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DP15869

## **Are Banks Catching Corona? Effects of COVID on Lending in the U.S.**

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**FINANCIAL ECONOMICS**



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# Are Banks Catching Corona? Effects of COVID on Lending in the U.S.

## Abstract

Exploiting geographic variation in the exposure of U.S. banks to COVID-19 and lockdown policies we find that banks more exposed to pandemic and lockdown policies show an increase in loss provisions and non-performing loans. While we observe an increase in corporate, especially small business, lending growth, this is driven by government-guaranteed loans. Finally, we observe a reduction in the number and average amount of syndicated loans for banks more affected by the pandemic as well as an increase in interest spreads and decrease in maturities. These findings point to a negative impact of the pandemic and swift reactions by banks.

JEL Classification: G21

Keywords: COVID-19, Banking

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# ARE BANKS CATCHING CORONA?

## EFFECTS OF COVID ON LENDING IN THE U.S.

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Exploiting geographic variation in the exposure of U.S. banks to COVID-19 and lockdown policies we find that banks more exposed to pandemic and lockdown policies show an increase in loss provisions and non-performing loans. While we observe an increase in corporate, especially small business, lending growth, this is driven by government-guaranteed loans. Finally, we observe a reduction in the number and average amount of syndicated loans for banks more affected by the pandemic as well as an increase in interest spreads and decrease in maturities. These findings point to a negative impact of the pandemic and swift reactions by banks.

JEL: G21

KEYWORDS: COVID-19 · banking

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## I. INTRODUCTION

THE COVID-19 pandemic has hit the U.S. economy fast and hard. Unemployment claims spiked up in the first half of 2020 at an unprecedented speed. While such a shock is unlikely to leave banks unaffected, equity buffers have improved significantly since the 2007 financial crisis and fiscal, monetary and regulatory policy responses were swift and radical. In this paper we examine if and how banks' health is affected and if there have been changes in lending growth, including in reaction to government support programmes, and in loan conditionality. Our results can shed light on how deep and long the trough and how speedy the economic recovery will be after the shockwave, both of which depend crucially on liquidity provision by financial intermediaries.

While negative economic shocks have often quick effects on loan performance and should thus be reflected in non-performing loans (NPL) and loan loss provisions, regulatory easing might counter these negative effects, at least to a certain extent. And while economic recessions and crises often result in a drop in demand for and supply of loans, the COVID-19 crisis shows unique characteristics in its effect on both real economy and financial system. Drops in aggregate demand have been swift but temporary, related to both the fear of contagion and to lockdown restrictions, resulting in an increase rather than decrease in corporate loan demand, as companies in affected sectors require liquidity for survival. Similar, while higher uncertainty and lower risk appetite tend to reduce loan supply during such a crisis, aggressive monetary and regulatory policy measures, combined with loan guarantees by government counter some of these effects. It is thus an empirical question how bank lending has reacted to the pandemic.

This paper combines county-, bank-, and loan-level data from several sources and uses a novel bank-level gauge of exposure to pandemic and lockdown policies to pro-

vide a first assessment of the effect of COVID-19 and lockdown policies on the banking system, exploiting variation in pandemic outbreaks and lockdown policies across U.S. counties. Our results suggest that both COVID outbreaks and lockdowns are associated with increases in unemployment and worse loan performance (led by household loans). COVID outbreaks and lockdown policies are also associated with higher C&I and small business lending growth though this only holds when government-supported loans under the Paycheck Protection Program (PPP) are included. We also find that this government-supported increase in small business lending is driven by supply rather than demand. Finally, we find that COVID outbreaks are associated with fewer loans, smaller loan amounts, higher interest spreads and shorter maturities in the syndicated loan market, suggesting a higher risk premium and tighter conditionality.

The U.S. offers a unique laboratory to test the impact of the pandemic and policy reactions. COVID-19 outbreaks were initially concentrated in urban centers on both coasts before the pandemic moved Mid-West and ultimately into the South and Southwest. Similarly, state and county governments across the U.S. have shown quite some variation in lockdown policies. Given the variation in regional exposure of banks, different banks were affected to a different degree by the pandemic as well as at different points in time. This allows us to use variation in geographic exposure of banks to pandemic and lockdown measures to construct a bank-specific gauge of exposure to pandemic and lockdowns and relate it to bank- and loan-level outcomes. Further, as in many other advanced countries, fiscal, monetary and regulatory authorities have reacted swiftly and resolutely to the crisis, including one-time tax rebates, extended unemployment benefits, loan (guarantees), lowering the federal funds rate to 0-0.25%, a variety of funding facilities targeted at commercial paper and corporate credit issuers and dealers and issuers of small business loans, among others, lowering of regulatory capital and liquidity buffers, and easing of loan classification requirements. In addi-

tion, under the April 2020 CARES Act's Paycheck Protection Program loans were made available by the Small Business Administration through banks to small businesses to encourage them to retain or rehire employees that have been furloughed. The loans will be forgiven if certain requirements are met.<sup>1</sup>

