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COVID-19 and lending responses of European banks

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\textbf{A B S T R A C T}

This paper examines how European banks adjusted lending at the onset of the pandemic depending on their local exposure to the COVID-19 outbreak and capitalization. Using a bank-level COVID-19 exposure measure, we show that higher exposure to COVID-19 led to a relative increase in worse-capitalized banks’ loans whereas their better-capitalized peers decreased their lending more. At the same time, only better-capitalized banks experienced a significantly larger increase in their delinquent and restructured loans. These findings are in line with the zombie lending literature that banks with low capital have an incentive to issue more loans during contraction times to help their weaker borrowers so that they can avoid loan loss recognition and write-offs on their capital.

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\section{1. Introduction}

While the COVID-19 outbreak initiated an unprecedented crisis all around the world, the severity varied substantially across countries. Figure 2 from the World Health Organization (WHO) shows the number of cases across Europe by the end of the first quarter of 2020. Italy had the highest number of cases with 101,739 infected people by the end of March, followed by Spain with 85,195 cases, whereas Liechtenstein, with only 64 infected people, suffered least. We use this variation across countries to study European banks’ response to this unexpected pandemic.\textsuperscript{1}

Our focus is on European banks’ response to the pandemic for several reasons: First, while there is an ongoing public debate about zombie lending to European firms (see, e.g., \textit{Economist, 2020; Financial Times, 2020}), there is limited empirical evidence on how European banks responded to the unprecedented pandemic. Second, European banks are likely to have behaved differently compared to their U.S. counterparts given that their balance sheets looked different just prior to the crisis, e.g., loan loss reserves across European banks have been low in comparison to U.S. banks (Schularick \textit{et al., 2020}). Last, Europe recovered much slower from the global financial crisis of 2007/08 compared to the U.S. (\textit{Acharya et al., 2020a}), and thus gaining an understanding of how European banks responded to COVID-19 may allow politicians and policy makers to avoid making similar mistakes.

In this paper, we first show that countries that had more COVID-19 cases experienced a significantly larger increase in loan demand at the onset of the pandemic. We next measure the exposure of each bank to the COVID-19 outbreak with the weighted average COVID-19 cases per 1000 people in all European countries that a bank has branches. The weights are the proportion of bank branches in each country (see, e.g., \textit{Dursun-de Neef and Schandlbauer, 2020}). Using this measure, the aim of this paper is to study whether banks with higher exposure to the COVID-19 outbreak responded differently as a result of the increase in their loan demand. While European banks, on average, decreased their loans in the first quarter of 2020, we find that banks with higher exposure to COVID-19 decreased their lending significantly less, i.e., they had a relative increase in their lending.

We next study whether bank capital matters. The impact of bank capital ratios on their lending decision may be ambiguous. On the one hand, a growing literature shows that European banks with lower capital ratios engaged in zombie lending dur-
ing the European debt crisis—they issued loans to their struggling corporate borrowers so that these firms can continue paying for their outstanding loans. The results of this literature suggest that worse-capitalized banks are likely to experience a relative increase in their loans as a response to the pandemic. On the other hand, another strand of the literature documents that worse-capitalized banks are perceived as riskier relative to better-capitalized banks, and hence they have harder time finding affordable financing sources during contraction times. This leads to a decrease in their loans during crises (see, e.g., Kashyap and Stein, 2000; Kishan and Opiela, 2000; Meh and Moran, 2010; Dursun-de Neef, 2019) and implies that worse-capitalized banks would reduce their lending more at the onset of the COVID-19 outbreak.

Following these two strands of the literature with opposing implications, we examine whether banks’ capital ratios have an impact on their lending behavior at the onset of the pandemic. Stated differently, we study whether worse-capitalized banks have a tendency to either increase or to decrease their loans compared to their better-capitalized peers. We find evidence for the former: Worse-capitalized banks experienced a significantly less reduction in their loans as their exposure to COVID-19 increased. Better-capitalized banks, on the other hand, decreased their loans significantly more.

The underlying argument provided in the zombie lending literature for why the worse-capitalized banks have an incentive to engage in zombie lending is to avoid loan loss recognition and capital write-offs (see, e.g., Peek and Rosengren, 2005; Caballero et al., 2008; Giannetti and Simonov, 2013; Acharya et al., 2020b). To investigate this further, we thus analyze whether worse-capitalized banks experienced a lower increase in their delinquent loans during the COVID–19 outbreak. We study loans that are 30+ days delinquent and we would expect delinquent loans to increase during the outbreak (see, e.g., Gordon and Jones, 2020). According to our results, better-capitalized banks increased their delinquent loans significantly more than worse-capitalized banks. This indicates that worse-capitalized banks managed to keep the increase in their delinquent loans less. In addition, we study the change in banks’ restructured loans and find evidence that only better-capitalized banks increased their loan restructuring as they became more exposed to the outbreak. These findings are thus in line with the zombie lending argument that worse-capitalized banks might have issued loans to existing borrowers that had potential problems, and as a result, they could avoid delinquent loans and loan restructuring. Moreover, better-capitalized banks experienced a significantly larger decrease in their equity, which might be the result of writing off loan losses on their capital. Worse-capitalized banks, instead, reduced their equity less, which again supports indirectly the zombie lending argument that these banks could prevent a reduction in their equity by avoiding write-offs on their capital.

As a result of a smaller reduction in their loans, we find that worse-capitalized banks decreased their size significantly less. Their better-capitalized peers, on the other hand, experienced a significant reduction in their assets. The next interesting question is how these banks financed their loans at the onset of the crisis. We find that worse-capitalized banks raised both deposits and non-depository debt whereas they didn’t use their cash holdings. Looking at whether the two types of banks experienced differences in their risk taking behavior as a result of the differences in their responses, we find that worse-capitalized banks experienced a significant increase in their risk-weighted assets whereas there was a significant decrease for better-capitalized banks. This implies that worse-capitalized banks increased their risk taking at the onset of the crisis, which might be attributed to zombie lending practice, whereas their better-capitalized peers decreased their risk taking.

As a next step, we examine whether different responses to the pandemic had an impact on worse-capitalized banks’ lending behavior. We analyse the financial support from governments, loosening of capital requirements, and adjustment of insolvency rules. To measure financial support of governments, we use the “economic support index” of the Oxford COVID-19 Government Response Tracker, which collects information of individual government responses across 19 indicators (Hale et al., 2020). To examine changes in capital requirements, we use the COVID–19 Financial Response Tracker by the Yale Program on Financial Stability, which tracks interventions by central banks, fiscal authorities, and organizations aimed at restoring financial stability. To analyse changes in insolvency rules, we rely on an overview provided by DLA Piper, a global law firm. We find that larger economic support, loosening of capital requirements, and adjustment of insolvency rules during the pandemic removed the difference in the lending responses of worse- versus better-capitalized banks. These results imply that the policy measures taken by governments and central banks to fight the negative effects of the pandemic are shown to be useful to eliminate the excessive lending of worse-capitalized banks relative to their better-capitalized peers.

Last, we repeat our analysis for the subsequent quarters to investigate whether the differential-lending practice of worse-capitalized banks continued in 2020Q2 and 2020Q3. According to our findings, only in the second quarter, a higher exposure to the pandemic led to a positive effect on worse-capitalized banks’ lending, however, the effect is significantly smaller. The effect of bank capital on lending disappears in the third quarter. The changes in delinquencies and restructurings follow a similar pattern: Better-capitalized banks experienced a significant increase in their delinquent loans in 2020Q2 and the impact again disappears in 2020Q3. Loan restructurings are not affected by banks’ pre-pandemic capital ratios in these quarters.

The remainder of the paper is organized as follows: Section 2 reviews the related literature and Section 3 describes our data and empirical methodology. Section 4 presents our main results for 2020Q1 while Section 5 shows what happened in 2020Q2 and 2020Q3. Section 6 describes some further results and robustness checks, and last, Section 7 concludes.

2 Related literature

Our paper contributes to two main strands of literature: First, we add to the growing number of papers that examine the effects of the COVID–19 pandemic on the banking sector. Second, we contribute to the zombie lending literature. Most COVID–19 banking papers focus on the U.S. and do not examine how Europe was affected. Li et al. (2020) were the first to show that large U.S. banks experienced significant loan commitment drawdowns at the onset of the pandemic and they supplied loans independent of their deposits or capital ratios. Banks thus “did their job” by providing liquidity to their borrowers. Supporting their results, Acharya and Steffen (2020) document that all firms drew down their credit lines and raised their cash holdings, where BBB-rated and non-investment-grade firms had the largest credit line drawdowns and term loan issuances as a result of their limited access to public debt. Dursun-de Neef and Schandlbauer (2020) find that U.S. commercial banks that are located in

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2 Studies that examine the zombie lending practices of European banks include e.g., Albertazzi and Marchetti (2010); Schiavardi et al. (2017); Storz et al. (2017); Adalet McGowan et al. (2018); Acharya et al. (2019); Anderson et al. (2019); Blattner et al. (2019); Laeven et al. (2020); Acharya et al. (2020b).

3 In addition, Colak and Oztekin (2020) evaluate the effect of pandemic on global bank lending by studying banks from 125 countries.
counties with more severe outbreaks supplied more loans relative to their peers which were financed by an increase in insured deposits. Similarly, Beck and Keil (2021) show that U.S. banks that were more affected by COVID-19 and the lockdown policies faced an increase in their loss provisions and non-performing loans. Hasan et al. (2020) find that syndicated loan spreads increased as either the lender or the borrower became more exposed to the pandemic. Horvath et al. (2020) analyze monthly U.S. credit card data and find that in counties that were more severely affected by the pandemic, more creditworthy borrowers reduced their credit card balances and transactions while banks engaged in “flight-to-safety” and reduced credit limits to risky borrowers.

