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# Fiscal support and banks' loan loss provisions during the COVID-19 crisis☆

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ABSTRACT

We study the effect of governments' fiscal support on banks' loan loss provisioning during the COVID-19 pandemic. In addition, we decompose fiscal support into direct support and liquidity support to examine the effect of different types of support measures on banks' loan loss provisioning. Direct support generally refers to cash transfers, tax reliefs, and tax deferrals, while liquidity support generally refers to government-backed loans and equity injections. We find that direct support reduced banks' loan portfolio risk whereas liquidity support did not. Moreover, we find the effect goes beyond a macroeconomic stabilization effect, suggesting that direct support directly contributed to mitigating banks' loan portfolio risk during the pandemic. Our results are robust to controlling for other policy interventions, alternative model specifications, and an instrumental variable approach. We further discuss the policy implications of our analysis.

## 1. Introduction

The COVID-19 pandemic led to the sharpest economic contraction since the Great Depression. As economic crises go hand in hand with financial crises (Jordà et al., 2011), policymakers were highly concerned that the COVID-19 shock would hit bank balance sheets and aggravate the economic downturn.[1] Contrary to expectations, however, the banking sector proved remarkably resilient during the COVID-19 pandemic. A natural question that arises is whether this resilience should only be attributed to stricter regulatory requirements in the banking sector or also to the unprecedented fiscal support provided by governments.

In this paper, we aim to contribute to this debate by examining the effect of fiscal support on banks' loan portfolio risk.[2] In order to empirically examine this, we focus on banks' loan loss provisions. Loan loss provisions directly influence the volatility of banks' earnings, and ensure an accurate assessment of banks' loan portfolio risk attributes (Goncharenko and Rauf, 2021; Nicoletti, 2018). In addition, previous studies have shown that loan loss provisions are of great concern to policymakers because the pro-cyclicality of banks' loan loss provisioning can adversely affect banks' resilience and lending capacity, thereby exacerbating economic recessions (Agénor and Zilberman, 2015; Beatty and Liao, 2011; Huizinga and Laeven, 2019; Krüger et al., 2018).

In the first part of our analysis, we study the effect of fiscal support on banks' loan loss provisioning expenses. To this end, we manually collect data on fiscal support measures from 37 different countries. Based on a sample of nearly one thousand banks over the period 2016–2021, we find that fiscal support limited pressure on financial institutions through reduced loan loss provisions during the COVID-19 crisis. Particularly, we find that a one standard deviation increase in total fiscal support is (ceteris paribus) associated with an 0.015 percentage point decrease in banks' loan loss provisions over lagged

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[1] See IMF (2020a) "Global Financial Stability Report: Markets in the Time of COVID-19"; IMF (2020b) "Global Financial Stability Report Update: Financial Conditions Have Eased, but Insolvencies Loom Large"; Financial Times (2020a) "Financial crunch looms as economies reel from coronavirus shock"; Financial Times (2020b) "IMF's grim forecasts show financial risks loom", among others.

[2] It is beyond the scope of this paper to assess the banking regulatory framework during the COVID-19 crisis, which is discussed by Duncan et al. (2022).

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total assets. This effect is statistically and economically significant, as it corresponds to approximately 20% of banks' average loan loss provisions.

Interestingly, we show that this effect goes beyond a macroeconomic stabilization effect. More specifically, we show that our results are robust to controlling for (1) a large set of bank variables, such as banks' capital position and the composition of banks' loan portfolio, (2) contemporary economic variables, such as real GDP growth, unemployment, and economic uncertainty, and (3) forward-looking economic variables, such as expected real GDP growth. This suggests that banks' provisioning behavior was not only based on the structure of their balance sheet and economic outlook, but also directly dependent on governments' fiscal support.

In the second part of our analysis, we study which types of fiscal support reduced banks' loan loss provisioning expenses. To do so, we decompose fiscal support into direct and liquidity support. Direct measures refer to additional spending and foregone revenue, whereas liquidity measures refer to measures aimed at providing credit and liquidity (see IMF, 2022). We show that the negative relationship between fiscal support and banks' provisioning expenses is driven by direct measures, such as targeted cash transfers and tax reliefs. In contrast, our findings suggest that liquidity measures, such as loan guarantee schemes and equity injections, did not play a significant role in banks' provisioning behavior.

We show that these results are robust to an instrumental variable approach. A potential endogeneity concern is that countries more severely hit by the COVID-19 pandemic adopted both stricter lockdowns and broader support measures to mitigate the adverse economic implications of those lockdowns. Following Aizenman et al. (2022), we use differences in countries' established political structure as instruments for the degree of countries' fiscal support measures during the pandemic. The results of this instrumental variable approach confirm that fiscal support had a negative effect on banks' loan loss provisions, and that this effect is driven by direct support measures.

We further provide evidence on the mechanism through which fiscal support reduced banks' loan portfolio risk. In particular, we show that the effect of direct support on loan loss provisions is generally more pronounced for banks with riskier loan portfolios. In addition, we find that the effect of fiscal support does not only apply to banks' loan loss provisions, but also to banks' net charge-offs (a measure of loan portfolio risk that is less susceptible to bank managers' manipulation and that more closely captures actual loan losses). In sum, these findings are consistent with the idea that direct support reduced borrowers' default risk and thereby mitigated banks' loan portfolio risk during the COVID-19 crisis.

We subject our findings to a battery of robustness checks. First, we show that our results hold after controlling for pre-existing social safety nets, central bank interventions, and public health interventions during the COVID-19 crisis. Second, we show that our results are not driven by one particular country in our data set. Third, we show that our results remain when employing alternative model specifications.

Our paper contributes to three strands of research. First, our paper contributes to the literature that studies banks' loan loss provisioning behavior during economic downturns. Previous studies have investigated the real effects of pro-cyclical loan loss provisioning in the banking sector (e.g., Beatty and Liao, 2011; Bushman and Williams, 2015; Laeven and Majnoni, 2003). These studies stress that pro-cyclical provisioning reduces banks' lending capacity during recessions, and thereby aggravates economic crises. More recently, researchers have studied how this pro-cyclicality depends on different accounting standards (Abad and Suarez, 2018; Agénor and Zilberman, 2015; Bouvatier and Lepetit, 2012; Goncharenko and Rauf, 2021). Our paper adds to this literature by analyzing whether fiscal support mitigated pro-cyclical loan loss provisioning during the COVID-19 pandemic.

Second, our paper contributes to the literature on the cost-benefit trade-offs of government interventions in the banking sector (Acharya et al., 2021). Several studies have shown that financial sector interventions can create moral hazard problems and thereby increase bank risk-taking (e.g., Bayazitova and Shivdasani, 2011; Dam and Koetter, 2012; Duchin and Sosyura, 2014; Gropp et al., 2014). These studies generally focus on measures directly targeted at the banking sector, such as bank recapitalizations and public guarantees. Our paper, however, examines how different types of fiscal support targeted at households and businesses affects the banking sector.

Third, we contribute to a growing body of literature that studies the effect of the COVID-19 crisis on the banking sector (e.g., see Berger and Demirgüç-Kunt, 2021). Previous studies have, for instance, examined the effect of the COVID-19 pandemic on bank performance (Demirgüç-Kunt et al., 2021), bank lending (Altavilla et al., 2021; Hasan et al., 2021; Beck and Keil, 2022), bank deposits (Levine et al., 2021), and systemic risk (Duan et al., 2021). To the best of our knowledge, our study is the first to analyze the effect of different types of fiscal support on banks' loan portfolio risk during the pandemic.

We provide a timely and policy-relevant analysis, but we want to stress that our empirical results should be interpreted with some limitations in mind. First, while we provide evidence that more extensive fiscal support is associated with reduced loan loss provisions, we do not directly observe to what degree a bank's customers benefited from fiscal support. Second, we lack information on cross-border bank exposures such that we implicitly assume that a bank only takes into account the support measures implemented by the country it is located in. Third, our results do not allow to claim that the COVID-19 crisis would have transitioned into a financial crisis in the absence of fiscal support. In particular, while our results on the reduced-form impact on loan loss provisioning are qualitatively close to those observed during the global financial crisis, the reduced-form impact on bank profitability and capitalization is mild, possibly due to the fact that our estimated effects only capture the direct effects of fiscal support. Nevertheless, our results provide valuable policy implications and warrant further research into the effectiveness of different types of fiscal support measures.

The remainder of this paper proceeds as follows. Section 2 outlines the accounting principles of loan loss provisioning and the policy concerns related to pro-cyclicality in banks' provisioning behavior. Section 3 introduces the empirical approach and the data sample. Section 4 presents the main results. Section 5 discusses the findings in greater depth and outlines the policy implications of our empirical analysis.

## 2. Background

Banks generally set aside loan loss provisions to cover for expected loan losses (Bushman and Williams, 2015). Conceptually, loan loss provision are non-cash expenses that banks keep as an allowance for impaired loans (Goncharenko and Rauf, 2021). The loan loss provisions are added to a bank's loan loss reserves – a contra-asset for loans – which serve as buffer to absorb loan losses (Andries et al., 2017).[3] When a loan loss eventually realizes, the loan loss provisions are charged off, which removes the loans and corresponding loan loss reserves from a bank's balance sheet (Andries et al., 2017; Ng et al., 2020).

Loan loss provisions are of great interest because they directly influence the volatility of bank earnings and provide an accurate assessment of banks' credit risk (Goncharenko and Rauf, 2021; Nicoletti, 2018). Many academics and practitioners have therefore investigated how loan loss provisioning affects lending behavior and bank stability, particularly during crisis periods (Agénor and Zilberman, 2015; Beatty and Liao, 2011; Bikker and Metzemakers, 2005; Laeven and Majnoni,

[3] Loan loss provision are banks' primary financial accounting expense and account for a large fraction of banks' total accruals (Beatty and Liao, 2014; Huizinga and Laeven, 2019). As such, loan loss provisions are also used by regulators as a signal of bank health (Andries et al., 2017; Nicoletti, 2018).

2003). In general, the policy concern is that banks' provisioning behavior tends to be pro-cyclical, meaning that provisions increase as economic activity declines, and vice versa. In this respect, two adverse consequences have been emphasized by the academic literature. First, pro-cyclical credit loss provisions can significantly weaken capital positions during recessions, which could cause a credit crunch and thus increase the depth and duration of economic downturns (Bernanke et al., 1991; Bouvatier and Lepetit, 2012; Kroszner et al., 2007). Second, pro-cyclical loan loss provisioning can threaten financial stability because "bank capitalizations are more negatively affected at the trough of the business cycle, which is exactly when capital market conditions for banks are at their weakest" (Huizinga and Laeven, 2019, p. 496).

To address these concerns, several regulatory reforms have been introduced following the global financial crisis, with the implementation of Basel III and expected loan loss provisioning standards being two of the most recent ones.[4] Regulators have claimed that these regulatory reforms would mitigate credit contractions in periods of distress, reduce financial instability, and prevent government intervention in financial institutions. Despite these reforms, policymakers expressed concerns that the COVID-19 shock would hit bank balance sheets and thereby aggravate the economic downturn (IMF, 2020a; Financial Times, 2020a,b), leading governments to provide massive fiscal support. Several studies have analyzed the effectiveness of this fiscal support in supporting firms (e.g., Altavilla et al., 2021; Granja et al., 2022), but little is known about the effect on bank balance sheets. To fill this gap in the literature, we study the effect of governments' fiscal support on banks' loan portfolio risk.