Theory and evidence from previous crises provide contradictory evidence on whether negative macroeconomic shocks result in lending retrenchment or not. On the one hand, theory and evidence suggests lending retrenchment, due to dropping collateral values and thus increasing agency conflicts (Gertler & Bernanke, 1989) or due to losses reducing bank capital and banks' limited ability to raise additional capital (see Ivashina & Scharfstein, 2010; Cornett, McNutt, Strahan & Tehranian, 2011). However, Kahle & Stulz (2013) find no evidence for a credit supply shock during the Global Financial Crisis, but rather evidence for a demand reduction. And while Ivashina & Scharfstein (2010) show a sharp downturn in syndicated lending from mid-2007 onwards, they also show an increase in C&I loans on the aggregate balance sheet of the U.S. banking sector between September and October 2008, due to drawdown of credit lines. Similarly, initial evidence from the current shock suggests that loan demand has increased substantially, with many firms drawing down credit lines or tapping capital markets (Acharya & Steffen, 2020). At the same time and as described above, there have been aggressive measures by central banks to encourage banks to keep lending to the real economy, while they also mitigated to an extent an immediate deterioration of loan performance. It is thus a-priori not clear whether the reaction of banks will be the same during the current as during previous crises. While the evidence on lending growth is thus ambiguous, it points more clearly to an increase in interest spreads, related to reduced net worth of borrowers (and thus collateral value), higher funding costs for banks, and increased uncertainty (see Santos (2010) for evidence from the

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<sup>1</sup>For more detail, see this cross-country compilation by the IMF on [Policy Responses to COVID-19](#). The PPP lending program was generally targeted at small businesses with at most 500 employees, with an interest rate of one percent and maturities of two years.

Global Financial Crisis). A similar effect can be expected in the context of the current crisis, related to lower asset prices and lower revenue streams reducing net worth of borrowers, while increasing demand for liquidity by firms.

Our first set of results shows that unemployment rates (the most accurate and most rapidly available indicator of economic activity) co-varies significantly across counties in the U.S. in the first three quarters of 2020 with COVID outbreaks and lockdown policies. While not a focus of our work, our results thus also speak to the discussion on whether it is COVID outbreaks and/or lockdown policies that are responsible for the drop in economic activity we have observed. Taking unemployment as the most accurate regularly and quickly published economic activity gauge, we find that both COVID outbreaks and lockdown policies have dampened economic activity. We also document an increase in loan loss provisions over 2020, related to banks' exposure to COVID-19 outbreaks and lockdown policies, while the results are somewhat less robust for non-performing loans (NPLs). This increase in loan loss provisions and NPLs is primarily driven by household loans. The difference in strength in terms results of the impact of the pandemic for loan loss provisions and NPLs can be explained with a stronger increase in general rather than specific loan loss provisions while at the same time loan loss classification rules were eased.

Our second set of results shows that banks have been expanding lending in response to COVID-19, though primarily driven by the government-sponsored PPP. The discrepancy between total lending in- and excluding PPP loans is especially marked for small business loans: while we observe a general increase in small business lending, which is stronger for banks that are geographically more exposed to the pandemic and lockdown measures, there is a general decline in small business lending without PPP loans, stronger for banks more exposed to the pandemic and lockdown measures. We also find an increase in overall C&I lending, stronger for banks geographically more exposed to the pandemic (though not lockdown measures), and a general decline in



household lending, which does not vary across banks' exposure to pandemic or lockdown measures. We also focus on bank-county data for the second quarter of 2020 (when most PPP loans approved under the CARES Act were approved) to differentiate between demand and supply effects in the bank-level reaction of small business lending to the pandemic. Specifically, we compare extensive and intensive margins in changes from small business lending in 2017 to 2019 to PPP loans in 2020 across banks with differential geographic exposure to the pandemic and lockdown measures within the same county and find that the increase in small business lending is driven by supply rather than by demand factors.

Our third set of results shows that banks more affected by COVID increased interest spreads on syndicated loans; interestingly, this is driven by exposure to COVID outbreaks rather than to lockdown policies. Similarly, we find that such banks grant shorter maturity loans, although this finding is somewhat less robust. Finally, such banks issued fewer loans and the average loan amount declined. These findings are consistent with theories and previous empirical work that have shown an increase in risk premiums and tighter risk appetite by banks.