The only recent exception, that we are aware of, that analyzes European banks is the working paper by Schularick et al. (2020), which focuses on 79 Eurozone banks that took part in the 2019 transparency exercise by the European Banking Authority. The authors estimate the capital shortfall of these banks in response to the COVID-19 crisis and propose that banks should recapitalize pre-emptively to provide insurance against further economic shocks coming from a potential second wave and to also prepare the ground for a quick recovery. We contribute to this literature by documenting the response of European banks to the COVID-19 outbreak, where we differentiate banks as better-capitalized and worse-capitalized.

The literature on zombie lending is also expanding quickly. Earlier papers examine whether zombie lending practices of Japanese banks extended the recession in Japan in the early 1990s (see, e.g., Peek and Rosengren, 2005; Caballero et al., 2008; Giannetti and Simonov, 2013). More recently, the focus shifted to the impact of zombie lending on the prolonged recession in Europe following the European sovereign debt crisis (see, e.g., Albertazzi and Marchetti, 2010; Schiavari et al., 2017; Storz et al., 2017; Adatele McGowan et al., 2018; Acharya et al., 2019; Anderson et al., 2019; Blattner et al., 2019; Laeven et al., 2020; Acharya et al., 2020b). Storz et al. (2017) find that zombie firms that get loans from weak banks in the Euro area periphery countries were more likely to increase their indebtedness further in the period from 2010 to 2014. Similarly, Schiavari et al. (2017) show that under-capitalized Italian banks engaged in zombie lending by providing credit to weaker firms rather than healthy borrowers. This credit misallocation decreased the default risk of weaker firms and kept them alive, whereas healthy firms became more likely to fail. However, the impact on the growth of healthy firms and the aggregate productivity is negligible. Acharya et al. (2019) document similar results: Weakly capitalized European banks provided lending to zombie firms after they experienced an exogenous recapitalization with the announcement of the Outright Monetary Transactions of the ECB, and these firms used these funds to build up cash instead of investing it in real economic activity. In contrast to Schiavari et al. (2017), they find that this led to a decrease in investment and employment growth of healthy firms and slowed down the economic recovery.

In a related paper, Blattner et al. (2019) show that Portuguese banks that had to increase their capital in 2011 after the intervention of the European Banking Authority were more likely to roll over loans to weak firms since their incentive for avoiding capital-reducing losses increased. In a contemporaneous paper, Schiavari et al. (2020) study zombie lending during the COVID-19 crisis using firm level data from Italy. The authors show that zombie lending is not a concern for Italian firms as most of the liquidity needs during the pandemic comes from firms that were financially sound during the pre-pandemic period. Thus, government policies that promote provision of loans are not expected to have negative consequences.

We contribute to the zombie lending literature by providing bank-level results from a broad set of European countries during the COVID-19 pandemic. We find that worse-capitalized banks continued providing significantly more loans relative to their better-capitalized peers. In the meantime, worse-capitalized banks experienced less loan restructurings, less delinquent loans, higher risk taking and lower decrease in their capital. We argue that these findings can be interpreted as an extension of the zombie lending behavior of worse-capitalized banks where they provide loans to their weaker borrowers to avoid writing off loan losses on their capital.

3. Data and empirical strategy

The aim of this paper is to study how European banks responded to the initial COVID-19 outbreak that occurred in the beginning of 2020. We first present a brief description of the data and descriptive statistics, followed by a country-level analysis of loan demand and COVID-19 cases. We subsequently explain the calculation of our bank-level COVID-19 measure. Last, we formulate the empirical strategy for our main bank-level analyses.

3.1. Data sources and sample selection

Our analysis focuses on European banks between 2018Q1 and 2020Q3. We include all banks that are headquartered in either the European Single Market, Great Britain, Norway, or Switzerland. All bank data is consolidated and collected from SNL Financial, part of S&P Global. We restrict the sample to deposit taking banks and eliminate institutions whose total deposits to total assets ratio is less than 2% (32 banks). To eliminate outliers, we exclude bank-quarters with negative values of total equity (three bank-quarters) and no total loans (11 bank-quarters). Moreover, we require banks to have at least 75% of their branches in Europe, resulting in 25 (mostly very large) banks being disregarded. The final unbalanced sample for the period from 2018Q1 to 2020Q3 consists of 2780 bank-quarter observations, which corresponds to 368 banks, though not all banks report in all times.

Data on the daily number of COVID-19 cases for each country are downloaded from ‘Our World in Data’ (https://ourworldindata.org/). We aggregate this data to calculate the number of COVID-19 cases in the first three quarters of 2020 for each country in Europe. Data on population, GDP per capita and median income are again retrieved via SNL Financial. Dassatti et al. (2020) use detailed data of all corporate loans from the credit registry in Uruguay and identify zombie lending by looking at changes in loans’ repayment schedules granted by banks to firms. The authors find a positive relationship between credit growth and zombie lending.

5 For our main analysis covering the period from 2018Q1 to 2020Q3, we have 2458 observations with 367 banks. This decreases to 907 observations with 151 banks when we concentrate on the ones that report all relevant bank control variables as shown in Column 4 in Table 4. Tables A7 and A8 in the Online Appendix provide a list of these banks.

6 These banks have total assets of 21.4 trillion Euro in 2019Q4, which corresponds to almost 60% of all total assets of credit institutions headquartered in the European single market according to recent statistics of the ECB and the respective central banks. When we do not restrict our sample to the banks with at least 75% of their branches located in Europe, the total assets of the banks increase to 26.6 trillion Euro, which corresponds to 72% of all total assets. When we repeat our analysis with no restrictions on the branches, we find that our results hold for this larger sample as well.
Table 1

Summary statistics. This table reports the summary statistics for our main variables. In total, our sample comprises of 2458 bank-quarter observations from either the European Single Market (incl. Great Britain) or Norway and Switzerland. Panel A) shows all bank quarters from 2018Q1 - 2019Q4, whereas Panels B) - D) show the first three quarters of 2020 separately.

|                | mean  | st. dev. | p1    | p25   | median | p75   | p99   |
|----------------|-------|----------|-------|-------|--------|-------|-------|
| **A) 2018Q1-2019Q4** |       |          |       |       |        |       |       |
| Δ Loans / lagged total assets | 0.012 | 0.068   | -0.059 | -0.003 | 0.007  | 0.020 | 0.145 |
| Equity / assets | 0.094 | 0.052   | 0.018 | 0.061 | 0.087  | 0.121 | 0.202 |
| Loan loss reserves / loans | 0.036 | 0.047   | 0.000 | 0.006 | 0.020  | 0.044 | 0.226 |
| Interest income / assets | 0.004 | 0.003   | 0.000 | 0.003 | 0.004  | 0.006 | 0.022 |
| Net income / assets | 0.002 | 0.003   | -0.007 | 0.001 | 0.002  | 0.003 | 0.009 |
| Cash / assets | 0.146 | 0.148   | 0.007 | 0.050 | 0.101  | 0.182 | 0.810 |
| Deposits / assets | 0.611 | 0.202   | 0.062 | 0.487 | 0.642  | 0.765 | 0.925 |
| Log(assets) | 16.538 | 2.072   | 12.385 | 14.978 | 16.387 | 17.832 | 21.195 |
| **B) 2020Q1** |       |          |       |       |        |       |       |
| Δ Loans / lagged total assets | -0.012 | 0.069   | -0.118 | -0.026 | -0.003 | 0.011 | 0.045 |
| Equity / assets | 0.088 | 0.036   | 0.025 | 0.059 | 0.084  | 0.115 | 0.172 |
| Loan loss reserves / loans | 0.037 | 0.048   | 0.000 | 0.006 | 0.017  | 0.044 | 0.192 |
| Interest income / assets | 0.005 | 0.003   | 0.000 | 0.003 | 0.004  | 0.005 | 0.026 |
| Net income / assets | 0.001 | 0.002   | -0.004 | 0.000 | 0.001  | 0.002 | 0.006 |
| Cash / assets | 0.144 | 0.140   | 0.008 | 0.058 | 0.104  | 0.178 | 0.834 |
| Deposits / assets | 0.629 | 0.189   | 0.065 | 0.521 | 0.646  | 0.772 | 0.922 |
| Log(assets) | 16.858 | 2.098   | 12.331 | 15.277 | 16.703 | 18.052 | 21.359 |
| **C) 2020Q2** |       |          |       |       |        |       |       |
| Δ Loans / lagged total assets | 0.018 | 0.036   | -0.040 | -0.003 | 0.010  | 0.039 | 0.141 |
| Equity / assets | 0.087 | 0.035   | 0.032 | 0.059 | 0.079  | 0.111 | 0.168 |
| Loan loss reserves / loans | 0.031 | 0.040   | 0.002 | 0.007 | 0.017  | 0.031 | 0.192 |
| Interest income / assets | 0.004 | 0.004   | 0.000 | 0.003 | 0.004  | 0.005 | 0.008 |
| Net income / assets | 0.001 | 0.003   | -0.008 | 0.000 | 0.001  | 0.002 | 0.005 |
| Cash / assets | 0.134 | 0.108   | 0.008 | 0.067 | 0.116  | 0.163 | 0.489 |
| Deposits / assets | 0.568 | 0.170   | 0.134 | 0.434 | 0.599  | 0.674 | 0.919 |
| Log(assets) | 17.117 | 2.088   | 13.100 | 15.679 | 17.002 | 18.320 | 21.512 |
| **D) 2020Q3** |       |          |       |       |        |       |       |
| Δ Loans / lagged total assets | 0.003 | 0.030   | -0.082 | -0.007 | 0.001  | 0.008 | 0.111 |
| Equity / assets | 0.086 | 0.033   | 0.037 | 0.058 | 0.079  | 0.113 | 0.167 |
| Loan loss reserves / loans | 0.030 | 0.062   | 0.002 | 0.007 | 0.016  | 0.037 | 0.210 |
| Interest income / assets | 0.004 | 0.002   | 0.001 | 0.004 | 0.004  | 0.004 | 0.009 |
| Net income / assets | 0.001 | 0.002   | -0.007 | 0.001 | 0.001  | 0.002 | 0.005 |
| Cash / assets | 0.120 | 0.083   | 0.006 | 0.057 | 0.115  | 0.165 | 0.374 |
| Deposits / assets | 0.584 | 0.161   | 0.144 | 0.497 | 0.606  | 0.684 | 0.904 |
| Log(assets) | 17.117 | 2.150   | 13.126 | 15.561 | 17.034 | 18.389 | 21.520 |
| **Weighted_Credit_19** | 1.805 | 1.202   | 0.000 | 0.921 | 1.728  | 2.238 | 2.234 |