## 3. Methodology and data

### 3.1. Empirical method

The main objective of this paper is to assess whether and how fiscal support mitigated the impact of the COVID-19 crisis on the banking sector through reduced loan loss provisions. In a first analysis, we therefore investigate the relationship between overall fiscal support and banks' provisions for (expected) loan losses. To this end, we use panel regressions similar to the ones used by previous academic studies (e.g., Beatty and Liao, 2011; Bushman and Williams, 2015; Huizinga and Laeven, 2019; Laeven and Majnoni, 2003; Silva, 2021). In particular, we estimate regressions of the following form:

$$LLP_{bt} = \alpha + \beta Fiscal\ support_{ct-1} + \gamma X_{bt} + \delta M_{ct} + \lambda_b + \lambda_t + \epsilon_{bt} \quad (1)$$

In this equation, $LLP_{bt}$ (henceforth referred to as the LLP ratio) represents the loan loss provisions scaled by the lagged level of total assets of bank $b$ located in country $c$ during quarter $t$. The variable of interest is $Fiscal\ support_{ct-1}$, which is the total fiscal support at quarter $t-1$ of the country $c$ that bank $b$ is located in expressed as a percentage relative to the 2019 GDP.[5] $X_{bt}$ is a vector of bank-specific variables and $M_{ct}$ a vector of country level macroeconomic variables. These two vectors allow to control for heterogeneity between banks and differential effects with respect to countries' economic conditions. $\lambda_b$ and $\lambda_t$ are bank and time fixed effects, respectively, that capture any bank or time-specific unobserved heterogeneity.[6] The error term, represented by $\epsilon_{bt}$, is clustered at the bank and time level (Petersen, 2009).[7]

The main variable of interest in the above regression model is the lagged degree of fiscal support, represented as $Fiscal\ support_{ct-1}$. We expect that banks located in countries with more extensive fiscal support recognize less loan loss provisions in the subsequent quarter, based on the rationale that greater government intervention shields financial institutions from substantial credit losses. This means that we expect a negative relationship between fiscal support and provisions for loan losses or, stated differently, that government intervention was a-cyclical as it reduced the pro-cyclicality of provisions in times of distress. Important to emphasize is that $Fiscal\ support_{ct-1}$ is the total level of fiscal support in quarter $t-1$, rather than the quarterly change in fiscal support. We use the total level because fiscal support measures were gradually implemented after being announced (or enacted). For instance, loan guarantee schemes and cash transfers were announced at a specific moment but rolled out over multiple periods. We argue that it is reasonable to assume that banks already derive information from governments' commitment to implement support measures, rather than the eventual implementation itself. In this sense, the accrued level of fiscal support allows to account for support measures announced in preceding periods. In robustness checks, we show that this assumption is however not critical to our results.

Following Beatty and Liao (2014), Laeven and Majnoni (2003), and Huizinga and Laeven (2019), we include a large set of bank and macroeconomic control variables. In terms of bank controls, we first introduce bank revenue before provisions. This variable comprises a bank's pre-provision net revenue over lagged total assets, and can be interpreted as the earnings capacity that can be used for capital or loan loss provisions. A positive relation between loan loss provisioning and pre-provision net revenue suggests that bank management uses discretionary provisioning to smooth bank income over time in order to reduce earnings volatility (Beatty et al., 1995; Fonseca and Gonzalez, 2008; Laeven and Majnoni, 2003). Second, we include loan growth (compared to the previous quarter) in order to account for banks' risk-taking motive. As stated by Huizinga and Laeven (2019), banks usually expand their loan portfolios by extending riskier loans which leads to higher loan loss provisions. In our context, controlling for loan growth also ensures that any effect of fiscal support on loan loss provisions is not driven by changes in bank lending during the crisis.

Third, we add the natural logarithm of lagged total assets as a measure of bank size. In this way, we can take into account that larger banks may be more diversified and more resilient to shocks (Huizinga and Laeven, 2019) or, alternatively, that larger banks may be more heavily regulated and monitored (Beatty and Liao, 2014; Bushman and Williams, 2012).[8] Fourth, we account for the riskiness of banks' loan

[4] Many advanced economies recently introduced the expected credit loss provisioning framework. Traditionally, a distinction can be made between incurred and expected loan loss provisioning standards. Under the incurred loss rules, banks are required to assess whether there is any objective evidence (a so-called "loss event") that a loan suffered a loss based on economic factors as of the financial statement date (Basel Committee on Banking Supervision, 2021). This implies that loan loss reserves can be established only in case a loss is probable based on past events existing at the reporting date. Under the expected provisioning framework, developed after the global financial crisis, banks are required to take on a more forward-looking approach. More specifically, banks should rely on historical experience, current conditions, and model-based forecasts to take provisions against expected loan losses (Basel Committee on Banking Supervision, 2017), which requires banks to take on a forward-looking approach when it comes to building up loan losses reserves. The main purpose of these so-called expected provisioning rules is to stimulate provisioning in a timely manner (i.e., during economic upturns and before credit risks actually materialize), which would enable banks to "better absorb losses by drawing upon these provisions in the wake of a negative credit cycle" (Tayler and Zilberman, 2021, p. 1).

[5] Note that we assume that the fiscal support received by a bank could be equalized to the fiscal support of the country that the bank is located in as we were not able to find accurate information on bank level government support.

[6] Considering that regulatory requirements (and national policies in general) are decided at the country level, we also run regressions where we replace the bank fixed effects by country fixed effects. Untabulated results confirm that our results hold in that case.

[7] Table A.5 in Appendix confirms that our results hold if we cluster the standard errors at the country and time level.

[8] In addition, controlling for bank size is particularly relevant during crisis periods, as previous evidence has shown that larger banks' provisioning behavior tends to be more pro-cyclical (Huizinga and Laeven, 2019).

portfolio by including the lagged ratio of NPLs to total assets and LLRs to total assets. Past NPLs and LLRs usually reflect the overall credit quality of banks' loan portfolio, so these ratios tend to be positively related to banks' current level of loan loss provisions (Agénor and Zilberman, 2015; Beatty and Liao, 2014). The ratios can, however, also reflect that banks built up sufficiently high levels of provisions in the past so that their effect on loan loss provisions may be negative. Lastly, we account for banks' capital strength, which captures capital management incentives. In particular, previous evidence suggests that banks base current provisions for loan losses on capital requirements (Beatty and Liao, 2014; Huizinga and Laeven, 2019).[9]

In terms of macroeconomic controls, we first include real GDP growth to capture countries' economic performance. Obviously, a higher rate of GDP growth is expected to lead to lower loan loss provisions given that upturns are associated with relatively lower default rates. The more negative the relationship between loan loss provisions and real GDP growth, the more pro-cyclical banks' provisioning behavior. Second, we include the unemployment rate as an alternative proxy for economic activity. As Beck and Narayanamoorthy (2013) and Hamadi et al. (2016) show, there is a positive relationship between unemployment and banks' credit loss provisions. Third, we control for economic uncertainty as recent evidence has shown that uncertainty increases banks' loan loss provisions (Ng et al., 2020). Finally, we control for expected economic growth to account for the fact that loan loss provisions generally comprise actual as well as expected future loan losses (i.e., loan loss provisions are forward-looking).[10]

In a second analysis, we extend the previous regression model by decomposing fiscal support into its two underlying components, namely direct measures and liquidity measures (see IMF, 2022). The former refer to additional spending and foregone revenue, whereas the latter refer to support measures aimed at providing credit and liquidity. This decomposition allows to investigate the role of the individual fiscal support measures in relation to banks' provisioning behavior. The equation of interest then becomes:

$$LLP_{bt} = \alpha + \beta_D Direct\ support_{ct-1} + \beta_L Liquidity\ support_{ct-1} + \theta X_{bt} + \eta M_{ct} + \lambda_b + \lambda_t + \epsilon_{bt} \quad (2)$$

In Eq. (2), $Direct\ support_{ct-1}$ indicates the direct support during quarter $t-1$ provided by country $c$ that bank $b$ is located in, expressed as a percentage of the corresponding country's GDP in 2019. Direct support measures mainly include targeted cash transfers (e.g., stimulus checks), tax delays, tax reliefs, and public investments, among others. We expect these types of support to have a negative effect because they directly improve the financial situation of individuals and businesses, thus decreasing financial distress and default risk.

$Liquidity\ support_{ct-1}$ indicates the liquidity support during quarter $t-1$ provided by country $c$ that bank $b$ is located in, expressed as a percentage of the corresponding country's GDP in 2019. Liquidity support measures mainly include government-sponsored loan guarantees and subsidized lending, and to a smaller extent also equity injections. We expect an insignificant relationship between these types of support and banks' provisioning expenses. The rationale is that government-backed loans were channeled to firms through banks. Although the government-backed loans may have been relatively risky, the coverage ratios of the COVID-19 guarantee schemes were relatively high, meaning that banks could shift a part of borrowers' default risk to governments (Casanova et al., 2021). Further, equity injections are not necessarily used to repay bank loans. Based on these arguments, liquidity support may not have a large impact on banks' (expected) credit losses. However, Altavilla et al. (2021) show that European banks slightly improved their asset quality during the COVID-19 crisis by actively substituting pre-existing (risky) exposures by guaranteed loans. Based on this evidence, we could also expect a negative relationship between liquidity support and banks' provisioning expenses.

### 3.2. Data

We start by manually collecting data on different countries' fiscal support measures during the pandemic. To this end, we collect information from the Fiscal Monitor Database of Country Fiscal Measures in Response to the COVID-19 Pandemic (developed by the International Monetary Fund—IMF), the Bruegel data set on fiscal response to the economic fallout from the coronavirus, the COVID-19 Financial Response Tracker (developed by the Yale Program on Financial Stability), official government statements, and news reports.[11] For all fiscal support measures, we collect details about the size of the announced measures (in the form of official or unofficial estimates). In this respect, two points need to be clarified. First, we only consider measures that supplement existing automatic stabilization mechanisms. Second, as several measures were announced without an explicit budget or rollout period, we use the announced ex-ante expenditure estimates rather than actual expenditures (as in Kirti et al., 2022). We then cross-check the information from the different data sources in order to verify the data quality and consistency. We further restrict our sample to countries that implemented an expected loan loss provisioning framework before the onset of the pandemic to ensure that the banks in our sample set aside provisions for actual as well as expected loan losses. In this way, we construct a quarterly data set on the fiscal support measures that governments in 37 different countries announced in response to the pandemic during 2020 and 2021.[12]

In order to accurately capture the dynamics of banks' provisioning behavior during the COVID-19 crisis, we use quarterly instead of annual data. Using SNL Financial, we collect quarterly bank data for all financial institutions operating in these 37 countries for the period 2016–2021. We generally rely on unconsolidated financial statements and only use consolidated data if banks fail to report unconsolidated statistics (as in Aizenman et al., 2022). To control for the consistency and quality of bank reporting, we remove banks having more than twelve missing observations for any of the financial covariates that we discussed earlier. In addition, in order to minimize the effects of outliers, we remove two extreme bank observations (related to mergers and changes in risk management) and further trim the bank level variables at the 2.5th and 97.5th percentiles. This eventually results in a sample of approximately 22,000 bank-quarter observations, with a total of 994 banks over 37 different countries.[13]

[9] The rationale is that loan loss provisioning expenses negatively affect earnings so that a one dollar increase in loan loss provisions reduces Tier 1 capital by the after-tax amount of the provision (Beatty and Liao, 2014).

[10] As explained in Section 3.2 below, we restrict our sample to countries that had implemented a forward-looking provisioning framework before the onset of the COVID-19 crisis. Loan loss provisions therefore capture actual as well as expected loan losses in our study.

[11] The Fiscal Monitor Database of Country Fiscal Measures in Response to the COVID-19 Pandemic can be found at https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19. The Bruegel data set can be found at https://www.bruegel.org/publications/datasets/covid-national-dataset/. The COVID-19 Financial Response Tracker can be found at https://som.yale.edu/faculty-research-centers/centers-initiatives/program-on-financial-stability/covid-19-crisis.

[12] Kirti et al. (2022) recently developed a comprehensive announcement-level database on policy measures taken by 74 different countries during the COVID-19 pandemic. However, the database constructed by Kirti et al. (2022) only covers 2020, while our sample period runs until 2021.

