)		(0.11)	(0.15)		(0.19)
sector_corp		0.05	-0.12		-0.16	-0.31*
		(0.10)	(0.12)		(0.15)	(0.17)
New Covid Cases per 100k*sector_bank				-0.06		0.01
				(0.04)		(0.06)
New Covid Cases per 100k*sector_corp					0.13**	0.13*
					(0.05)	(0.07)
Observations	66	66	66	66	66	66
R-squared	0.54	0.44	0.55	0.55	0.51	0.61
Number Countries	25	25	25	25	25	25
Adjusted R-squared	0.252	0.0893	0.256	0.257	0.178	0.311

Notes: The table shows the estimated parameter values from a panel regression of equation (2). All columns include country and sector fixed effects (in the form of bank and corporate sectoral dummies *sector_bank* and *sector_corp* respectively). Standard errors are clustered at the country level. The dependent variable measuring financial stress is the log change in sector-specific CDS during the *Covid Shock* (Jan 1 to Mar 23, 2020). See Appendix Table B for detailed definitions, sources and sample statistics for each variable.

Appendix D: Construction of Policy Response Variables

The IMF database in Kirti et al. (2022) contains two policy variables that are highly relevant for our empirical analysis but their original coding does not distinguish between tightening and loosening: "*27. market_based_measure*" (= Market-Based Measures) and "*28. NBFI*" (= Non-Bank Financial Institutions). To be able to use these variables consistently with other policy variables in our analysis, we code their direction based on the event description in the IMF database and, if more information is needed, on the basis of the linked background documents.

Our central guiding principle is that we code a policy action as a "loosening" ["tightening"] if a policy action *eases [increases]* today's challenges for an institution (for NBFI) or of a market participant (for market based measures) at the cost [benefit] of increasing [decreasing] the challenges of either (i) another entity today (e.g., the customer, the regulator, a counterparty) or (ii) of the same entity in the future.

Consider the following example: E.g., the policy action "*EIOPA [European Insurance and Occupational Pensions Authority] recommendations on supervisory flexibility regarding deadlines of supervisory reporting and public disclosure by insurers*" (recorded for the variable NBFI in Austria on 20 March 2020). This suggests that the regulator offers operational relief to the regulated entities by allowing delays in reporting and public disclosure standards. Hence, this policy action eases the impact on the personnel and financial resources of the regulated entity today, but possibly at the cost of lowering the regulatory standards in the sector, which might complicate the work for the regulator contemporaneously (e.g., who now faces data gaps) or negatively affect the work of the regulated entity in the future (e.g., investors may be more cautious due to the reduction in transparency).

Typical policy actions included in the NBFI variable are related to modifying reporting requirements, providing instructions on how to handle customer claims during the pandemic, and placing restrictions on share buy backs and dividend payouts for insurance companies.[69] For the market-based measure variable, common policy actions include modified reporting requirements as well as bans on short-selling. We exclude a small number of policies that are very unlikely to have any impact on CDS prices, e.g., the policy action "*Clarification of issues related to the application of MiFID II requirements on the recording of telephone conversations*" (recorded for the variable market-based measures, Spain, 20 March 2020) appears to merely modify previously issued guidelines on the recording of phone conversations.[70]

[69] In line with the guiding principle above, restricting share buy backs and dividends eases the challenges of the regulated entity today (i.e., through an increase in retained earnings) but could come at the costs of increased challenges in the future (i.e., investors may be more hesitant to invest in the company if the stock performs poorly or may not pay a dividend).

[70] While this minor modification of an already small policy action is unlikely to have any detectable impact on CDS prices, there are good reasons to still include seemingly smaller policy actions in the analysis. For example, instructions by the regulator to conduct audits in a virtual setting instead of in-person could reduce the level of thoroughness with which the audit is conducted, impact personnel and financial resources of the regulated entity, and increase the possibility of legal challenges in future.

Appendix Table D1: Summary Statistics and Data on Policy Responses

Variable	Variable in Kirti et al. (2022)	Description based on Kirti et al. (2022)	Mean	Med.	S.D.	Min	Max	Obs.
Non-Bank Financial Intermed-iation (NBFI) Policies	*NBFI* with a directional coding. (Dummy)	All prudential measures applied to non-bank financial institutions. Actions unrelated with prudential regulations are not included. We add a directional coding to the variable from Kirti et al. (2022).	0.0472	0	0.2546	-1	1	5,444
Market-Based Measures (MBM)	*market_based_ measure* with a directional coding. (Dummy)	Regulations on financial market participants or recommended actions in response to Covid, such as rules on short selling, security issuance, reporting, etc. We add a directional coding to the variable from Kirti et al. (2022).	0.0068	0	0.2495	-1	1	5,444
US$ Swap Lines	*swap_line* but only cases related to US$ swap lines. (Dummy)	Swap lines between central banks. Kirti et al. (2022) only record swap lines for the counterparty with a relatively greater need for foreign exchanges. If relative need cannot be determined, they record the measure for both sides. We focus only on US$ swap lines in our analysis.	0.0173	0	0.1303	0	1	5,444
Prudential Regulations	*prudential* (Dummy)	Summary measure of all prudential policies in Kirti et al. (2022). Sign of the sum of all policy dummies in this category, which covers: prudential buffers, buffer usability, capital requirements, dividend restrictions, special provisioning rules, borrower-based measures, supervisory expectations, lending standards, reporting requirements, liquidity requirements, and other.	0.0952	0	0.2934	0	1	5,444
Macropru-dential Buffers	*pru_buffer* (Dummy)	Three specific buffers are included: the countercyclical capital buffer (CCyB), the capital conservation buffer (CCoB), and the systemic risk buffer (SyRB). Sizes are actual buffer changes. Therefore, as is often the case, if a measure is to postpone scheduled future buffer changes, Kirti et al. (2022) recognize the measure but code its size as missing. If different banks are subject to different buffer changes, Kirti et al. (2022) choose one that affects most banks for CCyB and CCoB and take a simple average for SyRB.	0.0145	0	0.1196	0	1	5,444
Policy Rate Changes	*pol_rate_size (rescaled to percentage points)*	Changes in the policy interest rate. An announcement of no change or a speech on the expected rate path is not considered an actual policy. If a central bank uses multiple interest rates, Kirti et al. (2022) select the one that is most related to lending as the policy rate and include changes to other interest rates under the "other rates". Once Kirti et al. (2022) select the policy rate, they do not change it for consistency.	0.0038	0	0.0527	-0.79	1	5,444
Asset Purchases	*APP_gdp (rescaled to share of GDP)*	Purchases of securities, such as bonds, stocks, and commercial paper in the secondary market by the central bank. The intention should not be only to improve short-term market liquidity.	0.0006	0	0.0059	0	0.099	5,444
Market Liquidity Policy	*market_liquidity* (Dummy)	Short-term lending or interventions in asset markets, with the explicit and sole intention of improving short-term market liquidity. Kirti et al. (2022) determine the intention of a measure based on its stated aim as well as any relevant context.	0.005	0	0.0703	0	1	5,444
Fiscal Policy	*broad_fiscal_gdp (rescaled to share of GDP)*	Summary measure of all fiscal policies in Kirti et al. (2022). Sign of the sum of all policy dummies in this category, which covers: grants, tax reliefs, tax referrals, equity participation, public loans, public guarantees.	0.0015	0	0.0105	0	0.1591	5,444