3.2. Descriptive statistics

Panel (A) in Table 1 shows the summary statistics of the main balance sheet variables for the eight quarter pre-COVID-19 period, i.e., 2018Q1-2019Q4. Our sample consists primarily of large European banks: the average bank in our sample has 1.5 trillion euros in total assets. The largest bank has 2.5 trillion euros in assets, though the smallest bank has only 141 million euros in assets. As usual, the largest asset class is loans (with 66.1% of their total assets) whereas the cash to assets ratio is 14.6%. Banks mainly finance their assets with deposits (61.1%) and the average total equity to total assets ratio is 9.4% in the pre-pandemic years.

Panel (B) shows the summary statistics for the first quarter of the pandemic (2020Q1) and Panels (C) and (D) focus on the subsequent two quarters. One of our main variables in the bank-level regressions below is the quarterly change in loans, normalized by the lagged total assets: While this ratio is on average 1.2% in the pre-crisis period, it drops significantly to -1.2% in the first quarter of 2020. After that, it increases again to 1.8% in 2020Q2, before stalling in 2020Q3 to 0.3%. Looking at other balance sheet characteristics, we see that at the onset of the crisis, banks reduced their equity to asset ratio by 0.6 percentage points to 8.8% and they increased their deposits to assets ratio by 1.8 percentage points to almost 63%. Subsequently, banks’ equity remains rather constant (8.7% in 2020Q2 and 8.6% in 2020Q3) whereas the amount of deposits fluctuates significantly: first it decreases to 56.8% before increasing again to 58.4%. Moreover, banks reduced their amount of cash by 2.7 percentage points in the three quarters of 2020 (from 14.6% pre-crisis to 12.0% in 2020Q3). Last, loan loss reserves and interest income remained relatively constant throughout all time periods while banking profits, measured by net income over total assets, decreased in the pandemic.

3.3. COVID-19 and country level bank loan demand

We first briefly examine the impact of the pandemic on loan demand at the country level. To do so, we make use of the Bank Lending Survey (BLS) of the European Central Bank (ECB), which provides aggregated country level information on the lending policies of Euro area banks. In a press release on 28 April 2020, the ECB announced that “firms’ demand for loans or drawing of credit lines surged in the first quarter of 2020, on account of their emergency liquidity needs in the context of the coronavirus pandemic”. To examine this further, we regress the changes in demand for
loans as reported in the quarterly BLS on each country's number of COVID-19 cases per 1000 people from 2018Q1 to 2020Q3.\footnote{In the BLS, the demand for loans is measured as net percentages of banks reporting an increase in loan demand, where net percentages for the questions on demand for loans are defined as the difference between the sum of the percentages of banks responding “increased considerably” and “increased somewhat” and the sum of the percentages of banks responding “decreased somewhat” and “decreased considerably” (https://www.ecb.europa.eu/stats/ecb_surveys/bank_lending_survey). The regressions include country and time fixed effects and country control variables such as the GDP growth, median income, or the country population. All standard errors are clustered at the country level.}

Table 3 reports the results separately for the first, second, and third quarter of 2020. Columns (1), (3), and (5) focus on the COVID-19 cases per 1000 people whereas columns (2), (4), and (6) add further country level control variables. A positive and statistically significant effect between the country level loan demand and the country level COVID-19 cases per 1000 people is found for the first quarter. According to the coefficient in column (2), 10 percent-

3.4. Measuring banks’ exposure to COVID-19

Next, we turn our attention to the bank level analysis and define a bank specific COVID-19 variable. To do so, we calculate the weighted average COVID-19 cases per 1000 people for each bank by using the proportion of bank branches in each country as weights. Stated differently, our bank-specific COVID-19 measure is calculated as the weighted average COVID-19 cases per 1000 people in all European countries in which the bank has branches.
call this measure “Weighted_Covid_19” and it is defined as:

\[
\text{Weighted}_\text{Covid}_19 = \sum_{j=1}^{N} \text{Branch}_\text{bank}_{ij} \times \text{Covid}_19
\]

for bank \(i\). \(\text{Branch}_\text{bank}_{ij}\) is the proportion of bank \(i\)’s branches in country \(j\).\(^{12}\) \(\text{Covid}_19\) is the number of COVID-19 cases per 1000 people in country \(j\) in the first quarter of 2020.\(^{11}\) To summarize, the “Weighted_Covid_19” measure is at the bank-level and it quantifies the exposure of each bank to COVID-19 outbreak through its branches in each country all around Europe.\(^{12}\)

The bottom row of Panels (B)-(D) in Table 1 shows the simple descriptive statistics for this measure. While it had an average of 0.84 in the first quarter of 2020, it increased sharply to 1.81 in the second quarter, before increasing even further to 2.92 in the third quarter. Not all banks were, however, similarly exposed, as can be seen by the large standard deviation, which is the result of the different speed of COVID-19 spreading throughout Europe (see also Figs. 2 and 3). In general, the Weighted_Covid_19 measure correlates with some of the bank and country characteristics. Table 2 presents a simple correlation table for the pre-pandemic quarter and shows that four balance sheet variables depict a significant correlation: Loan loss reserves, interest income, the amount of deposits are negatively correlated whereas bank size shows a positive correlation. Moreover, banks located in wealthier countries, measured by either GDP per capita or the median income, have had a higher COVID-19 exposure, which can again be related to the way COVID-19 spread initially throughout Europe.\(^{13}\) We explicitly control for all these bank-level and country-level variables in our regressions.

3.5. Empirical strategy

Our primary goal is to shed light on banks’ reactions to COVID-19. We first analyze the relative impact of higher exposure to COVID-19 outbreak on banks’ loans when they are facing such an unexpected crisis in the first quarter of 2020, and estimate the following regression model:

\[
\Delta \text{Loans}_{i,t}/\text{assets}_{i,t-1} = \alpha + \beta_1 \cdot \text{Weighted}_\text{Covid}_19 \times \text{Crisis}_i + \gamma \cdot \text{X}_t + \theta \cdot \text{Country}_{i,t-1} + \delta_i + \epsilon_{i,t}.
\]

Similar to e.g., Li et al. (2020), the dependent variable is in first differences of total loans divided by lagged total assets. Weighted_Covid_19 is our bank-specific COVID-19 measure defined as in Eq. (1) above.\(^{14}\) Our time period in the main part of the analysis is from the first quarter of 2018 until the first quarter of 2020 (nine quarters in total). Crisis is equal to one for the first quarter of 2020 and zero otherwise. The main coefficient of interest is \(\beta_1\) which captures the relation between exposure to COVID-19 and the change in the loans during the first quarter of 2020.\(^{15}\)

\(^{12}\) The number of bank branches across European countries is downloaded from SNL Financial, part of S&P Global. Unfortunately, there is no historical data on this. Therefore, we use the distribution of branches from July 7, 2020, when we downloaded our data. In general, average fraction of branches that banks have in their headquarter country is 89%. 62% of these banks are only present in their home country. There is unfortunately no branch specific data (e.g., the size or the amount of deposits) available. See Section 3.1 for a description of the data.

\(^{13}\) We calculate it similarly for the second and third quarter of 2020, where the Covid_19 becomes the number of COVID-19 cases per 1000 people in the corresponding quarter.

\(^{14}\) By using the number of bank branches in each country to measure each bank’s exposure to the COVID-19 pandemic and the triggered loan demand in that country, we make the implicit assumption that banks lend predominantly through their branches. However, one potential limitation of this approach is that large European banks might have sizeable cross-border lending activities that do not go through their branches (see, e.g., Buch et al., 2011).

\(^{15}\) The correlations between these two country variables become insignificant when looking at the weighted COVID-19 measure of 2020Q2 and 2020Q3 and the correlation with the countries’ population becomes significantly positive.

\(^{16}\) One might argue that banks’ lending behavior might have an impact on their exposure to COVID-19 related risks, i.e., possibility of a reverse causality. We address this issue by providing evidence on pre-pandemic parallel trends in relevant bank characteristics for banks with different exposure. The results are shown in Section 6.5; COVID-19 exposure is not correlated with the changes in bank characteristics prior to 2020Q1.

\(^{17}\) The variables Weighted_Covid_19 and Crisis are omitted because of firm- and time-fixed effects. We also (more briefly) examine what happens in 2020Q2 and 2020Q3 where we adjust the Crisis variable accordingly – see Section 5 for details.
Fig. 2. Cumulative COVID-19 cases and deaths by country in Europe. These two figures – provided by the WHO – depict the geographical dispersion in COVID-19 cases and deaths across Europe. The top (bottom) figure shows the numbers as of March 11th (April 1st).

$X_{t-1}$ is a set of bank characteristics, lagged one quarter, that proxy the confidential CAMELS supervisory rating, which is used by federal banking regulators to provide a convenient summary of bank conditions. The acronym CAMELS refers to the six components of a bank’s condition: Capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk. Banking regulators argue that these six components can provide a comprehensive assessment of a bank’s overall condition (e.g., Lopez, 1999). The size and the amount of unused loan commitments are included as additional control variables.