[13] In order to provide a sense of the representativeness of the banks in our data sample, we have compared the total assets of banks in our sample to the total assets of the global banking sector. Based on figures provided by the Financial Stability Board (2020), we find that our banks cover 30% of the total assets of the global banking sector, with a coverage of about 30% of banking assets in the EU, 80% in the US, and around 50% for the other covered countries.

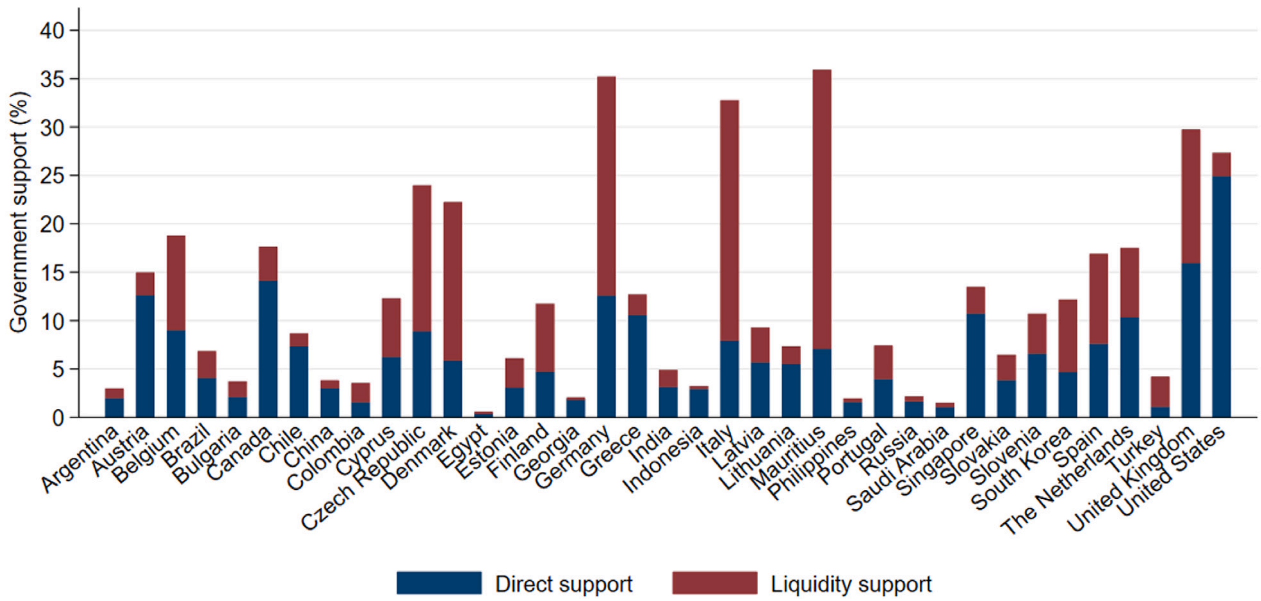


**Fig. 1.** Decomposition of total fiscal support per country by the third quarter of 2021.

Data on unemployment and real GDP growth is retrieved from the OECD database. For countries not reported in the OECD database, we collect data from the website of the responsible national authority. Data on real GDP forecasts is retrieved from the IMF economic outlook database. Particularly, we use the one-year-ahead real GDP forecast. These forecasts are published on a semi-annual basis, so we assume that the one-year-ahead real GDP forecast remains unchanged for two consecutive quarters.[14] Data on economic uncertainty is retrieved from the World Uncertainty Index developed by Ahir et al. (2022). We use the smoothed version of the World Uncertainty Index, which is a three-quarter weighted moving average of the World Uncertainty Index and is based on the frequency of economic uncertainty discussions in the quarterly country reports of the Economist Intelligence Unit (Ahir et al., 2022).[15,16] Table A.1 in Appendix presents an overview of all the variables used in our empirical analysis, their definition, and data source.

Table 1 depicts the descriptive statistics of the different bank and country variables. On average, banks set aside 0.092% of (lagged) total assets to cover for expected loan losses.[17] This constitutes a large fraction of banks' expenses (also see Huizinga and Laeven, 2019) and we can derive that this corresponds to nearly one fifth of banks' pre-provisioning revenue. The average NPL ratio equals 1.498% but the distribution shows substantial heterogeneity across banks as this ratio reaches more than 10% for some banks. Further, we can derive that banks remained relatively well-capitalized throughout the whole period, given that the minimum and average Tier 1 ratio in the data sample equal approximately 8.8% and 14.9%, respectively. Turning to the country level variables, the statistics on real GDP growth and unemployment clearly illustrate the radical effect of the COVID-19 crisis. While the average real GDP growth is surprisingly close to zero (0.67%), the average unemployment rate is remarkably high (7.39%), and the large standard deviation of both variables demonstrates the economic volatility caused by the global pandemic. In response to the economic downturn, countries launched wide-scale fiscal support measures. For instance, the average total fiscal support provided by governments in our data sample equals 8.17% (compared to 2019 GDP). Decomposing fiscal support into the two underlying components learns that the average direct and liquidity support corresponds to 3.87% and 4.31%, respectively.

**Table 1**
Descriptive statistics.

| | N | Mean | Median | SD | Min | Max |
|---|---|---|---|---|---|---|
| *Bank level variables* | | | | | | |
| LLP | 22,169 | 0.092 | 0.032 | 0.161 | −0.099 | 0.697 |
| RBP | 22,355 | 0.443 | 0.389 | 0.294 | −0.046 | 1.447 |
| ln(Total assets$_{t-1}$) | 22,813 | 14.967 | 14.625 | 2.043 | 11.791 | 19.984 |
| LLR$_{t-1}$ | 22,630 | 1.409 | 0.853 | 1.584 | 0.253 | 8.151 |
| NPL$_{t-1}$ | 22,058 | 1.498 | 0.787 | 2.019 | 0.034 | 10.072 |
| NPL growth | 21,349 | 1.742 | −1.466 | 25.579 | −49.954 | 98.852 |
| Loan growth | 22,179 | 1.893 | 1.439 | 5.117 | −10.053 | 17.742 |
| Tier 1 ratio$_{t-1}$ | 21,587 | 14.935 | 13.577 | 4.904 | 8.837 | 32.315 |
| *Country level variables* | | | | | | |
| Real GDP growth | 888 | 0.67 | 0.74 | 3.74 | −29.33 | 27.11 |
| Unemployment rate | 888 | 7.39 | 6.58 | 3.73 | 1.87 | 24.33 |
| Real GDP forecast | 888 | 3.33 | 2.94 | 1.98 | −8.52 | 9.90 |
| Uncertainty | 888 | 0.09 | 0.07 | 0.06 | 0.00 | 0.49 |
| Fiscal support$_{t-1}$ | 296 | 8.17 | 5.01 | 8.89 | 0.00 | 37.89 |
| Direct support$_{t-1}$ | 296 | 3.87 | 2.66 | 4.17 | 0.00 | 24.94 |
| Liquidity support$_{t-1}$ | 296 | 4.31 | 2.01 | 6.38 | 0.00 | 29.64 |

Note: Variable definitions are described in Table A.1 in Appendix. Fiscal support is assumed to be zero in before the onset of the COVID-19 crisis, so descriptive statistics on support measures are computed within the COVID-19 crisis period.

The decomposition of the level of fiscal support by the third quarter of 2021 is shown in Fig. 1. It shows data for 37 countries spread out over a range of continents. The figure clearly demonstrates the heterogeneity in the level and composition of support provided by the individual countries. For instance, we observe that countries such as Germany, Italy, and Mauritius mainly relied on liquidity measures, while countries such as the United States, Canada, and Austria primarily relied on direct measures to sustain economic activity. Further, we

[14] Table A.7 in Appendix confirm that our findings remain robust to using interpolation.

[15] More specifically, in order to compute the uncertainty level in period $t$, the smoothed World Uncertainty Index uses the uncertainty level at period $t$, $t-1$, and $t-2$ where each period is attributed a weight of 60%, 30%, and 10%, respectively.

[16] Since there is no data on the uncertainty of Cyprus and Estonia, we used the median index value of the eurozone member states to proxy the uncertainty level of these two countries.

[17] To account for the skewness of banks' LLP ratio, we have also run regression with the natural logarithm of $(1 + LLP)$ as outcome variable. These regression results, which are not tabulated, are quantitatively similar to our baseline results.

see that the most extensive measures were introduced in Mauritius, Germany, Italy, the United States, and the United Kingdom, where total fiscal support exceeded 25% of GDP by the third quarter of 2021. Moreover, a detailed inspection of the data shows that certain countries responded more quickly than others. Immediate action was taken in Germany for instance, where the (announced) support in the second quarter of 2020 already amounted to 30% of GDP due to the immediate implementation of an exceptional loan guarantee scheme.

Additional descriptive statistics are provided in Appendix. Table A.2 in Appendix shows the cross-correlation matrix of the main variables used in our analysis. Table A.3 in Appendix shows the distribution of our sample of banks across countries. From this table, we learn that our sample predominantly consists of banks located in the US (63.28%). Fig. A.1 in Appendix visualizes the evolution of the median LLP ratio over our sample period. We can observe that the COVID-19 pandemic caused a sharp increase in banks' loan loss provisions, followed by a surprisingly rapid drop. In addition, it is quite remarkable to observe that banks' provisioning has remained well below pre-COVID-19 levels during 2021.

## 4. Results

### 4.1. Loan loss provisions and fiscal support

#### 4.1.1. Overall support

Our first research objective is to examine the relationship between overall fiscal support and banks' loan portfolio risk during the COVID-19 crisis. For this purpose, we use the panel model outlined in Eq. (1). Table 2 shows the results for the period 2016–2021.[18] Across the different columns, we control for a large set of bank and country controls, and we gradually saturate the model with bank and time fixed effects. The gradual inclusion of the fixed effects allows to study the stability of the coefficient on $Fiscal\ support$ across specifications, and to see in which direction possible omitted variables would influence our results.

We first discuss the key variable of interest, $Fiscal\ support$. Across the different columns, we find a significantly negative coefficient for $Fiscal\ support$ implying a negative association between the level of fiscal support and the subsequent loan loss provisions set aside by financial institutions. In particular, the estimated coefficient ranges from −0.0022 in column (1) to −0.0021 in column (3) where we include bank as well as time fixed effects. Note that the coefficient estimate remains stable as we gradually saturate the model with bank and time fixed effects, which alleviates concerns about omitted variable bias. On the basis of column (3), a one standard deviation increase in total fiscal support is (ceteris paribus) associated with a 0.019 percentage point decrease in loan loss provisions in the next quarter. Considering that the average and the median LLP ratio in the data sample equal 0.092% and 0.032%, respectively, this finding is economically significant and in line with evidence from the Bank for International Settlements (2021) and Feldman and Schmidt (2021), who state that fiscal support helped to reduce banks' loan losses.

Overall, the coefficient estimates of the bank control variables are in line with previous studies. For instance, we find a significantly positive association between revenue before provisioning expenses (RBP) and the LLP ratio. These results are in line with the income smoothing hypothesis documented by previous research, indicating that banks use discretionary provisioning to reduce the variability of reported bank earnings and the risk of not meeting regulatory capital requirements (Fonseca and Gonzalez, 2008; Huizinga and Laeven, 2019; Laeven and Majnoni, 2003). In line with Beck and Narayanamoorthy (2013), we also find a significantly positive coefficient for NPL growth and the lagged NPL ratio, indicating that past problem loans are indicative for (expected) future loan losses. The coefficient estimate of bank size (i.e., the natural logarithm of lagged total assets) is positive, implying that large banks make considerably more loan loss provisions than small banks. This finding is in accordance with Huizinga and Laeven (2019), who argue that larger banks' provisioning behavior tends to be more pro-cyclical as they take on more business cycle-related risk. In addition, this evidence is in line with the results of Beatty et al. (1995) and Bushman and Williams (2012) who state that large banks usually take on riskier loans than small banks.