16 The following proxies are chosen: Total equity for a bank’s capital adequacy, loan loss reserves for asset quality, net interest income for management quality, return on assets for earnings, cash for liquidity, and deposits for the last acronym sensitivity to market risk.
We further control for a set of lagged demographic and economic variables of the countries \( \text{Country}_{i,t-1} \) that might be related to the local loan market: The overall population, the GDP per capita, and the median income. These control variables are weighted by the geographic distribution of each bank's branches similar to our main independent variable, \( \text{Weighted\_Covid\_19} \), as shown in Eq. 1. To additionally control for unobserved bank-level heterogeneity, bank fixed-effects, \( \delta_i \), as well as quarter-year fixed-effects, \( \delta_t \), are included and all standard errors are clustered at the bank level.

As the next step, we analyze whether banks’ pre-pandemic capital ratios had an impact on their lending at the onset of the outbreak. To do so, we examine a bank’s total equity ratio in the last quarter of 2019 (i.e. the last quarter before the unexpected pandemic) and compare that to the median equity ratio in that quarter for all banks. We create an indicator variable that is equal to

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**Fig. 3. Cumulative COVID-19 cases and deaths by country in Europe.** These two figures – provided by the WHO – depict the geographical dispersion in COVID-19 cases and deaths across Europe. The top (bottom) figure shows the numbers as of July 1st (October 1st).
one if a bank’s total equity ratio was above the median, and zero otherwise.\textsuperscript{17} We estimate the following regression model
\begin{equation}
\Delta \text{Loans}_{t,t-1} / \text{assets}_{t,t-1} = \alpha + \beta_1 \cdot \text{Crisis}_t \cdot \text{Weighted\_Covid\_19}_t \times \text{High\_Capital}_t + \beta_2 \cdot \text{Crisis}_t \times \text{Weighted\_Covid\_19}_t + \beta_3 \cdot \text{Crisis}_t \times \text{High\_Capital}_t + \gamma \cdot X_{t,t-1} + \theta \cdot \text{Country}_{t,t-1} + \delta_t + \delta_t + \epsilon_{it}
\end{equation}
where the main coefficients of interest are the coefficient $\beta_1$ of the triple interaction which captures the differential effect of having more capital at hand, i.e., of being “better-capitalized”, when being affected more heavily by COVID-19 and the coefficient $\beta_2$ of the double interaction which captures the effect of higher COVID-19 exposure on worse-capitalized banks’ lending.\textsuperscript{18}

We further study the impact of the COVID-19 outbreak on other balance sheet items: total credit, size, deposits, 30-days delinquent loans, restructured loans, etc. We start with the change in the total credit which is defined as the sum of total loans and unused commitments. The change is defined as: $\Delta \text{Loans}_{t,t-1} = \text{Loans}_{t} - \text{Loans}_{t-1}$. We then continue with the change in other bank variables, e.g., to look at what happened to deposits we analyze the change as $\Delta \text{Deposits}_{t,t-1} = \text{Deposits}_{t} - \text{Deposits}_{t-1}$. Changes in other balance sheet items are calculated analogously.

4. Main results

Our main results focus on how European banks reacted to the onset of the COVID-19 pandemic, i.e., we focus on the first quarter of 2020. Table 4 first examines how banks adjusted their lending. While the general lending decreased at the onset of the unprecedented crisis, banks with a higher exposure to COVID-19 decreased their lending significantly less. Besides time fixed effects, column (1) includes no additional control variables, while columns (2) and (3) add bank and country controls. Columns (4) and (5) show that including bank fixed effects does not alter the results. According to our results in column (4), banks with 10 percentage points higher weighted average COVID-19 cases (per 1000 people) decreased their loans significantly less by 0.1 percentage point of their total assets. In addition, column (2) in Table 5 shows that banks with a higher exposure to COVID-19 experienced a significantly smaller decrease in their unused commitments. Thus the total credit, which is the sum of total loans and unused loan commitments, decreased significantly less as well (column (3)). As a result of the loan growth, these banks decreased their asset size significantly less as shown in column (4).

4.1. Better- vs. worse-capitalized banks

4.1.1. The impact on lending

We next study whether banks’ pre-pandemic capital to asset ratios have an impact on their lending behaviour. There are two opposing hypotheses related to worse-capitalized banks’ loans during crises. First, worse-capitalized banks are perceived as riskier and financial frictions during contraction times might prevent these banks from finding affordable financing sources to continue financing their loans (Schandlbauer, 2017). As a result, worse-capitalized banks decrease their loans relatively more during crises (see, e.g., Kashyap and Stein, 2000; Kishan and Opiele, 2000; Meh and Moran, 2010; Dursun-de Neef, 2019). According to this hypothesis, we expect that worse-capitalized banks would decrease their loans during the pandemic as a result of not being able to finance new loans. Second is the alternative hypothesis: Worse-capitalized banks increase their lending during contraction times to help their borrowers that are in financial trouble, i.e., zombie lending, to avoid writing off loan losses on their capital (see, e.g., Albertazzi and Marchetti, 2010; Schivardi, et al., 2017; Storz et al., 2017; Adalet McGowan et al., 2018; Acharya et al., 2019; Anderson et al., 2019; Blatter, et al., 2019; Laeven, et al., 2020; Acharya et al., 2020b). This hypothesis suggests that we expect to find a less reduction in worse-capitalized banks’ loans compared to better-capitalized banks during the pandemic. We analyze which of these hypotheses was dominant at the onset of the pandemic.

We thus examine whether banks with high capital ratios reacted differently to the unexpected crisis compared to banks with low capital ratios.\textsuperscript{19} We first plot the average change in loans for better- and worse-capitalized banks separately. As shown in Fig. 1, better-capitalized banks (dash line) decreased their loans much more than worse-capitalized banks (solid line) in the first quarter of 2020. We subsequently estimate the regression Eq. (3), where we control for several bank- and country-level characteristics. According to our results reported in column (1) of Table 6, banks with low capital decreased their lending significantly less as their exposure to COVID-19 increased: 10 percentage points higher exposure to COVID-19 led to a significantly less reduction in their loans by about 0.16 percentage point of their total assets. On the other hand, we find that banks with high capital reduced their lending significantly more: Better-capitalized banks with 10 percentage points higher exposure to COVID-19 decreased their loans significantly more by about 0.5 percentage point of their total assets compared to worse-capitalized banks.

Overall, we find that worse-capitalized banks decreased their loans significantly less relative their better-capitalized peers. This might be attributed to zombie lending behavior of these banks in an effort to avoid writing off loan losses on their capital.

4.1.2. Delinquent and restructured loans

At the onset of the pandemic, many firms had problems paying back their loans to their banks, and as a result, we expect the delinquent loans to increase significantly (see, e.g., Gordon and Jones, 2020). If worse-capitalized banks engaged in “evergreening” of existing loans, i.e., issued loans to weaker firms to help these firms pay back their outstanding loans so that they can avoid the realization of loan losses and write-downs on their capital as argued by the zombie lending literature, we expect that these banks would experience a relatively less increase in their delinquent loans. To investigate this further, we examine how 30+ days delinquent loans changed. Table 7 highlights that this is indeed the case that better-capitalized banks had a significantly larger increase in their delinquent loans,\textsuperscript{20,21} According to the coefficient estimates

\textsuperscript{17} It is important to note that bank capital ratios are not correlated with the weighted average COVID-19 cases per 1000 people (the correlation is –0.0618 with a p-value of 0.4049).

\textsuperscript{18} One caveat is, however, that only a small fraction of banks (81 banks) report delinquent loans. For the pre-pandemic period, these are larger banks (log(assets) = 17.018 which corresponds to total assets of more than 2.46 trillion EUR), with a bit lower equity to asset ratios (0.088), cash (0.12), and deposits (0.58) and similar net income (0.001), interest income (0.0004), and loan loss reserves (0.03).

\textsuperscript{20} All regressions include all double interactions. However, the interaction term “Crisis × High capital” is omitted in the regressions where the delinquent loans are dependent variables, reported in columns (1) and (3), due to the low number of observations. If we repeat these regressions without controls, the number of observations is almost doubled, and, as a result this interaction term is not omitted and the results are very similar.
in column (1), 10 percentage points increase in COVID-19 cases per 1000 people led to significantly more 30+ days delinquent loans of better-capitalized banks by 0.2 percentage point of their total loans compared to their worse-capitalized peers. In line with this, we also find that better-capitalized banks increased their loan re-structuring significantly more so as they became more exposed to the outbreak. As reported in column (2), better-capitalized banks with 10 percentage points higher COVID-19 cases had significantly larger restructured loans by about 0.21 percentage point of their total loans. On the other hand, worse-capitalized banks did not change the amount of their restructured loans.\footnote{On March 20, 2020, the ECB announced that it relaxes the rules on the classification of non-performing loan standards [https://www.bankingsupervision.europa.eu/press/pr/date/2020/html/ssm.pr.2003120-4c6dbc466.en.html]. This gave banks more flexibility on deciding which borrowers are classified as “unlikely to pay”. Although this has an impact on the amount of delinquent loans, we expect that the effect to be minimal in the first quarter of 2020 as the decision happened only seven working days before the end of the quarter.}