[18] As several countries adopted expected provisioning regulation in 2018, we test whether our results hold if we adjust the estimation window to the period 2018–2021. Table A.4 in Appendix confirms that our results hold.

**Table 2**
Loan loss provisions and fiscal support.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal $support_{t-1}$ | −0.0022*** | −0.0024*** | −0.0021*** | −0.0021*** |
| | (0.0004) | (0.0006) | (0.0006) | (0.0005) |
| RBP | 0.1982*** | 0.2045*** | 0.2102*** | 0.2104*** |
| | (0.0130) | (0.0144) | (0.0140) | (0.0139) |
| Loan growth | −0.0007 | −0.0002 | −0.0002 | −0.0002 |
| | (0.0005) | (0.0003) | (0.0004) | (0.0004) |
| ln(Total $assets_{t-1}$) | 0.0031* | 0.0527*** | 0.0367*** | 0.0345*** |
| | (0.0015) | (0.0172) | (0.0112) | (0.0104) |
| $LLR_{t-1}$ | 0.0182*** | 0.0002 | 0.0005 | 0.0005 |
| | (0.0042) | (0.0046) | (0.0045) | (0.0045) |
| NPL growth | 0.0006*** | 0.0005*** | 0.0005*** | 0.0005*** |
| | (0.0001) | (0.0000) | (0.0000) | (0.0000) |
| $NPL_{t-1}$ | 0.0113*** | 0.0180*** | 0.0183*** | 0.0185*** |
| | (0.0034) | (0.0032) | (0.0030) | (0.0031) |
| Tier 1 $ratio_{t-1}$ | −0.0010 | 0.0003 | −0.0001 | −0.0001 |
| | (0.0007) | (0.0009) | (0.0009) | (0.0009) |
| Real GDP growth | −0.0021 | −0.0024 | −0.0014* | −0.0014* |
| | (0.0019) | (0.0016) | (0.0008) | (0.0008) |
| Unemployment rate | 0.0088*** | 0.0102*** | 0.0076*** | 0.0073*** |
| | (0.0016) | (0.0021) | (0.0012) | (0.0015) |
| Real GDP forecast | | | | 0.0012 |
| | | | | (0.0022) |
| Uncertainty | | | | 0.0798 |
| | | | | (0.0856) |
| Observations | 19,880 | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.3927 | 0.5896 | 0.6017 | 0.6020 |
| Bank FE | No | Yes | Yes | Yes |
| Time FE | No | No | Yes | Yes |

Note: In this table, we present the results of the regressions based on Eq. (1). Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Similarly, the coefficient estimates of the macroeconomic controls are in line with expectations. Particularly, in accordance with Huizinga and Laeven (2019), we find pro-cyclicality in banks' loan loss provisioning behavior. Column (3), for instance, shows a significantly negative relationship between real GDP growth and loan loss provisions. The coefficient estimate suggests that a one standard deviation decrease in real GDP growth is associated with a 0.005 percentage point increase in the LLP ratio, corresponding to approximately 6% of the average LLP ratio. Our results also show a significantly positive coefficient estimate for the unemployment rate. This means that an increase in employment is associated with an increase in loan loss provisions, which also indicates pro-cyclical provisioning behavior and accords with earlier evidence from Feldman and Schmidt (2021).

In column (4) of Table 2, we add additional control variables regarding the expected economic outlook and economic uncertainty. These may be particularly relevant during economic downturns. Indeed, the COVID-19 pandemic was characterized by an unparalleled level of uncertainty, particularly in the short run, and empirical evidence has shown that banks base expected future loan losses on the current economic uncertainty level (Ng et al., 2020). Column (4) therefore re-estimates our baseline regressions and controls for real GDP expectations as well as economic uncertainty. We find that, after controlling for contemporary economic factors, forward-looking economic factors, and economic uncertainty, the effect of fiscal support on banks' loan loss provisioning remains significantly negative and the magnitude of the coefficient is unaltered. Taken together, this suggests that the effect of fiscal support on loan loss provisions goes beyond a macroeconomic stabilization effect, meaning that banks' provisioning behavior was not only based on the composition of their loan portfolio and economic conditions, but also on the degree of fiscal support. Stated differently, this suggests that the fiscal support measures – which were targeted at households and businesses – directly mitigated pro-cyclical effects in banks' provisioning and thereby contributed to the banking sector resilience observed during the COVID-19 crisis.

#### *4.1.2. Direct and liquidity support*

Our second research objective is to examine how different types of fiscal support measures are associated with banks' provisioning behavior. We thus break up fiscal support into direct and liquidity measures. We hypothesized that the coefficient of the former would be negative, and the coefficient of the latter would be negative or insignificant. The results from estimating Eq. (2) are displayed in Table 3. Across the different columns, we gradually saturate the model with bank and time fixed effects. While the coefficient estimates of the control variables are shown, they are not discussed in detail as they are in line with the estimates of Table 2.

In line with our expectation, we find evidence that direct measures were crucial in limiting the pressure on financial institutions by mitigating (expected) credit losses. This can be derived from the significantly negative coefficient estimates of *Direct support* in columns (1) to (4). The estimated coefficient ranges from −0.0025 to −0.0023. This suggests that a one standard deviation increase in total direct support is related to a decrease in the LLP ratio of approximately 0.010 percentage points, corresponding to approximately 10% percent of banks' average loan loss provisions. The economic magnitude of this estimated effect is similar to that of a one standard deviation increase in policy uncertainty (Ng et al., 2020) or a one standard deviation increase in unemployment (Beatty and Liao, 2014). Note that we also control for economic expectations and uncertainty in column (4), which suggests that the effect of direct support on loan loss provisions also goes beyond a macroeconomic stabilization effect. Regarding liquidity support, we find that none of the coefficient estimates in columns (1) to (4) are statistically significant (and that the coefficient estimates are very close to zero). These results can be interpreted as evidence that banks' loan portfolio risk is unaffected by government-backed loans and other liquidity measures (which is broadly consistent with evidence from Altavilla et al., 2021).

#### *4.1.3. Instrumental variable approach*

A potential endogeneity concern is that countries more severely hit by the COVID-19 pandemic adopted both stricter lockdowns – which adversely affected banks' credit risk – and broader support measures to mitigate the adverse economic implications of those lockdowns (see Aizenman et al., 2022). To address this concern, we turn to instrumental variable estimation. In particular, following Aizenman et al. (2022), we use a country's established political structures as instruments for its fiscal support measures during the COVID-19 crisis. Our identifying assumption is that established political structures directly influence a country's fiscal strategy but not banks' loan loss provisions.

Similar to the approach of Aizenman et al. (2022), we use a cross-sectional analysis for our instrumental variable estimation. In the first stage, we use three political indicators as instrumental variables for a country's total fiscal support during the COVID-19 crisis. In particular, we use a regime durability indicator, a presidential system indicator,

**Table 3**
Loan loss provisions, direct support, and liquidity support.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Direct support$_{t-1}$ | −0.0025*** | −0.0028*** | −0.0024*** | −0.0023*** |
| | (0.0004) | (0.0006) | (0.0006) | (0.0005) |
| Liquidity support$_{t-1}$ | −0.0004 | −0.0000 | −0.0003 | −0.0005 |
| | (0.0013) | (0.0012) | (0.0008) | (0.0009) |
| RBP | 0.1990*** | 0.2049*** | 0.2101*** | 0.2104*** |
| | (0.0131) | (0.0144) | (0.0140) | (0.0139) |
| Loan growth | −0.0007 | −0.0002 | −0.0002 | −0.0002 |
| | (0.0005) | (0.0003) | (0.0004) | (0.0004) |
| ln(Total assets$_{t-1}$) | 0.0028* | 0.0537*** | 0.0384*** | 0.0361*** |
| | (0.0016) | (0.0172) | (0.0111) | (0.0101) |
| LLR$_{t-1}$ | 0.0184*** | 0.0009 | 0.0011 | 0.0010 |
| | (0.0042) | (0.0046) | (0.0045) | (0.0045) |
| NPL growth | 0.0006*** | 0.0005*** | 0.0005*** | 0.0005*** |
| | (0.0001) | (0.0000) | (0.0000) | (0.0000) |
| NPL$_{t-1}$ | 0.0112*** | 0.0184*** | 0.0185*** | 0.0186*** |
| | (0.0034) | (0.0031) | (0.0030) | (0.0031) |
| Tier 1 ratio$_{t-1}$ | −0.0011 | 0.0001 | −0.0002 | −0.0001 |
| | (0.0007) | (0.0009) | (0.0009) | (0.0009) |
| Real GDP growth | −0.0022 | −0.0025 | −0.0014* | −0.0014* |
| | (0.0019) | (0.0016) | (0.0008) | (0.0008) |
| Unemployment rate | 0.0087*** | 0.0099*** | 0.0078*** | 0.0075*** |
| | (0.0016) | (0.0021) | (0.0013) | (0.0015) |
| Real GDP forecast | | | | 0.0012 |
| | | | | (0.0022) |
| Uncertainty | | | | 0.0716 |
| | | | | (0.0862) |
| Observations | 19,880 | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.3930 | 0.5900 | 0.6019 | 0.6021 |
| Bank FE | No | Yes | Yes | Yes |
| Time FE | No | No | Yes | Yes |

Note: In this table, we present the results of the regressions based on Eq. (2). Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

and a government effectiveness indicator.[19] The first stage regression is specified as follows:

$$Fiscal\ support_c = \alpha + \rho_1 Regime\ durability_c + \rho_2 Presidential\ system_c + \rho_3 Government\ effectiveness_c + \gamma X_b + \delta M_c + \epsilon_c \quad (3)$$

In this cross-sectional regression, $Fiscal\ support_c$ is the total fiscal support provided by country $c$ over the COVID-19 crisis period. $X_b$ and $M_c$ represent, respectively, the vector of bank and country controls used in our previous regressions. The standard errors are clustered at the bank level. In the second stage, we regress banks' total loan loss provisions during the crisis period on the estimated fiscal support of the first stage regression and other control variables. The second stage regression is specified as follows:

$$LLP_b = \alpha + \beta \widehat{Fiscal\ support}_c + \gamma X_b + \delta M_c + \epsilon_b \quad (4)$$

In this cross-sectional regression, $LLP_b$ represents the total loan loss provisions set aside by bank $b$ during the COVID-19 crisis. We include the complete set of pre-COVID-19 bank and country controls to account for pre-crisis differences in banks' balance sheet or countries' economic situation. We apply a similar instrumental variable approach for the regressions with direct and liquidity support.

[19] The regime durability indicator reflects the number of years since the most recent regime change or the end of a transition period (defined by the lack of stable political institutions). The presidential system indicator is a dummy equal to one if the country has an (assembly-elected) president and zero otherwise. The government effectiveness indicator reflects the effectiveness of a country's public services and ranges from zero to one, where one is the most effective. We use indicator values from 2019 to avoid endogeneity issues.

**Table 4**
Instrumental variable estimation: Second stage regression results.

| | (1)<br>LLP | (2)<br>LLP |
|---|---|---|
| Fiscal support | −0.0540* | |
| | (0.0264) | |
| Direct support | | −0.0584* |
| | | (0.0283) |
| Liquidity support | | −0.0826 |
| | | (0.0453) |
| Observations | 720 | 720 |
| Adjusted R-squared | 0.305 | 0.296 |
| Controls | Yes | Yes |

Note: In this table, we present the second stage regression results of the instrumental variable estimation. Variable definitions are described in Table A.1 in Appendix. Standard errors (in parentheses) are clustered at the bank level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table A.6 in Appendix presents the first stage regression results.[20,21] The first stage results show that our instruments strongly affect the degree of fiscal support. Column (1), for instance, suggests that countries with a longer regime durability and higher government effectiveness provided significantly more fiscal support. Interestingly, the results in columns (2) and (3) suggest that political structures can also explain differences in countries' fiscal strategy during the COVID-19 pandemic. For instance, our instrumental variables capture that countries with a longer regime durability (e.g., Canada and the US) provided significantly more direct support and less liquidity support. Similarly, countries with a presidential system provided more direct support and less liquidity support than countries with a parliamentary system. Government effectiveness is positively related to direct as well was liquidity support.