One caveat, however, is that our data does not allow us to study the individual borrower performances of specific banks. As a consequence, we are restricted to showing bank-level evidence, rather than bank-firm level evidence, which can be interpreted as an extension of zombie lending. Hence, our findings are only able to provide indirect evidence for the argument that worse-capitalized banks might have issued loans to their weaker borrowers with potential problem loans to avoid writing off losses, and as a result, this might be the reason why we do not observe a significant in-

| Table 4 | The effect of COVID-19 on bank loans. This table shows how bank lending reacted to the COVID-19 crisis. Weighted_Covid_19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. |
|----------------|----------------|----------------|----------------|----------------|
|                | (1)            | (2)            | (3)            | (4)            | (5)            |
|                | Δ Loans / lagged assets | Δ Loans / lagged assets | Δ Loans + unused commitments / lagged assets | Δ Assets / lagged assets |
| Crisis         |                |                |                |                |
| Weighted_Covid_19 | −0.001 (−0.36) | 0.017 (0.94)   | 0.011 (0.60)   | −0.026∗∗∗ (−5.68) |
| Crisis × Weighted_Covid_19 | 0.008∗∗ (2.13) | 0.008∗ (1.91)  | 0.010∗∗ (1.93) | 0.010∗∗ (2.50)  |
| Unused loan commitments | −0.034 (−1.03) | −0.015 (−1.03) | −0.018 (−1.17) | −0.023 (−2.25)  |
| Equity / assets | 0.053 (0.62)   | 0.043 (0.64)   | 0.189 (1.52)   | 0.073 (0.54)    |
| Loan loss reserves / loans | −0.294∗∗∗ (−2.98) | −0.291∗∗∗ (−2.95) | −0.43∗∗∗ (−2.66) | −0.47∗∗∗ (−2.91) |
| Interest income / assets | 0.997 (0.85)   | 0.936 (0.80)   | −6.482∗∗ (−2.17) | −7.854∗∗ (−2.45) |
| Net income / assets | 0.156 (0.51)   | 0.153 (0.50)   | −0.038 (−0.18) | 0.194 (0.80)    |
| Cash / assets | 0.131 (1.28)   | 0.131 (1.28)   | 0.150∗ (1.93) | 0.123 (1.47)    |
| Deposits / assets | 0.015 (0.73)   | 0.019 (0.83)   | −0.108 (−1.17) | −0.093 (−1.08)  |
| Log(assets) | −0.002 (−0.65) | −0.002 (−0.65) | −0.207∗∗∗ (−5.60) | −0.185∗∗∗ (−4.85) |
| Log(weighted GDP per capita) | 0.031 (0.84)   | 0.374∗ (1.95)  | 0.387∗∗ (3.65) | 0.387∗∗ (3.65)  |
| Log(weighted country population) | −0.004 (−0.64) | −0.548 (−0.92) | −0.190 (−0.24) | −0.190 (−0.24)  |
| Log(weighted median income) | −0.021 (−0.70) | −0.157 (−1.30) | −0.244∗∗ (−2.47) | −0.244∗∗ (−2.47) |
| Country FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | No |
| Bank FE | No | No | No | Yes |
| Observations | 1803 | 922 | 922 | 907 |
| Adjusted $^{2}$ | 0.023 | 0.108 | 0.107 | 0.234 |

| Table 5 | The effect of COVID-19 on bank characteristics. This table shows how several bank characteristics reacted to the COVID-19 crisis. Weighted_Covid_19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. |
|----------------|----------------|----------------|----------------|----------------|
|                | (1)            | (2)            | (3)            | (4)            |
|                | Δ Loans / lagged assets | Δ Loans / lagged assets | Δ Loans + unused commitments / lagged assets | Δ Assets / lagged assets |
| Crisis × Weighted_Covid_19 | 0.010∗∗ (2.25) | 0.004∗∗ (2.37) | 0.011∗ (1.79) | 0.017∗ (1.87) |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 907 | 703 | 701 | 935 |
| Adjusted $^{2}$ | 0.234 | 0.296 | 0.233 | 0.205 |
increase in their delinquent and restructured loans. Overall, our results provide indirect support for the zombie lending hypothesis.

4.1.3. How to finance the lending growth

As their decreased their loans significantly less, worse-capitalized banks experienced a significantly less reduction in their total assets. Column (3) of Table 6 shows that 10 percentage points increase in the exposure to COVID-19 outbreak led to a significantly less reduction in size by 0.26 percentage point. The question that arises is how worse-capitalized banks financed this relative expansion. They used both deposits and non-depository debt. Columns (5) and (6) highlight that 10 percentage points higher exposure to COVID-19 led to a significant increase in deposits (a significantly smaller decrease in non-depository debt) by about 0.15 (0.06) percentage point of their total assets. They did not adjust their cash holdings with an increase in their exposure to COVID-19.

In addition, while banks on average decreased their equity during the pandemic, worse-capitalized banks experienced a significantly less reduction in their equity: A 10 percentage points higher COVID-19 exposure decreased their equity significantly less by about 0.01 percentage point of their total assets. This is again in line with the argument that worse-capitalized banks could avoid a reduction in their equity which might be due to issuing new loans to their struggling borrower firms. On the other hand, our results show that better-capitalized banks experienced a significantly larger drop in their equity which might be the result of writing off loan losses on their capital; 10 percentage points increase in the

Table 6

The effect of COVID-19 on bank characteristics: High vs. low capital. This table shows how bank characteristics of better- and worse-capitalized banks reacted to the COVID-19 crisis. Weighted_Covid_19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. High capital is an indicator variable that takes the value one if a bank’s capital ratio is above the median in 2019Q4 and zero otherwise. All regressions include control variables, bank, and time fixed effects. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

|                      | (1) Δ Loans / lagged assets | (2) Δ Total lending / lagged assets | (3) Δ Assets / lagged assets | (4) Δ Risk weighted assets / lagged assets |
|----------------------|-----------------------------|-----------------------------------|----------------------------|--------------------------------------------|
| Crisis × Weighted_Covid_19 × High capital | -0.049*** (-2.53) | -0.039*** (-2.03) | -0.067*** (-2.67) | -0.031*** (-2.17) |
| Crisis × Weighted_Covid_19 | 0.016** (3.63) | 0.020*** (2.32) | 0.026** (2.39) | 0.013*** (2.98) |
| Crisis × High capital | 0.006 (0.69) | 0.006 (0.66) | 0.011 (0.68) | 0.001 (1.13) |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 905 | 701 | 929 | 829 |
| Adjusted R² | 0.256 | 0.239 | 0.221 | 0.189 |

|                      | (5) Δ Deposits / lagged assets | (6) Δ Other debt / lagged assets | (7) Δ Total equity / lagged assets | (8) Δ Cash / lagged assets |
|----------------------|-------------------------------|-----------------------------------|-----------------------------------|--------------------------|
| Crisis × Weighted_Covid_19 × High capital | -0.037*** (-2.12) | -0.018*** (-2.70) | -0.010*** (-2.97) | -0.000 (-0.00) |
| Crisis × Weighted_Covid_19 | 0.015** (2.49) | 0.006*** (2.93) | 0.001* (1.70) | 0.004 (0.84) |
| Crisis × High capital | 0.015 (1.37) | 0.002 (0.62) | -0.001 (-0.41) | 0.007 (0.74) |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 907 | 875 | 927 | 881 |
| Adjusted R² | 0.219 | 0.109 | 0.207 | 0.352 |

Table 7

The effect of COVID-19 on delinquencies and restructurings: High vs. low capital. This table shows how delinquencies and restructurings reacted to the COVID-19 crisis. Weighted_Covid_19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. High capital is an indicator variable that takes the value one if a bank’s capital ratio is above the median in 2019Q4 and zero otherwise. All regressions include control variables (but due to the small sample size, we refrain from controlling for unused commitments - undisclosed results show that our results are stable to including them but the sample size is halved), bank, and time fixed effects. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

|                      | (1) Days 30 delinquent / total loans | (2) Restructured loans / total loans | (3) Δ days 30 delinquent / lagged assets | (4) Δ restructured loans / lagged assets |
|----------------------|------------------------------------|-------------------------------------|------------------------------------------|-----------------------------------------|
| Crisis × Weighted_Covid_19 × High capital | 0.020*** (2.32) | 0.022*** (4.05) | 0.010** (2.85) | 0.008*** (2.25) |
| Crisis × Weighted_Covid_19 | 0.003* (1.96) | -0.001 (0.37) | 0.000 (0.88) | 0.000 (0.26) |
| Crisis × High capital | -0.017 (1.28) | -0.107 (-1.08) | -0.001 (0.79) | -0.002 (-0.79) |
| Controls | Yes | Yes | Yes | Yes |
| Bank FE | Yes | Yes | Yes | Yes |
| Time FE | Yes | Yes | Yes | Yes |
| Observations | 108 | 225 | 45 | 147 |
| Adjusted R² | 0.896 | 0.991 | 0.884 | 0.228 |
exposure led to a significantly more reduction in their total equity by 0.09 percentage point of their total assets.

4.1.4. Risk taking behaviour
Next, we examine the risk taking behaviour of banks. If worse-capitalized banks issued loans to their struggling borrowers, we expect that they would experience an increase in their risk taking. Column (4) of Table 6 highlights that worse-capitalized banks with 10 percentage points higher COVID-19 exposure had an increase in their risk-weighted assets by 0.13 percentage point of their total assets, whereas better-capitalized banks had a reduction in their risk-weighted assets. This finding suggests that worse-capitalized banks increased their risk taking at the onset of the pandemic while their better-capitalized peers decreased their risk taking. This difference supports the argument that banks with low capital ratios might have issued loans to their riskier borrowers.

4.1.5. Responses to the pandemic
As a result of the rapid spread of the COVID-19 pandemic, central banks and governments around the world have undertaken a wide range of responses. These measures include, for example, bans on public gatherings, interventions to contain the spread of the virus, but also actions that affect the economy. However, there has been a large variation across countries, both in terms of what is implemented, but also how fast the changes were made.

Government responses
To analyze the impact of government responses, we first examine whether financial support by governments had an impact on banks’ lending behavior. To measure financial support of governments, we use the “economic support index” of the Oxford COVID-19 Government Response Tracker, which collects information of individual government responses across 19 indicators and then groups this information together and forms different indexes, such as the overall “government response index”, the “economic support index”, but also indexes about the health and stringency (Hale et al., 2020). According to the literature, the provision of liquidity by governments might exaggerate lending to nonviable firms, e.g., zombie firms, and crowd out productive firms (see, e.g., Banerjee and Hofmann, 2018; Andrews and Petrouakis, 2019; Blattner et al., 2019; Acharya et al., 2019; Anderson et al., 2019; Blattner et al., 2019; Laeven et al., 2020; Acharya et al., 2020b). On the other hand, Laeven et al. (2020) and Brunnermeier and Krishnamurthy (2020) argue that COVID-19 is different than previous crises as the shock to some sectors is much larger. As a result, the objective of government supports should be to promote banks’ engagement in the evergreening of loans, i.e., rolling over existing loans, to carry businesses alive through the pandemic. To examine this further, we study whether banks that are located in countries that provided more economic support adjusted their lending differently compared to the banks in countries with fewer policy measures.

Columns (1) and (2) of Table 8 split the sample into two groups based on the quarterly values of the economic policy index, where we again use the proportion of bank branches in each country as weights. Column (1) focuses on banks that are subject to less economic support and show that these banks reduced lending significantly more (less) if they had higher (lower) capital ratios. On the contrary, with more economic support, column (2) shows that banks’ capital ratios did not play a role and both types of banks reduced their lending significantly less as their exposure to the pandemic increases. Hence, we find that the significant effect of bank capital on banks’ lending is especially present in countries with less economic support. In addition, the finding that better-capitalized banks decrease their lending significantly less if they are located in countries with more economic support could be attributed to banks being used as financial intermediaries to intermediate government support in these countries.

To summarize, these findings suggest that larger economic support helped to remove the excessive lending of worse-capitalized banks relative to their better-capitalized peers, which might be seen as a potential sign of zombie lending by worse-capitalized banks.

Loosening of capital requirements
As a next step, we examine whether changes to banks’ capital requirements have had an impact on their lending behaviour. The loosening of bank capital requirements might have differential effects on banks with low and high capital ratios. The zombie lending literature argues that banks with low capital ratios engage in excessive lending during crises in an attempt to write off less non-performing loans on their capital since they would like to avoid a decrease in their capital (see, e.g., Albertazzi and Marchetti, 2010; Schiviardi et al., 2017; Storz et al., 2017; Adalet McGowan et al., 2018; Acharya et al., 2019; Anderson et al., 2019; Blattner et al., 2019; Laeven et al., 2020; Acharya et al., 2020b). One thus expects that the loosening of bank capital requirements might alleviate this behavior as reduced required capital ratios could give worse-capitalized banks additional capital buffers.

To investigate this, we use the COVID-19 Financial Response Tracker by the Yale Program on Financial Stability, which tracks interventions by central banks, fiscal authorities, and organizations aimed at restoring financial stability, to measure the changes in banks’ capital requirements. We focus on the loosening of capital requirements by central banks or financial supervisory authorities and we count how many were implemented in the first quarter of 2020. Examples of such policy instruments are countercyclical capital buffers or the relaxation of eligible capital instruments and in general, there exists a relatively large variation across countries: While some have implemented fewer changes (such as Poland or Norway), others changed their capital requirements more often (e.g., Austria or Romania). We again use the proportion of bank branches in each country as weights and subsequently split the sample into two subgroups.

Columns (3) and (4) of Table 8 show that worse-capitalized banks decreased their loans significantly less only when they are located in countries with fewer loosening of capital requirements. On the other hand, better-capitalized banks exposed to fewer loosening of capital requirements reduced their lending significantly more, whereas we find no effect for the ones with more loosening of capital requirements.

In summary, these findings imply that the significant difference in the lending responses of worse- versus better-capitalized banks however, includes a broader set of 16 ordinal indicators that incorporates also information on e.g. the workplace closings, stay at home requirements, or containment and health indicators. Alternatively, using an interaction term of being part of the larger economic support index group provides again similar results.

The data can be downloaded via https://som.yale.edu/faculty-research-centers/centers-initiatives/program-on-financial-stability/covid-19-tracker.

We split the sample based on the weighed count of capital requirement changes, however, one limitation of this approach is that capital buffers may differ in terms of their magnitude. Unfortunately, data limitations prevent us from conducting a more detailed analysis.

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23 The project is organized by the Blavatnik School of Government and the data, which is available daily for a large number of countries worldwide, and tracks individual policy measures across 20 indicators. Most indicators are recorded on an ordinal scale representing the level of strictness of the policy. We focus on the “economic policy” subindex, which consists of two parts: government freeing of financial obligations for households such as stopping loan repayments, and direct cash payments to people who lose their jobs or cannot work. The data can be downloaded via github: https://github.com/OnCGRT/covid-policy-tracker.

24 Undisclosed results show that while the Weighted_Covid_19 is slightly lower for the low economic response group, banks in both groups have had similar bank characteristics prior to the pandemic. Moreover, similar results are obtained when splitting the sample according to the overall “government response index”, which however, includes a broader set of 16 ordinal indicators that incorporates also information on e.g. the workplace closings, stay at home requirements, or containment and health indicators.
is eliminated by the loosening of capital requirements. If worse-capitalized banks decrease their lending less as a result of zombie lending, this finding is consistent with the literature.

Adjustment of insolvency rules

As a last step, we examine changes to insolvency laws, the idea being that if countries adjust their insolvency laws to protect claims by creditors, this may indirectly impact banks’ willingness to lend as it has an effect on firms’ and individuals’ bankruptcy procedures (e.g., Davydenko and Franks, 2008; Armour et al., 2015). If firms have a lower likelihood of bankruptcy due to moratoria of insolvency rules, this might decrease the non-performing loans on banks’ balance sheets. If worse-capitalized banks’ excessive lending behavior is due to overgenerous of existing loans to struggling borrowers, we expect that this behavior would be alleviated for banks located in the countries that adjusted their insolvency rules.

We mainly use an overview of changes in insolvency rules by the end of March 2020, provided by DLA Piper, a global law firm, and roughly half of the countries in our sample adopted such law change.27 Examples of such law changes are the suspension of insolvency filing duties or the postponement of the execution of an insolvency. Similar to above we again use the proportion of bank branches in each country as weights, and we differentiate between banks that are subject to insolvency law changes and those that are not. Columns (5) and (6) of Table 8 show that worse-capitalized banks that are active in countries with no adjustments to insolvency laws reduced their lending significantly less. On the contrary, if subject to insolvency law changes, banks’ capital ratios did not play a role.

Hence, these findings document that by adjusting their insolvency laws, countries were able to alleviate differences in the lending responses of worse- versus better-capitalized banks. Stated differently, bank capital mattered for banks’ lending responses only in countries with no changes in insolvency laws.

To summarize all findings in this section, we find that larger economic support, loosening of capital requirements, and adjustment of insolvency rules during the pandemic removed the excessive lending behavior of worse-capitalized banks. If the excessive lending of worse-capitalized banks relative to their better-capitalized peers is an extension of zombie lending, these results suggest that the policy measures taken by governments and central banks to combat the COVID-19 are shown to be useful.

5. Results for 2020Q2 and 2020Q3

According to our results from Section 3.3, countries with more COVID-19 cases per 1000 people experienced a significantly larger increase in loan demand in the first quarter of 2020 as reported in Table 3. This positive impact becomes insignificant in the second quarter and the effect becomes negative and insignificant in the third quarter. Moving from a country level analysis to our bank level analysis, we next examine whether our results from the first quarter hold for the following two quarters as well. Given that the positive impact of the COVID-19 cases per 1000 people on loan demand diminishes over time, we expect that the significant difference in the lending responses of worse- versus better-capitalized banks would slowly disappear over time.28

Table 9 shows the impact of COVID-19 cases, again per 1000 people, on banks’ lending in 2020Q2 and 2020Q3. According to our results, an increase in COVID-19 exposure decreases the reduction in banks’ lending significantly for the second quarter: As reported in column (1), 10 percentage points higher COVID-19 cases per 1000 people decreases bank loans significantly less by about 0.07 percentage point of their total assets. In addition, as reported in column (2), bank capital matters for the reduction in the amount

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27 Austria, France, Germany, Hungary, Romania, Spain, Great Britain, Slovakia, and Greece implemented such changes, Finland drafted a proposal and Belgium introduced measures for the delayed payment of public debts and suspended the repayment obligations of bank debts. In the remaining countries no such law changes were implemented. The overview can be downloaded via DLA Piper. For Switzerland, Bulgaria and Greece we additionally use the following sources, as they are not coved in the overview of DLA Piper: Swisssinfo, Schoenherr, and e-justice.europa.eu.

28 In addition, from Q2 onwards almost all countries had economic supports, relaxation of non-performing loan classifications and capital requirements as well as adjustments of insolvency rules. As shown in the previous section, these are expected to remove the significant difference in the lending responses of worse- and better-capitalized banks as they eliminate the excessive lending incentives of worse-capitalized banks.
of loans. While only marginally significant, we find that better-capitalized banks reduced their lending more: 10 percentage points higher exposure to COVID-19 decreased better-capitalized banks’ loans more by about 0.06 percentage point of their total assets compared to worse-capitalized banks. The positive effect of COVID-19 on bank lending disappears in the third quarter of 2020 and the impact of bank capital is also not there anymore.