Table 4 presents the second stage results from our instrumental variable approach. The second stage results are entirely consistent with our baseline findings as we find that fiscal support had a negative effect on banks' loan loss provisions, and that this effect is driven by direct support. In terms of economic significance, the instrumental variable estimates suggest that a 10 percentage point increase in total direct support results in a 0.584 percentage point decrease in banks' total loan loss provisions over the crisis period, which corresponds to approximately 40% of the standard deviation of banks' total loan loss provisions during this period. Taken together, the instrumental variable results bolster our claim that fiscal support, especially direct support, reduced banks' loan loss provisions.

#### *4.1.4. Mechanism*

A potential mechanism through which fiscal support reduced banks' actual and expected loan losses is that fiscal support directly reduced borrowers' default risk. In this case, we would expect that the effect of fiscal support, and especially direct support, is stronger for banks with a relatively larger and riskier loan portfolio. To assess whether this holds, we examine how the relationship between fiscal support and banks' loan loss provisioning depends on different bank characteristics such as banks' lending activities, NPLs, and LLRs. Particularly, we create dummy variables equal to one when above the sample mean and 0 otherwise, and label them $Loan\ dummy$, $NPL\ dummy$, and $LLR\ dummy$, respectively. We then extend the baseline regressions by including interaction terms of the different dummy variables with our different proxies for fiscal support.

**Table 5**
Loan loss provisions, fiscal support, and the role of bank characteristics.

| | (1)<br>LLP | (2)<br>LLP | (3)<br>LLP |
|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0018*** | −0.0020*** | −0.0020*** |
| | (0.0005) | (0.0005) | (0.0005) |
| Fiscal support$_{t-1}$ × Loan dummy | −0.0003 | | |
| | (0.0002) | | |
| Fiscal support$_{t-1}$ × NPL dummy | | −0.0002 | |
| | | (0.0006) | |
| Fiscal support$_{t-1}$ × LLR dummy | | | −0.0012 |
| | | | (0.0010) |
| Observations | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.6020 | 0.6019 | 0.6021 |
| Controls | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |

Note: In this table, we present the results of the regressions that include interaction terms between fiscal support and specific bank characteristics. Variable definitions are described in Table A.1 in Appendix. Column (1) examines the role of lending activities. The loan dummy equals 1 if a bank's loan ratio over total assets is above the sample mean and 0 otherwise. Column (2) examines the role of problem loans. The NPL dummy equals 1 if a bank's average problem loans over total assets is above the sample mean and 0 otherwise. Column (3) examines the role of loan loss reserves. The LLR dummy equals 1 if a bank's average loan loss reserves over total assets is above the sample mean and 0 otherwise. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

Table 5 show the fiscal support variable and its interactions with the different dummy variables (along with the complete set of controls as well as bank and time fixed effects). Table 6 shows the dummy variables capturing the bank characteristics interacted with $Direct\ support$ and $Liquidity\ support$, respectively. Based on Table 5, it seems that the effect of fiscal support does not depend on any bank characteristics. Based on Table 6, however, we do find evidence that there are differences in the effect of the support measures on banks' loan loss provisioning behavior. First, the interaction between direct support and the loan dummy in Table 6 is negative but not statistically significant (albeit with $p$-value = 0.15). This somewhat suggests that banks with a larger loan portfolio benefited more from direct support. Second, we find that the effect of direct support is stronger for banks with a relatively higher NPL and LLR ratio, suggesting that banks with a riskier loan portfolio benefited more from direct support. Given that banks with larger and riskier loan portfolios were more exposed to the increased default risk caused by the pandemic, these results support that direct support reduced borrowers' default risk and thereby mitigated banks' loan portfolio risk.

To provide further evidence that fiscal support reduced banks' loan portfolio risk by reducing borrowers' default risk, we also estimate the effect of fiscal support on banks' net charge-offs (NCO), which represent the amount of loans written off as irrecoverable (net of any recoveries) (Cantrell et al., 2014). Charged off loans are realized losses to banks' loan portfolio (i.e., charged off loans are removed from banks' balance sheet) and therefore less susceptible to bank managers' manipulation (Heitz and Narayanamoorthy, 2021).[22] We thus re-estimate our baseline regressions but we replace the outcome variable by banks' net charge-offs divided by lagged total loans (Beatty and Liao, 2014; Liu and Ryan, 2006).[23]

[20] Diagnostic tests confirm the validity of our instrumental variable approach. First, the Hansen tests for overidentifying restrictions are not rejected which confirms the validity of our instruments. Second, the F-statistics are statistically significant which alleviates concerns about weak instruments.

[21] Note that the instrumental variable approach is based on a sample of 740 banks due to the fact that 274 banks of our original sample have one or more missing LLP values during the crisis period, which prohibits us from computing the total loan loss provisions over the crisis period for those 274 banks.

[22] Although bank managers have more discretion over loan loss provisions, the advantage of using loan loss provisions as outcome variable is that they capture more than only actual loan defaults and thereby provide a more general picture of banks' loan portfolio risk.

[23] Due to limited data on reported net charge-offs, we approximate net charge-offs as follows (e.g., see Ng et al., 2020): $NCO_t = LLR_{t-1} - LLR_t + LLP_t$.

**Table 6**
Loan loss provisions, fiscal support, and the role of bank characteristics.

| | (1) LLP | (2) LLP | (3) LLP |
|---|---|---|---|
| Direct support$_{t-1}$ | −0.0020*** | −0.0020*** | −0.0022*** |
| | (0.0006) | (0.0005) | (0.0005) |
| Liquidity support$_{t-1}$ | −0.0009 | −0.0020** | −0.0009 |
| | (0.0011) | (0.0009) | (0.0008) |
| Direct support$_{t-1}$ × Loan dummy | −0.0005 | | |
| | (0.0003) | | |
| Liquidity support$_{t-1}$ × Loan dummy | 0.0007 | | |
| | (0.0012) | | |
| Direct support$_{t-1}$ × NPL dummy | | −0.0015* | |
| | | (0.0007) | |
| Liquidity support$_{t-1}$ × NPL Dummy | | 0.0029* | |
| | | (0.0014) | |
| Direct support$_{t-1}$ × LLR dummy | | | −0.0030** |
| | | | (0.0013) |
| Liquidity support$_{t-1}$ × LLR dummy | | | 0.0015 |
| | | | (0.0016) |
| Observations | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.6021 | 0.6023 | 0.6026 |
| Controls | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |

Note: In this table, we present the results of the regressions that include interaction terms between the different types of fiscal support and specific bank characteristics. Variable definitions are described in Table A.1 in Appendix. Column (1) examines the role of lending activities. The loan dummy equals 1 if a bank's average loans over total assets is above the sample mean and 0 otherwise. Column (2) examines the role of problem loans. The NPL dummy equals 1 if a bank's average problem loans over total assets is above the sample mean and 0 otherwise. Column (3) examines the role of loan loss reserves. The LLR dummy equals 1 if a bank's average loan loss reserves over total assets is above the sample mean and 0 otherwise. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table 7**
Net charge-offs and fiscal support.

| | (1) NCO | (2) NCO | (3) NCO | (4) NCO |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.00005*** | −0.00005** | | |
| | (0.00001) | (0.00002) | | |
| Direct support$_{t-1}$ | | | −0.00006*** | −0.00006*** |
| | | | (0.00001) | (0.00002) |
| Liquidity support$_{t-1}$ | | | 0.00001 | 0.00006 |
| | | | (0.00003) | (0.00004) |
| Observations | 19,878 | 19,878 | 19,878 | 19,878 |
| Adjusted R-squared | 0.3608 | 0.4662 | 0.3614 | 0.4678 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we estimate the effect of (different types of) fiscal support on banks' net charge-offs. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

The results, presented in Table 7, show that fiscal support significantly reduced banks' net charge-offs. In addition, we find that the effect is driven by direct support, which is in line with our baseline results. In terms of economic relevance, these results are also similar to the loan loss provisioning regressions. The coefficient estimate of *Direct support* in column (4) of Table 7, for instance, implies that a one standard deviation increase in direct support is associated with a 0.0003 percentage point decrease in banks' NCO, corresponding to 20% of banks' average NCO. In sum, these regression results support that fiscal support, especially direct support, reduced borrowers' default risk and thereby mitigated banks' loan portfolio risk during the COVID-19 crisis.

### 4.2. Additional analyses

This section presents additional analyses which confirm that our results withstand a battery of robustness checks. In particular, we show that our baseline results are robust to controlling for other policy interventions, alternative sample compositions, and alternative model specifications. In addition, we provide further analyses to underline the economic relevance of our estimated effects.

#### 4.2.1. Other policy interventions

To investigate the robustness of our results, we address the impact of three other policy interventions that could possibly confound our results. First, we focus on the role of central bank interventions. Monetary policy played a prominent role in the stabilization of the economic situation after the outbreak of the COVID-19 pandemic. In addition to policy rates, central banks relied on a wide toolkit of monetary instruments, including asset purchases, reserve requirements, and forward guidance, to stabilize financial markets. In order to control for the action taken by central banks, we collect quarterly data on the central banks' total consolidated assets and policy rates from the IMF Monetary and Financial Statistics database. In case we cannot retrieve the data from the IMF Monetary and Financial Statistics database, we collect the data from the central bank's website.[24] Accordingly, as a measure of unconventional monetary policy, we include the lagged level of central bank assets relative to 2019 GDP (Morais et al., 2019) and the change in the central bank policy rate in our main regression models.

The results, depicted in Table A.8 in Appendix, confirm that the effect of fiscal support on provisioning behavior is negative and economically relevant, even after controlling for central bank interventions. In addition, in line with our previous results, this effect appears to be driven by direct measures. Note that, while the regression results in Table A.8 support that our results are not driven by central bank interventions, these results should not be interpreted as evidence that the central bank interventions during the COVID-19 pandemic were ineffective. Previous papers have, for instance, shown that central banks' expansionary monetary policy and liquidity support policies contributed to stabilizing corporate bond markets and economic conditions (e.g., Bordo and Duca, 2022; Boyarchenko et al., 2022).

Second, we focus on non-financial government interventions. Governments took several non-financial measures, such as workplace closures and travel bans, to contain the spread of the COVID-19 crisis. These measures also had a significant impact on economic activity and thus on banks' credit risk. In order to control for such interventions, we collect quarterly data on the severity of governments' public health interventions. Particularly, we use the Stringency Index developed by Oxford University (2022). This index is the weighted average of nine distinct public health interventions rescaled to a value between 0 and 100, where 100 is the strictest.[25] Accordingly, as a measure of non-financial government intervention, we control for the lagged level of the Stringency Index.[26]

[24] We do not account for forward guidance because this is not straightforward to quantify and most likely incorporated into forecasters' expectations of future economic conditions.

[25] The nine interventions considered in the Stringency Index are school closings, workplace closings, restrictions on public events, restrictions on gatherings, public transport shutdowns, stay-at-home orders, restrictions on internal movements, international travel controls, and public information campaigns.