As a next step, Table 10 focuses on delinquencies and restructurings.29 Similar to banks’ loan responses, we find weaker effects for the second and third quarter of 2020 compared to the first quarter. While in 2020Q2, 10 percentage points increase in COVID-19 exposure led to significantly larger 30+ days delinquent loans of better-capitalized banks by 0.06 percentage point of their total loans compared to their worse-capitalized peers, we find no consistent effect for loan restructuring and the effect also disappears for delinquent loans in 2020Q3.30

Overall, our results suggest that worse-capitalized banks’ excessive lending practice was most pronounced at the onset of the pandemic in 2020Q1 when loan demand increased significantly for banks located in countries with larger COVID-19 cases. As the trend on loan demand diminished over time and almost all governments responded by e.g., financial supports, relaxation of non-performing loan classifications and adjustment of insolvency rules, the significant impact of COVID-19 cases on bank lending and the difference between banks with high versus low capital ratios declined slowly where it disappeared in the third quarter of 2020.

29 We also report other bank characteristics in Tables A3 and A4 in the Online Appendix. Consistent with the main findings presented in this section, we do not find much evidence that any of these changed in 2020Q2 and 2020Q3 with regards to our weighted COVID-19 cases measure and the interaction with the high-capital dummy.

30 As already mentioned above, the ECB announced that it relaxes the rules on the classification of non-performing loan standards on March 20, 2020 (https://www.banking-supervision.europa.eu/press/pr/date/2020/html/ssm.pr200320-4cdbc666.en.html). One caveat related to this is that the amount of delinquent loans reported in 2020Q2 and 2020Q3 is thus likely to be affected by the relaxation of standards and the effect might not be homogenous across banks.
Table 11
Robustness check: Other correlated bank characteristics. This table shows whether banks’ reaction to the COVID-19 crisis changes with other bank characteristics that are significantly correlated to bank capital as shown in Table 2. Weighted_Covid_19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. High loan loss reserves is an indicator variable that takes the value one if a bank’s loan loss reserves ratio is above the median in 2019Q4 and zero otherwise. The other dummies, High net interest income, High deposits and High size, are defined similarly. All regressions include control variables, bank, and time fixed effects. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

|                  | (1) Δ Loans / lagged assets | (2) Δ Loans / lagged assets | (3) Δ Loans / lagged assets | (4) Δ Loans / lagged assets |
|------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Crisis × Weighted_Covid_19 | 0.024*** (2.91)          | 0.012*** (2.76)          | 0.016** (2.02)             | 0.012*** (3.15)             |
| Crisis × Weighted_Covid_19 × High loan loss reserves | −0.016* (−1.74)         | 0.034*** (2.79)         |                             |                             |
| Crisis × High net interest income | −0.080*** (−3.18)      |                             |                             |                             |
| Crisis × High deposits | 0.009 (0.82)             |                             |                             |                             |
| Crisis × Weighted_Covid_19 × Low size |                             |                             |                            | −0.052** (−2.06)             |
| Crisis × Low size |                             |                             |                            | −0.004 (−0.32)             |
| Controls         | Yes                        | Yes                        | Yes                        | Yes                        |
| Bank FE          | Yes                        | Yes                        | Yes                        | Yes                        |
| Time FE          | Yes                        | Yes                        | Yes                        | Yes                        |
| Observations     | 901                        | 899                        | 903                        | 905                        |
| Adjusted R²      | 0.241                      | 0.280                      | 0.236                      | 0.267                      |

6. Further results and robustness checks

6.1. Other bank characteristics

According to Table 2, bank capital is significantly positively correlated with loan loss reserves, net interest income and deposits, and significantly negatively correlated with bank size. To see whether these bank characteristics might be driving our results, we define high/low dummy variables and repeat our analysis with triple interactions with these dummies instead of using our “high capital” dummy. For example, the “high loan loss reserves” dummy is equal to one for banks with 2019Q4 loan loss reserves divided by total assets above the median and to zero for banks below the median. Similar dummies are created for net interest income and deposits. The correlation of bank capital with size is negative, and as a result, we define a “low size” dummy, which is equal to one for banks with 2019Q4 size below the median and to zero for banks above the median.

The coefficient estimates are reported in Table 11. As can be seen in column (1), the coefficient estimate of the triple interaction with loan loss reserves is not as significant and as large as the triple interaction with capital in our main regression (−0.049). The triple interaction with deposits, as reported in column (3), is not significant so deposits cannot be driving the results. On the other hand, as reported in columns (2) and (4), the coefficients on the triple interactions with high net interest income and with low size are highly significant and negative. This might suggest that net interest income or size might be driving our results on bank capital.

To investigate this further, we repeat our analysis where we add these triple interactions with the triple interaction of “high capital” dummy in the same regression. We find that the triple interaction with the “high capital” dummy is still significantly negative in each specification as reported in Table 12. In column (2), we show the results when adding the triple interaction of high net interest income, the one that seems most similar to bank capital as shown in Table 11, with the triple interaction of high bank capital, the latter is still significantly negative. In addition, in column (4), the triple interaction with bank size is no longer significant when we add the triple interaction with “high capital” in the same regression.

According to these results, only high net interest income dummy has a similar effect with high capital dummy. However, given that the impact of bank capital is still highly significant when we add the interaction with the high interest income dummy in the same regression, we believe that it is unlikely to drive our results.

6.2. Controlling for expectations

While the analysis above includes both bank- and time-fixed effects (similar to e.g., Li et al. (2020)), bank loans might depend on many other variables that are not captured in the regression Eq. (3). We thus use the EU Business and Consumer Survey which offers a wide range of information on current economic activity and its perspectives. Table 13 includes five lagged country-level variables, both at the consumer level (economic, financial, unemployment, and major purchase expectations) and at the firm level (planned investments). Similar to our country control variables, we weight these variables by the geographic distribution of each bank’s branches. Adding these additional control variables does not impact the economic and statistical significance of our results.

6.3. Changes in different types of loans

Table 14 shows the results on retail and corporate loans. The former are loans that are given to individual consumers and include personal, home, or auto loans, whereas latter are loans given to companies and can be used to finance term loans, working
Table 12
Robustness check: Other correlated bank characteristics in addition to bank capital. This table shows whether banks’ reaction to the COVID-19 crisis changes with other bank characteristics that are significantly correlated to bank capital as shown in Table 2, Weighted_Covid.19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. High loan loss reserves is an indicator variable that takes the value one if a bank’s loan loss reserves ratio is above the median in 2019Q4 and zero otherwise. The other dummies, High net interest income, High deposits and High size, are defined similarly. All regressions include control variables, bank, and time fixed effects. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

|                       | (1) Δ Loans / lagged assets | (2) Δ Loans / lagged assets | (3) Δ Loans / lagged assets | (4) Δ Loans / lagged assets |
|-----------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Crisis × Weighted_Covid_19 | 0.030***                    | 0.016***                    | 0.015**                     | 0.016***                    |
| Crisis × Weighted_Covid_19 × High loan loss reserves | (4.11) | (3.31) | (2.30) | (3.61) |
| Crisis × High loan loss reserves | 0.038***                    | (2.78)                       |                             |                             |
| Crisis × Weighted_Covid_19 × High net interest income | −0.063** | (−2.54) | (−2.42) | (−1.86) |
| Crisis × High net interest income | 0.001                       | (0.12)                       |                             |                             |
| Crisis × Weighted_Covid_19 × High deposits | 0.003                       | (0.31)                       |                             |                             |
| Crisis × High deposits | 0.009                       | (0.83)                       |                             |                             |
| Crisis × Weighted_Covid_19 × Low size | −0.040 | (−1.64) |                             |                             |
| Crisis × Low size | 0.004                       | (−0.39)                       |                             |                             |
| Crisis × Weighted_Covid_19 × High capital | −0.033* | (−1.94) | (−2.26) | (−2.42) |
| Crisis × High capital | 0.009                       | 0.014                        | 0.003                       | 0.009                       |
| Controls               | Yes                         | Yes                         | Yes                         | Yes                         |
| Bank FE                | Yes                         | Yes                         | Yes                         | Yes                         |
| Time FE               | Yes                         | Yes                         | Yes                         | Yes                         |
| Observations           | 901                        | 899                         | 903                         | 905                         |
| Adjusted R²            | 0.260                       | 0.283                       | 0.257                       | 0.271                       |

Table 13
Robustness check: Including economic expectations. This table shows how bank loans reacted to the COVID-19 crisis. Weighted_Covid.19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. High capital is an indicator variable that takes the value one if a bank’s capital ratio is above the median in 2019Q4 and zero otherwise. All regressions include control variables, bank, and time fixed effects. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

|                       | (1) Δ loans / lagged assets | (2) Δ loans / lagged assets | (3) Δ loans / lagged assets | (4) Δ loans / lagged assets | (5) Δ loans / lagged assets | (6) Δ loans / lagged assets | (7) Δ loans / lagged assets |
|-----------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Crisis × Weighted_Covid_19 × High capital | −0.049** | (−2.53) | (−2.63) | (−2.84) | (−2.45) | (−2.71) | (−2.90) |
| Crisis × Weighted_Covid_19 | 0.016*** | 0.018*** | 0.016*** | 0.014*** | 0.019*** | 0.018*** | 0.019*** |
| Crisis × High capital | 0.005                       | 0.006                       | 0.009                       | 0.010                       | 0.007                       | 0.013                       | 0.015                       |
| Weighted financial expectation | 0.002** | (2.22) | (2.22) | (2.22) | (2.22) | (2.22) | (2.22) |
| Weighted economic expectation | −0.000 | (−0.97) | (−0.97) | (−0.97) | (−0.97) | (−0.97) | (−0.97) |
| Weighted unemployment expectation | 0.001** | (2.49) | (2.49) | (2.49) | (2.49) | (2.49) | (2.49) |
| Weighted major purchase expectation | 0.001 | (1.39) | (1.39) | (1.39) | (1.39) | (1.39) | (1.39) |
| Weighted planed firm investments | 0.001*** | (4.53) | (4.53) | (4.53) | (4.53) | (4.53) | (4.53) |
| Controls               | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         |
| Bank FE                | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         |
| Time FE               | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         | Yes                         |
| Observations           | 905                        | 905                         | 905                         | 905                         | 905                         | 905                         | 905                         |
| Adjusted R²            | 0.256                       | 0.257                       | 0.255                       | 0.261                       | 0.256                       | 0.268                       | 0.274                       |

6.4. Alternative regression set-ups

We next show the results with different regression specifications as robustness checks. In our main specification, we use changes in the amount of loans divided by lagged total assets. Column (1) of Table 15 uses the log-changes in loans instead.
and the coefficients are significant for both worse-capitalized and better-capitalized banks. In addition, we require banks to have at least 75% of their branches in Europe for our main specification. Columns (2) and (3) show the results with 50% and 100%. The coefficients are similar and significant for both specifications. Columns (4) and (5) change the start of the sample period to 2017 and 2019 instead of 2018. The results are again very similar to our main specification. Column (6) includes bank group-time fixed effects, by defining bank groups based on the quartiles of the equity ratios and column (7) further adds country-time fixed effects. These additional fixed effects enable us to control for loan demand further as country-time fixed effects should capture the changes in loan demand at the country level and the bank group-time fixed effects should capture the differential changes in loan demand across different capital ratios. Adding these fixed effects does not alter the findings on better-capitalized banks: Banks with high capital ratios again reduce their lending significantly more although the significance decreases. For worse-capitalized banks, the positive effect of an increase in weighted COVID-19 cases on their loan supply disappears when we add country-time fixed effects. Given that country-time fixed effects partially control for time-varying demand effects at the country level, this result supports our main findings that worse-capitalized banks with higher exposure to the pandemic experienced an increase in their loan demand and they reacted by increasing their lending which can only be captured if we do not control for the changes in the loan demand. Last, introducing a squared Weighted_Covid_19 term, column (8) shows that this does not alter the main coefficients of interest.\footnote{Undisclosed results show that the turning point is above the 94th percentile and hence very near the edge of the Weighted_Covid_19 data. We thus refrain from using the squared term in all regressions.}

6.5. Falsification test

Our identification is based on the assumption that banks with higher exposure to COVID-19 would have changed their loans similar to banks with lower exposure if there had not been a pandemic.

| Table 14 | Robustness check: The effect of COVID-19 on loan types. This table shows how retail and corporate loans reacted to the COVID-19 crisis. Weighted_Covid_19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. |
| --- | --- |
| (1) | (2) |
| Δ Retail loans / lagged assets | Δ Corporate loans/ lagged assets |
| Crisis × Weighted_Covid_19 × High capital | −0.069* |
| | (−1.90) |
| Crisis × Weighted_Covid_19 | 0.007* |
| | (1.78) |
| Crisis × High capital | −0.001 |
| | (0.78) |
| Controls | Yes |
| Bank FE | Yes |
| Time FE | Yes |
| Adjusted $R^2$ | 0.252 |

| Table 15 | Robustness check: Alternative specifications. This table shows the impact of COVID-19 on loans using different regression specifications. Column (1) uses the first differences of ln(loans) as the dependent variable. Columns (2) focuses on banks with more than 50% of their branches in Europe. Column (3) uses only banks that have all their branches in Europe. Columns (4) and (5) look at the time period starting with 2017 and 2019, respectively. Column (6) includes bank group-time fixed effects, by defining bank groups based on the quartiles of the equity ratio, and column (7) further adds country-time fixed effects. Column (8) further includes the squared term of Weighted_Covid_19. Weighted_Covid_19 is our bank-specific weighted average COVID-19 cases per 1000 people measure. Crisis is a dummy variable that is one for 2020Q1 and zero otherwise. High capital is an indicator variable that takes the value one if a bank’s capital ratio is above the median in 2019Q4 and zero otherwise. All regressions include all control variables from the main regression. Coefficients on control variables are not reported in the interest of parsimony. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| ln(Loans) - ln(lagged loans) | Δ Loans / lagged assets ≥ 50% | Δ Loans / lagged assets ≥ 100% | Δ Loans / lagged assets ≥ 2017 | Δ Loans / lagged assets ≥ 2019 | Δ Loans / lagged assets | Δ Loans / lagged assets | Δ Loans / lagged assets |
| Crisis × Weighted_Covid_19 × High capital | −0.044* |
| | (−1.59) |
| Crisis × Weighted_Covid_19 | 0.020*** |
| | (2.71) |
| Crisis × High capital | 0.002 |
| | (0.12) |
| Crisis × Weighted_Covid_192 × High capital | 0.065* |
| | (2.19) |
| Crisis × Weighted_Covid_192 | 0.010 |
| | (0.41) |
| Controls | Yes |
| Bank FE | Yes |
| Bank group-time FE | No |
| Country-time FE | No |
| Observations | 905 |
| Adjusted $R^2$ | 0.303 |

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To support this, we show that banks’ exposure to COVID-19 did not have an impact on the change in their loans and other bank characteristics before the pandemic started in 2020Q1. We, first, falsely assume that there was a pandemic during 2019, and, then, show that banks with higher exposure to COVID-19 did not show any differences in how they changed their bank characteristics during 2019 relative to 2016, 2017 and 2018. The results are reported in Table 16. This suggests that parallel trends assumption holds.

7. Conclusion

In this paper, we study how European banks responded to the COVID-19 outbreak by focusing on the differences between worse-capitalized and better-capitalized banks at the onset of the pandemic. Using a bank-level COVID-19 exposure measure calculated as the weighted average COVID-19 cases per 1000 people, we document that while European banks decreased their loans significantly at the onset of the pandemic, the ones with a higher exposure to the COVID-19 outbreak, on average, experienced a significantly less reduction in their loans.

Dividing our sample into worse- and better-capitalized banks, we find significant differences in the response: Worse-capitalized banks decreased their lending significantly less whereas their better-capitalized peers decreased their lending significantly more. Moreover, better-capitalized banks increased their delinquent and restructured loans significantly more relative to their worse-capitalized peers. These findings are in line with the zombie lending hypothesis that worse-capitalized banks might have an incentive to issue more loans during contraction times to help their weaker borrowers so that they can avoid loan losses and write-offs on their capital.

We next show evidence that different government responses to the pandemic helped mitigate worse-capitalized banks’ excessive lending behavior. We find that governments that provided larger economic support, loosened capital requirements and adjusted insolvency rules during the pandemic helped remove the differences in the lending responses of worse- versus better-capitalized banks.

Overall, our results can shed some light on the general progress of the recovery from the unprecedented pandemic, which crucially depends on the liquidity provision of banks. Our findings suggest that larger economic support, loosening of capital requirements and adjustment of insolvency rules during the pandemic removed the difference in the lending responses of worse- versus better-capitalized banks. Given that the significant difference in lending responses, i.e., the significant negative effect of bank capital on lending, might be seen as a potential sign of zombie lending, these results imply that the policy measures taken by governments and central banks to fight the negative effects of the pandemic on the real economy are shown to be useful to eliminate the excessive lending of worse-capitalized banks relative to their better-capitalized peers.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jbankfin.2021.106236.

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For this analysis, we extend our sample period to 16 quarters from 2016Q1 to 2019Q4.

### Table 16

Robustness check: Falsification test. This table shows the findings from the falsification test. We falsely assume that pandemic happened in 2019 and show that COVID-19 exposure does not have any significant effects on the changes in the bank characteristics. `Weighted_Covid_19` is our bank-specific weighted average COVID-19 cases per 1000 people measure. `Crisis` is a dummy variable that is one for 2019 (all quarters) and zero otherwise. The time period runs for 16 quarters from 2016Q1 to 2019Q4. `High capital` is an indicator variable that takes the value one if a bank’s capital ratio is above the median in 2019Q4 and zero otherwise. All regressions include control variables, bank, and time fixed effects. The robust standard errors, clustered at the bank level, are reported under the coefficients. The symbols **, *, and * denote significance at the 1%, 5%, and 10% levels, respectively.

|                  | (1)                  | (2)                  | (3)                  | (4)                  |
|------------------|----------------------|----------------------|----------------------|----------------------|
|                  | Δ Loans / lagged assets | Δ Total lending / lagged assets | Δ Unused commitments / lagged assets + commit. | Δ Assets / lagged assets |
| Crisis × Weighted_Covid_19 | −0.001 (−0.33) | −0.001 (−0.18) | −0.000 (−0.38) | 0.003 (0.60) |
| Observations     | 1416                  | 1167                  | 1171                  | 1457                  |
| Adjusted R²      | 0.152 (5)             | 0.122 (6)             | 0.138 (7)             | 0.191 (8)             |
|                  | Δ Deposits / lagged assets | Δ Other debt / lagged assets | Δ Total equity / lagged assets | Δ Cash / lagged assets |
| Crisis × Weighted_Covid_19 | 0.003 (0.73) | 0.002 (0.87) | −0.007 (−1.13) | 0.005 (1.63) |
| Observations     | 1434                  | 1388                  | 1451                  | 1392                  |
| Adjusted R²      | 0.139 (9)             | 0.069 (10)            | 0.229 (11)            | 0.342 (11)            |
|                  | Δ Days 30 delinquent / lagged assets | Δ Restructured loans / lagged assets | Δ Risk weighted assets / lagged assets |
| Crisis × Weighted_Covid_19 | 0.000 (0.15) | 0.000 (0.06) | −0.003 (−1.07) | |
| Observations     | 113                   | 270                   | 1844                  |                    |
| Adjusted R²      | 0.385 (113)           | −0.205 (114)          | 0.134 (115)           |                    |
| Controls         | Yes                   | Yes                   | Yes                   | Yes                   |
| Bank FE          | Yes                   | Yes                   | Yes                   | Yes                   |
| Time FE          | Yes                   | Yes                   | Yes                   | Yes                   |
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