[26] In addition to the severity of public health interventions, we could control for the overall severity of the health crisis by including COVID-19 estimates of excess deaths per country (see Aizenman et al., 2022). Table A.10 in Appendix shows regressions where we control for the lagged value of cumulative excess deaths (per 100,000 population) from the Economist's Global Excess Deaths model. Cyprus is excluded from this analysis because the Economist's Global

The results, shown in Table A.9 in Appendix, confirm that the effect of fiscal support on provisioning behavior remains statistically negative and economically relevant, even after controlling for the stringency of governments' public health interventions. In addition, in line with our previous results, this effect is entirely driven by direct support. Further, while columns (1) and (3) show a statistically positive coefficient estimate for the Stringency Index, we do not find consistent evidence that containment measures influenced banks' provisioning behavior.

Third, we focus on the role of pre-crisis social safety nets. In general, different countries apply different types of social protection measures for unemployment, pensions, and health care, among others. European countries, for instance, tend to have a more extensive social safety net than the United States. In order to control for differences in countries' social protection systems, we collect yearly data from the International Labour Organization on the share of countries' population that is effectively covered by social protection.[27,28] Accordingly, as a measure of social protection, we control for the share of the population effectively covered by at least one social protection measure. Note that we use pre-pandemic values for the COVID-19 period to avoid endogeneity concerns (i.e., we use social protection values from 2019 for the years 2020 and 2021).

The results are shown in Table A.11 in Appendix and confirm that, after controlling for countries' social security system, the effect of fiscal support on provisioning behavior remains significantly negative. In line with our previous results, this effect is driven by direct support. Further, the coefficient estimates of the social protection variable provide some evidence that loan loss provisions were also lower in countries with broader social security. Taken together, these results imply that fiscal support – not just social safety nets – played an important role in mitigating banks' loan portfolio risk during the COVID-19 pandemic.

#### 4.2.2. Sample composition

Considering that US banks make up a substantial share of our data sample, our results could be driven by those banks only. We therefore exclude these banks and re-estimate the baseline regressions to rule out that our findings are driven by the United States. These results are presented in Table A.12. With the exception of column (3), in general, we can observe that the results are stable, which confirms that our results are not driven by the United States. In untabulated results, we further find that our results are not driven by any single country.

#### 4.2.3. Alternative model specifications

In a final, robustness check, we employ two alternative model specifications. As a first alternative specification, we employ a dynamic panel model. In particular, following Laeven and Majnoni (2003), we estimate the following regression model:

$$LLP_{bt} = \alpha + \rho LLP_{bt-1} + \beta Fiscal\ support_{ct-1} + \theta X_{bt} + \eta M_{ct} + \lambda_b + \lambda_t + \epsilon_{bt} \quad (5)$$

In this model, a lag of the dependent variable is included as explanatory variable to control for persistence in banks' loan loss provisioning. As the inclusion of lagged values of the dependent variable renders Ordinary Least Squares (OLS) estimation inconsistent, we employ the Arellano and Bond (1991) two-step system Generalized Method of Moments (GMM) estimator, which uses lagged values of the explanatory variables as instruments. Since first differencing magnifies gaps in unbalanced panels, we use the forward orthogonal deviations proposed by Arellano and Bover (1995). We restrict the lag range for generating instruments to five in order to avoid problems related to too many instruments (Roodman, 2009). Further, following the existing literature, we treat the lagged dependent variable as endogenous and other explanatory variables as predetermined. We estimate regressions with one, two, and three lags of the dependent variable. A similar two-step GMM approach is applied for the regressions with direct and liquidity support.

The results are presented in Tables A.13 and A.14 in Appendix.[29] We find that there is persistence in banks' loan loss provisioning as lags of the dependent variable are significantly positive across the different regressions. Nevertheless, in line with our baseline results, we find a significantly negative relationship between fiscal support and loan loss provisions which is driven by direct support.

As a second alternative model specification, we alter the definition of our variable of interest. In our baseline regressions, the variable of interest is the level of total fiscal support in the previous period. Considering that fiscal measures were rolled out over multiple periods, we argued that this approach allows to account for support measures announced in preceding periods. However, this might raise concerns related to non-stationarity. To address these concerns, we estimate the effect of the change in fiscal support over the previous period ($\Delta\ Fiscal\ support_{t\text{-}1}$) on loan loss provisions, and the change in fiscal support over the previous two periods ($\Delta\ Fiscal\ support_{t\text{-}1,t\text{-}2}$) on loan loss provisions. We apply a similar approach for the regressions with direct and liquidity support.

The results, which are presented in Table A.15 in Appendix, are quantitatively very similar to our baseline results, and confirm that fiscal support directly mitigated the effect of the COVID-19 crisis on banks' loan loss provisions. In addition, in line with our previous findings, we find that this effect is driven by direct support measures.

#### 4.2.4. Economic relevance

Having established that fiscal support reduced banks' loan portfolio risk, we provide further insight into the economic relevance of the magnitude of our estimated effect. In addition to the discussion about comparability with other drivers of loan loss provisions mentioned above, we underpin our analysis with two additional steps. First, we compare banks' loan loss provisions during the COVID-19 crisis and the global financial crisis in order to illustrate that banks' loan loss provisions during the COVID-19 crisis were substantial.[30] Specifically, in Fig. A.2 in Appendix, we plot the distribution of banks' loan loss provisions during the global financial crisis in green, banks' loan loss provisions during the first year of the COVID-19 crisis (2020) in orange, and banks' loan loss provisions during the second year of the COVID-19 crisis (2021) in grey.[31] The vertical lines indicate the median across banks of the corresponding distributions. Fig. A.2 shows that, in the first year of the pandemic, banks' loan portfolio risk very closely resembled the loan portfolio risk observed during the global financial crisis, which supports policymakers' concerns that the COVID-19 shock would hit bank balance sheets.

Second, we compute the counterfactual of banks' loan loss provisions during the pandemic without the estimated effect of fiscal support. In particular, in Fig. A.3 in Appendix, we plot the counterfactual distribution of banks' loan loss provisions during the COVID-19 crisis in blue, banks' actual loan loss provisions during the COVID-19 crisis in red, and banks' actual loan loss provisions during the global

Excess Deaths model does not provide information on this country. These regressions results show that our baseline estimates remain quantitatively equivalent.

[27] This data tends to be collected on a bi-annual basis for the countries covered in our data sample. Considering that the social protection coverage values are generally stable over time, we impute missing values using linear interpolation.

[28] Due to a lack of data, Mauritius is excluded from this analysis.

[29] Diagnostic tests confirm the validity of the GMM instruments. First, the Hansen tests confirm the joint validity of all instruments employed in our models. Second, the Arellano–Bond tests reject concerns about second order residual auto-correlation.

[30] The global financial crisis is assumed to run from the third quarter of 2007 (i.e., the failure of Lehman Brothers) until the second quarter of 2009.

[31] To reduce the impact of outliers, we first take the average of each bank's loan loss provisions over the corresponding period.

financial crisis in green. The vertical lines indicate the median across banks of the corresponding distributions. Fig. A.3 shows that banks' loan loss provisions would have been substantially higher in case there had not been any fiscal support. In addition, in interpreting this figure, it should be stressed that the counterfactual distribution in Fig. A.3 only takes into account the direct effect of fiscal support on banks' loan loss provisions, not the indirect effect of fiscal support on banks' loan loss provisions (e.g., through economic conditions, see Chudik et al., 2021; Laeven and Majnoni, 2003), suggesting that our counterfactual probably represents a lower bound of the counterfactual distribution of banks' loan loss provisions.[32]

In sum, our results do not allow to claim that in the absence of fiscal support we would have ended up with a full-blown financial crisis. Indeed, while our results on the reduced-form impact on loan loss provisioning are qualitatively close to those observed during the global financial crisis, we find that the impact on bank profitability and capitalization is mild, possibly due to the fact that our estimated effects only capture the direct effects of fiscal support.

## 5. Discussion and conclusion

The first question this paper aimed to study is the effect of governments' fiscal support on banks' loan loss provisioning during the COVID-19 crisis. Overall, our results suggest that there is a negative effect of fiscal support on banks' loan loss provisions, and that this effect goes beyond a macroeconomic stabilization effect.[33] More particularly, our results show that banks' provisioning behavior was not only based on the composition of their loan portfolio and economic outlook, but also directly based on governments' fiscal support. This is in line with findings from Feldman and Schmidt (2021), for instance, who state that the US government absorbed the COVID-19 shock, essentially shielding the banking sector from credit losses.

The second question this paper aimed to study is the effect of the two underlying components of fiscal support, i.e. direct support and liquidity support, on banks' loan loss provisioning. In this respect, our findings provide important insights into the effect of different types of fiscal support measures. In particular, our results indicate that only direct support reduced banks' loan portfolio risk. A possible explanation for this finding is that such support measures offer a direct economic boost by relieving firms from liquidity and solvency problems and supporting individuals through direct cash transfers. In this way, direct support may have mitigated mass bankruptcies and reduced banks' loan portfolio risk. In contrast, our results clearly show that liquidity support measures, such as government guaranteed loans and equity injections, did not affect banks' provisioning behavior during the pandemic. This could be explained by the fact government-backed loans and equity injections do not necessarily improve firms' repayment capacity and, therefore, do not necessarily affect banks' actual and expected loan losses (Casanova et al., 2021).

We further find that the effect of fiscal support on loan loss provisions is more pronounced for banks with larger and riskier loan exposures, and that the effect of fiscal support also applies to banks' net charge-offs. In sum, these results are consistent with the idea that fiscal support reduced borrowers' default risk, so that banks primarily involved in (risky) lending benefited more from the fiscal support measures targeted at households and businesses.

Our results have important policy implications regarding the design of governments' fiscal strategy. In particular, our results indicate that liquidity support did not have an effect on banks' loan loss provisions, while direct support had a significantly negative effect. In addition, the latter effect was more pronounced for banks with riskier loan portfolios, suggesting that direct support may have benefited to a greater degree non-viable firms. While understanding the effectiveness of different types of fiscal support measures is an important policy issue, studies on the effectiveness of fiscal support measures during the COVID-19 crisis have mainly focused on individual types of fiscal support (e.g., Altavilla et al., 2021; Granja et al., 2022).[34] Thus, our results warrant further research into comparing the effectiveness of different types of fiscal support measures.

Our results also have important policy implications regarding financial stability and macroprudential regulation. On the one hand, from a financial stability perspective, our baseline results could be interpreted as evidence that fiscal support effectively mitigated financial pro-cyclicality in banks' loan loss provisioning. On the other hand, from a macroprudential regulation perspective, it must be stressed that financial pro-cyclicality should be prevented by effective provisioning rules, adequate capital requirements, and stress tests, not by government interventions. Thus, in order to prevent unsustainable fiscal policies, further research into the potential role of macroprudential policies is needed.

Finally, while this time is different, it should be mentioned that the government interventions during the COVID-19 crisis might have created a moral hazard problem. As Black and Hazelwood (2013, p. 791) state, "explicit government support provides a perception of implicit government support going forward, which can induce excessive risk-taking". In line with this argument, banks may be less motivated to reduce financial pro-cyclicality if massive fiscal support will be provided whenever the overall economy enters a severe recession. Policymakers should therefore take into account the insights from this study in the debate on the trade-off between the relative costs and benefits of government support during economic downturns.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix

See Figs. A.1–A.3 and Tables A.1–A.15

[32] In untabulated analyses, we estimate the direct impact of fiscal support through loan loss provisions on banks' profitability. We find that, in the absence of fiscal support, the average percent of unprofitable banks (per quarter) during the COVID-19 crisis would have increased from 3.7% to 5%. This estimate is however based on the assumptions that (1) banks' profitability is only affected through banks' loan loss provisions and (2) that banks' loan loss provisions are only directly affected by governments' fiscal support. In other words, this estimate does not account for indirect effects such as the fact that fiscal support may have alleviated the economic downturn. A similar analysis also reveals that the direct impact of fiscal support through loan loss provisions on banks' capitalization is limited.

[33] While our results are robust to various empirical modeling choices, we refrain from making causal claims as establishing this would require micro data at loan, firm, and household level.

[34] In general, previous papers on the effectiveness of fiscal support measures during the COVID-19 crisis find mixed results. In the United States, Granja et al. (2022) find that funds from the Paycheck Protection Program were not channeled to sectors that were most severely hit by the COVID-19 crisis. In contrast, in Europe, Altavilla et al. (2021) find that guaranteed loans were primarily channeled to firms whose cash flows were most severely hit.

**Table A.1**
Overview of variables.

| Variable | Description | Source |
|---|---|---|
| *Bank level variables* | | |
| LLP | The ratio of a bank's loan loss provisions over lagged total assets. | SNL Financial |
| RBP | The ratio of a bank's pre-provision net revenue over lagged total assets. | SNL Financial |
| Loan growth | The quarterly change in a bank's total loans. | SNL Financial |
| ln(Total assets) | The natural logarithm of a bank's total assets. | SNL Financial |
| LLR | The ratio of a bank's loan loss reserves over total assets. | SNL Financial |
| NPL growth | The quarterly change in a bank's problem loans. | SNL Financial |
| NPL | The ratio of a bank's problem loans over total assets. | SNL Financial |
| Tier 1 ratio | The ratio of a bank's Tier 1 capital over total risk-weighted assets. | SNL Financial |
| NCO | The amount of loans written off as irrecoverable, net of recoveries. | SNL Financial |
| Liquidity ratio | The ratio of a bank's liquid assets over total assets. | SNL Financial |
| Deposit ratio | The ratio of a bank's deposits over total assets. | SNL Financial |
| *Country level variables* | | |
| Real GDP growth | The quarterly change in a country's real GDP. | OECD and national agencies |
| Unemployment rate | The number of a country's unemployed individuals as a percentage of the labor force. | OECD and national agencies |
| Real GDP forecast | The one-year-ahead year-on-year forecast of future real GDP. | IMF economic outlook |
| Uncertainty | A three-quarter weighted moving average of a country's uncertainty. | World Uncertainty Index (Ahir et al., 2022) |
| Fiscal support | The total fiscal support provided by a certain government during the COVID-19 crisis, expressed as a percentage of the respective country's 2019 GDP level. | IMF, Bruegel, Yale Program on Financial Stability, official government statements, news reports |
| Direct support | The direct support provided by a certain government during the COVID-19 crisis, expressed as a percentage of the respective country's 2019 GDP level. Direct support measures include cash transfers, tax reliefs, and tax deferrals, among others. | IMF, Bruegel, Yale Program on Financial Stability, official government statements, news reports |
| Liquidity support | The liquidity support provided by a certain government during the COVID-19 crisis, expressed as a percentage of the respective country's 2019 GDP level. Liquidity support measures include cash equity injections, public loans, and loan guarantee schemes, among others. | IMF, Bruegel, Yale Program on Financial Stability, official government statements, news reports |
| Monetary stimulus | The ratio of central bank total assets over the 2019 GDP level of the respective country (or region). | IMF Monetary and Financial Statistics and national agencies |
| $\Delta$ Policy rate | The quarterly change in central banks' policy rate. | IMF Monetary and Financial Statistics and national agencies |
| Stringency index | The strictness of containment measures (e.g., school closures and restrictions in movement) implemented by the government. | COVID-19 Government Response Tracker (Oxford University, 2022) |
| Social security coverage | The share of countries' population that is effectively covered by at least one social protection benefit. | ILOSTAT |
| Excess deaths | Cumulative excess deaths per 100.000 population | The Economist's Global Excess Deaths model |
| Regime durability | The number of years since the most recent regime change or the end of a transition period (defined by the lack of stable political institutions). | The Quality of Government dataset |
| Presidential system | A dummy variable equal to one if the country has an (assembly-elected) president and zero otherwise. | The Database of Political Institutions |
| Government effectiveness | A measure of the effectiveness of a country's public services which ranges from zero to one, where one is the most effective. | Worldwide Governance Indicators dataset |

**Table A.2**
Cross-correlation table.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) LLP | 1.000 | | | | | | | | | | | | | | |
| (2) ln(Total assets$_{t-1}$) | 0.137 | 1.000 | | | | | | | | | | | | | |
| (3) LLR$_{t-1}$ | 0.471 | 0.081 | 1.000 | | | | | | | | | | | | |
| (4) RBP | 0.478 | 0.119 | 0.273 | 1.000 | | | | | | | | | | | |
| (5) NPL$_{t-1}$ | 0.389 | 0.061 | 0.843 | 0.104 | 1.000 | | | | | | | | | | |
| (6) NPL growth | 0.088 | −0.016 | −0.036 | 0.029 | −0.081 | 1.000 | | | | | | | | | |
| (7) Loan growth | −0.009 | −0.044 | −0.104 | 0.060 | −0.114 | 0.142 | 1.000 | | | | | | | | |
| (8) Tier 1 ratio$_{t-1}$ | −0.013 | −0.267 | 0.019 | 0.058 | 0.030 | 0.002 | −0.019 | 1.000 | | | | | | | |
| (9) Fiscal support$_{t-1}$ | −0.176 | 0.011 | −0.133 | −0.111 | −0.162 | −0.055 | −0.067 | −0.041 | 1.000 | | | | | | |
| (10) Direct support$_{t-1}$ | −0.183 | −0.022 | −0.140 | −0.103 | −0.177 | −0.055 | −0.072 | −0.052 | 0.982 | 1.000 | | | | | |
| (11) Liquidity support$_{t-1}$ | −0.074 | 0.136 | −0.046 | −0.096 | −0.034 | −0.031 | −0.020 | 0.019 | 0.643 | 0.488 | 1.000 | | | | |
| (12) Real GDP growth | −0.063 | 0.014 | 0.014 | −0.002 | 0.009 | −0.057 | −0.155 | 0.026 | 0.092 | 0.087 | 0.075 | 1.000 | | | |
| (13) Unemployment rate | 0.333 | 0.185 | 0.344 | 0.216 | 0.315 | 0.020 | 0.005 | −0.000 | 0.129 | 0.096 | 0.209 | −0.153 | 1.000 | | |
| (14) Real GDP forecast | 0.121 | 0.051 | 0.040 | 0.052 | 0.033 | 0.010 | −0.019 | 0.175 | 0.268 | 0.257 | 0.199 | 0.068 | 0.176 | 1.000 | |
| (15) Uncertainty | 0.060 | 0.008 | −0.011 | −0.024 | −0.016 | 0.046 | 0.025 | −0.093 | −0.200 | −0.208 | −0.082 | −0.235 | 0.095 | −0.278 | 1.000 |

Variable definitions are described in Table A.1 in Appendix.

**Table A.3**
Distribution of banks per country included in the data sample.

| | Frequency | Percentage |
|---|---|---|
| Argentina | 20 | 2.01 |
| Austria | 2 | 0.20 |
| Belgium | 1 | 0.10 |
| Brazil | 5 | 0.50 |
| Bulgaria | 2 | 0.20 |
| Canada | 19 | 1.91 |
| Chile | 10 | 1.01 |
| China | 10 | 1.01 |
| Colombia | 8 | 0.80 |
| Cyprus | 2 | 0.20 |
| Czech Republic | 4 | 0.40 |
| Denmark | 7 | 0.70 |
| Egypt | 13 | 1.31 |
| Estonia | 4 | 0.40 |
| Finland | 4 | 0.40 |
| Georgia | 1 | 0.10 |
| Germany | 2 | 0.20 |
| Greece | 5 | 0.50 |
| India | 8 | 0.80 |
| Indonesia | 96 | 9.66 |
| Italy | 6 | 0.60 |
| Latvia | 2 | 0.20 |
| Lithuania | 1 | 0.10 |
| Mauritius | 1 | 0.10 |
| Philippines | 2 | 0.20 |
| Portugal | 2 | 0.20 |
| Russia | 39 | 3.92 |
| Saudi Arabia | 12 | 1.21 |
| Singapore | 3 | 0.30 |
| Slovakia | 3 | 0.30 |
| Slovenia | 1 | 0.10 |
| South Korea | 24 | 2.41 |
| Spain | 8 | 0.80 |
| The Netherlands | 2 | 0.20 |
| Turkey | 33 | 3.32 |
| United States | 629 | 63.28 |
| United Kingdom | 3 | 0.30 |
| Total | 994 | 100.00 |

**Table A.4**
Robustness check: Alternative estimation window.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0030*** | −0.0022*** | | |
| | (0.0004) | (0.0005) | | |
| Direct support$_{t-1}$ | | | −0.0032*** | −0.0024*** |
| | | | (0.0004) | (0.0006) |
| Liquidity support$_{t-1}$ | | | −0.0017 | −0.0014 |
| | | | (0.0011) | (0.0010) |
| Observations | 13,176 | 13,176 | 13,176 | 13,176 |
| Adjusted R-squared | 0.4142 | 0.6002 | 0.4144 | 0.6002 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we examine whether our results are robust to an alternative estimation window (i.e., 2018–2021). Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.5**
Robustness check: Alternative clustering method.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0027*** | −0.0021** | | |
| | (0.0005) | (0.0008) | | |
| Direct support$_{t-1}$ | | | −0.0030*** | −0.0023** |
| | | | (0.0006) | (0.0008) |
| Liquidity support$_{t-1}$ | | | −0.0013 | −0.0005 |
| | | | (0.0018) | (0.0013) |
| Observations | 19,880 | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.4111 | 0.6020 | 0.4113 | 0.6021 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |
| Clustering | Country-Time | Country-Time | Country-Time | Country-Time |

Note: In this table, we examine whether our results are robust to clustering the standard errors at the country and time level. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the country and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.6**
Instrumental variable estimation: First stage regression results.

| | (1) Fiscal support | (2) Direct support | (3) Liquidity support |
|---|---|---|---|
| Regime durability | 0.069*** | 0.104*** | −0.038*** |
| | (0.012) | (0.009) | (0.007) |
| Presidential system | −0.545 | 3.797*** | −4.452*** |
| | (1.349) | (0.727) | (0.991) |
| Government effectiveness | 0.186*** | 0.111*** | 0.080* |
| | (0.050) | (0.032) | (0.035) |
| RBP | 0.257 | 0.296 | −0.064 |
| | (0.289) | (0.213) | (0.210) |
| Loan growth | −0.049 | −0.030 | −0.019 |
| | (0.026) | (0.015) | (0.011) |
| ln(Total assets$_{t-1}$) | −0.192* | −0.202** | 0.015 |
| | (0.081) | (0.066) | (0.057) |
| LLR$_{t-1}$ | −0.040 | −0.170 | 0.168 |
| | (0.195) | (0.155) | (0.146) |
| NPL growth | 0.000* | 0.000** | 0.000 |
| | (0.000) | (0.000) | (0.000) |
| NPL$_{t-1}$ | 0.167 | 0.256** | −0.074 |
| | (0.133) | (0.096) | (0.107) |
| Tier 1 ratio$_{t-1}$ | −0.022* | −0.018* | −0.005 |
| | (0.011) | (0.008) | (0.006) |
| Real GDP growth | 1.830*** | 1.235*** | 0.647*** |
| | (0.279) | (0.270) | (0.164) |
| Unemployment rate | −0.193 | −0.082 | −0.122 |
| | (0.175) | (0.112) | (0.120) |
| Real GDP forecast | −1.581*** | −0.321 | −1.261*** |
| | (0.398) | (0.254) | (0.296) |
| Uncertainty | 37.314*** | 35.64*** | 3.014 |
| | (8.577) | (8.824) | (6.342) |
| Observations | 720 | 720 | 720 |
| F-test of excluded instruments | F(3792) = 23.28 | F(3705) = 62.88 | F(3705) = 24.20 |
| | Prob > F = 0.00 | Prob > F = 0.00 | Prob > F = 0.00 |
| Hansen test | $\chi^2_{(2)}$ p-value = 0.4919 | $\chi^2_{(1)}$ p-value = 0.5700 | $\chi^2_{(1)}$ p-value = 0.5700 |

Note: In this table, we present the first stage regression results of the instrumental variable estimation. The corresponding second stage regression of column (1) is depicted in column (1) of Table 4. The corresponding second stage regression of columns (2) and (3) is depicted in column (2) of Table 4. Variable definitions are described in Table A.1 in Appendix. Standard errors (in parentheses) are clustered at the bank level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.7**
Robustness check: Interpolation of GDP forecasts.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0030*** | −0.0020*** | | |
| | (0.0003) | (0.0005) | | |
| Direct support$_{t-1}$ | | | −0.0033*** | −0.0023*** |
| | | | (0.0003) | (0.0005) |
| Liquidity support$_{t-1}$ | | | −0.0012 | −0.0004 |
| | | | (0.0011) | (0.0009) |
| Observations | 19,880 | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.4149 | 0.6019 | 0.4152 | 0.6021 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we examine whether our results are robust to interpolation of GDP forecasts. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.8**
Robustness check: Central bank interventions.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0027*** | −0.0019*** | | |
| | (0.0003) | (0.0005) | | |
| Direct support$_{t-1}$ | | | −0.0029*** | −0.0021*** |
| | | | (0.0003) | (0.0005) |
| Liquidity support$_{t-1}$ | | | −0.0019 | −0.0004 |
| | | | (0.0012) | (0.0009) |
| Monetary stimulus$_{t-1}$ | 0.0159 | 0.0196 | 0.0153 | 0.0173 |
| | (0.0096) | (0.0250) | (0.0099) | (0.0255) |
| $\Delta$ Policy rate | −0.0013 | 0.0007 | −0.0013 | 0.0007 |
| | (0.0029) | (0.0016) | (0.0029) | (0.0016) |
| Observations | 19,880 | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.4124 | 0.6020 | 0.4125 | 0.6021 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we examine whether our results are robust to controlling for central bank interventions. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.9**
Robustness check: Public health interventions.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0038*** | −0.0021*** | | |
| | (0.0004) | (0.0005) | | |
| Direct support$_{t-1}$ | | | −0.0039*** | −0.0023*** |
| | | | (0.0004) | (0.0005) |
| Liquidity support$_{t-1}$ | | | −0.0029** | −0.0007 |
| | | | (0.0011) | (0.0010) |
| Stringency index$_{t-1}$ | 0.0004** | −0.0004 | 0.0004** | −0.0004 |
| | (0.0002) | (0.0003) | (0.0002) | (0.0003) |
| Observations | 19,880 | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.4128 | 0.6020 | 0.4128 | 0.6021 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we examine whether our results are robust to controlling for non-financial government interventions. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.10**
Robustness check: Excess deaths.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0026*** | −0.0018*** | | |
| | (0.0003) | (0.0005) | | |
| Direct support$_{t-1}$ | | | −0.0028*** | −0.0020*** |
| | | | (0.0003) | (0.0006) |
| Liquidity support$_{t-1}$ | | | −0.0013 | −0.0007 |
| | | | (0.0011) | (0.0010) |
| Excess deaths$_{t-1}$ | −0.0000 | −0.0002*** | −0.0000 | −0.0002*** |
| | (0.0001) | (0.0001) | (0.0001) | (0.0001) |
| Observations | 19,833 | 19,833 | 19,833 | 19,833 |
| Adjusted R-squared | 0.4041 | 0.5976 | 0.4043 | 0.5976 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we examine whether our results are robust to controlling for the severity of the health crisis (via estimated excess deaths). Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.11**
Robustness check: Social security.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0015*** | −0.0019*** | | |
| | (0.0003) | (0.0005) | | |
| Direct support$_{t-1}$ | | | −0.0019*** | −0.0021*** |
| | | | (0.0003) | (0.0005) |
| Liquidity support$_{t-1}$ | | | 0.0013 | −0.0004 |
| | | | (0.0012) | (0.0011) |
| Social security coverage | −0.0013*** | −0.0007 | −0.0013*** | −0.0006 |
| | (0.0002) | (0.0008) | (0.0002) | (0.0008) |
| Observations | 19,861 | 19,861 | 19,861 | 19,861 |
| Adjusted R-squared | 0.4218 | 0.6020 | 0.4224 | 0.6021 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we examine whether our results are robust to controlling for pre-existing social security measures. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.12**
Robustness check: Leaving out US banks.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| Fiscal support$_{t-1}$ | −0.0018** | −0.0012* | | |
| | (0.0008) | (0.0007) | | |
| Direct support$_{t-1}$ | | | −0.0023 | −0.0035* |
| | | | (0.0019) | (0.0018) |
| Liquidity support$_{t-1}$ | | | −0.0013 | 0.0002 |
| | | | (0.0011) | (0.0010) |
| Observations | 7162 | 7162 | 7162 | 7162 |
| Adjusted R-squared | 0.3243 | 0.5520 | 0.3243 | 0.5522 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | No | Yes | No | Yes |
| Time FE | No | Yes | No | Yes |

Note: In this table, we examine whether our results are robust to excluding the United States. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.13**
Robustness check: Dynamic panel model.

| | (1) LLP | (2) LLP | (3) LLP |
|---|---|---|---|
| LLP$_{t-1}$ | 0.1350*** | 0.1360*** | 0.1210*** |
| | (0.0198) | (0.0269) | (0.0287) |
| LLP$_{t-2}$ | | 0.0496** | 0.0358 |
| | | (0.0166) | (0.0243) |
| LLP$_{t-3}$ | | | 0.0295 |
| | | | (0.0165) |
| Fiscal support$_{t-1}$ | −0.0020*** | −0.0020*** | −0.0020*** |
| | (0.0003) | (0.0003) | (0.0003) |
| Observations | 17,871 | 16,855 | 15,847 |
| Controls | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |
| Second order autocorrelation test | p-value = 0.114 | p-value = 0.562 | p-value = 0.787 |

Note: In this table, we present the dynamic panel model estimates (based on the Arellano and Bond (1991) GMM difference estimator). Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.14**
Robustness check: Dynamic panel model.

| | (1) LLP | (2) LLP | (3) LLP |
|---|---|---|---|
| LLP$_{t-1}$ | 0.1330*** | 0.1350*** | 0.1200*** |
| | (0.0198) | (0.0271) | (0.0289) |
| LLP$_{t-2}$ | | 0.0480** | 0.0332 |
| | | (0.0166) | (0.0242) |
| LLP$_{t-3}$ | | | 0.0281 |
| | | | (0.0165) |
| Direct support$_{t-1}$ | −0.0021*** | −0.0020*** | −0.0020*** |
| | (0.0003) | (0.0003) | (0.0003) |
| Liquidity support$_{t-1}$ | −0.0009 | −0.0017 | −0.0019 |
| | (0.0012) | (0.0011) | (0.0012) |
| Observations | 17,871 | 16,855 | 15,847 |
| Controls | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes |
| Second order autocorrelation test | p-value = 0.118 | p-value = 0.596 | p-value = 0.747 |

Note: In this table, we present the dynamic panel model estimates (based on the Arellano and Bond (1991) GMM difference estimator). Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

**Table A.15**
Robustness check: Alternative model specification.

| | (1) LLP | (2) LLP | (3) LLP | (4) LLP |
|---|---|---|---|---|
| $\Delta$ Fiscal support$_{t-1}$ | −0.2408** | | | |
| | (0.0990) | | | |
| $\Delta$ Fiscal support$_{t-1,t-2}$ | | −0.1949** | | |
| | | (0.0854) | | |
| $\Delta$ Direct support$_{t-1}$ | | | −0.3764*** | |
| | | | (0.1231) | |
| $\Delta$ Liquid support$_{t-1}$ | | | 0.1375 | |
| | | | (0.1523) | |
| $\Delta$ Direct support$_{t-1,t-2}$ | | | | −0.2738*** |
| | | | | (0.0932) |
| $\Delta$ Liquid support$_{t-1,t-2}$ | | | | 0.0807 |
| | | | | (0.1163) |
| Observations | 19,880 | 19,880 | 19,880 | 19,880 |
| Adjusted R-squared | 0.6006 | 0.6007 | 0.6007 | 0.6009 |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |

Note: In this table, we examine whether our results are robust to alternative definitions of the variable of interest. Variable definitions are described in Table A.1 in Appendix. A constant is included in all regressions but not reported. Standard errors (in parentheses) are clustered at the bank and time level. *, ** and *** denote significance at 10%, 5% and 1%, respectively.

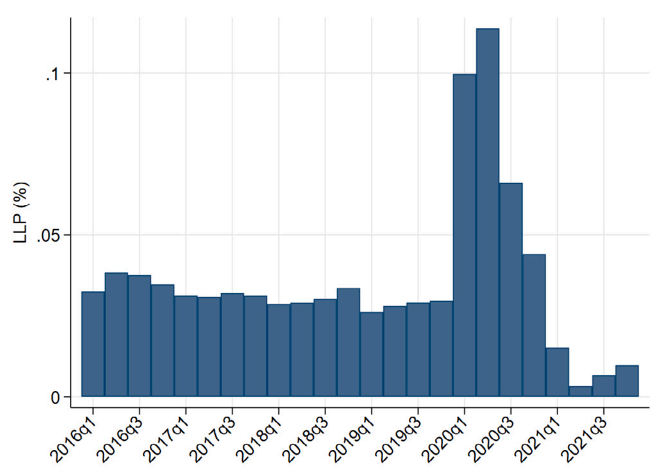


**Fig. A.1.** Evolution of the median LLP ratio.

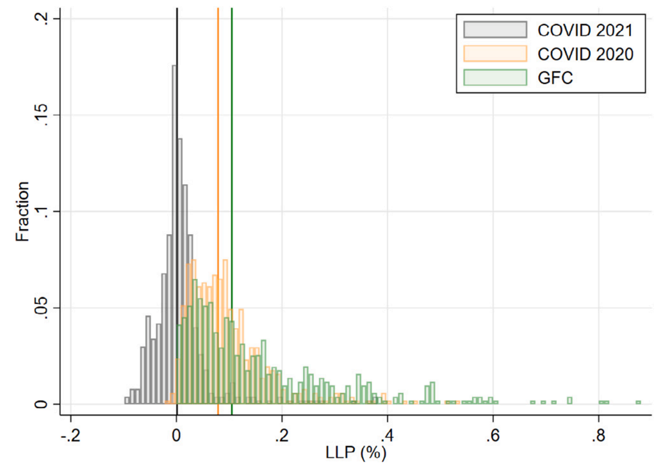


**Fig. A.2.** Distribution of LLP during the global financial crisis (GFC) and the COVID-19 crisis. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

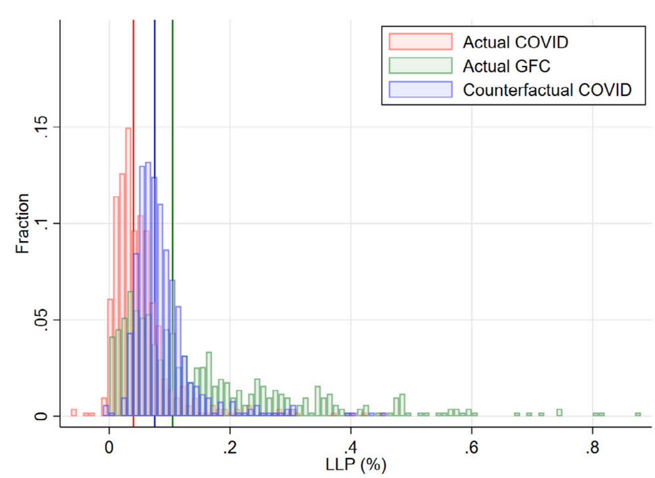


**Fig. A.3.** Counterfactual analysis of LLP. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

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