Our paper is related to a small literature on the effect of COVID-19 on the banking system. Specifically, using bank regulatory filings [Li, Strahan & Zhang \(2020\)](#) document the largest ever liquidity demand by firms drawing down preexisting credit lines; banks were able to accommodate the liquidity demand due to cash inflows from the Fed and from depositors. Using loan-level data, [Greenwald, Krainer & Paul \(2020\)](#) show that bank lending increased following the March 2020 U.S. COVID-19 outbreak, concentrated on C&I lending, and in the form of credit line draw-downs. [Halling, Yu & Zechner \(2020\)](#) gauge U.S. firms' access to public capital markets and show that particularly highly rated firms issued public debt after the onset of the pandemic, but substantially less equity. Focusing on the firm-side, [Acharya & Steffen \(2020\)](#) show that while AAA-A-rated firms raised cash through bond and equity issuances

(in addition to credit line drawdowns), BBB-rated firms mainly increased cash holdings through credit line drawdowns and term loan issuances; non-investment grade and unrated firms had to rely fully on credit-line drawdowns and term loans from banks. [Chodorow-Reich, Darmouni, Luck & Plosser \(2020\)](#) show that the increase in bank credit in the first two quarters of 2020 are almost completely due to drawdowns by large firms of lines of credit.<sup>2</sup> Our paper adds to this literature by considering a larger time horizon, through 30 September 2020, exploiting cross-bank exposure to the pandemic and lockdown measures and gauging the impact on loan performance, lending growth and loan conditionality.<sup>3</sup>

Our paper is also related to a more established literature on the transmission of macroeconomic shocks through credit markets. [Gertler & Gilchrist \(1993\)](#) show a rise in credit following contractionary monetary shocks, and also argue that this increase is biased toward larger firms. Using loan-level data and a structural model [Greenwald et al. \(2020\)](#) do not only look at the COVID-19 shock but also identified monetary policy shock based on the approach of [Romer & Romer \(2004\)](#) and show an increase in overall lending after shocks, due to a credit line draw-downs, while term lending to smaller firms drops. We add to this literature by focusing specifically on the COVID shock but looking both at bank-level lending and loan-level conditionality and exploiting cross-bank variation in exposure to the pandemic.

While our results are for the U.S., they offer important lessons for other advanced countries in terms of the impact of the pandemic and lockdown policies on banking systems. Before proceeding, we would like to stress the tentative nature of our exercise,

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<sup>2</sup>[Duchin & Hackney \(2020\)](#) show that firms with prior lending relationships or personal connections to bank executives are more likely to obtain Paycheck Protection Program loans. [Darmouni & Siani \(2020\)](#) show that corporate bond issuance is used to increase holdings of liquid assets rather than for real investment and that most issuers, including many riskier “high-yield” firms, prefer issuing bonds to borrowing from their bank.

<sup>3</sup>[Hasan, Politsidis & Sharma \(2020\)](#) also focus on the pricing of syndicated loans, but in a cross-country setting and using a text-based approach based on transcripts of quarterly conference calls held by companies. Similar to us, they find an increase in interest spreads for higher firm and lender exposure to the pandemic.

as the pandemic and its economic fall-out are still evolving. And while we relate our analysis to theories on bank behaviour over the business cycle, we cannot rigorously test specific hypotheses and thus refrain from making any causal statements. Finally, while we can differentiate across banks according to their exposure to the pandemic and – separately – to lockdown policies and use county-bank level data to differentiate between supply and demand-side effects in small business lending, we are careful to state that we cannot exclude alternative explanations.

The remainder of the paper is organised as follows. The next section introduces the different data sources and variables we use in our analysis. Section III provides evidence on the relationship between COVID-19 and unemployment across U.S. counties as well as loan performance across banks. Section IV presents bank-level evidence on the effect of COVID-19 on lending and loan conditionality. Section V concludes.

## II. DATA AND VARIABLES

We combine data from a number of data sources to assess the impact of COVID-19 and lockdown policies on the real economy and the banking system in the U.S. Descriptive statistics for all the variables used in county, bank, bank-county, and loan level analyses are in tables A1, A2, A3, and table A4 in the appendix, respectively, while we present the most important variables in Table 1.

### A. COVID-19 and lockdown policies

In our first set of tests we gauge the impact of the pandemic and policy responses on unemployment across 3,142 counties in the U.S. We capture exposure to the pandemic by COVID-19 related deaths per 100,000, based on data from the *New York Times*, except for the 5 counties that are part of New York City, which the *New York Times* sums up into one metropolitan aggregate. For consistency we use *CDC* data for these

counties. Population data come from the [U.S. Census](#). Observations are per county and the number of new deaths in a quarter (we use cumulative deaths in the [Online Appendix](#) as robustness). In county regressions we use the logarithm of 1 + the number of deaths per 100,000 inhabitants. The descriptive statistics in Table 1 show an increase in the average COVID-19 deaths from 0.44 per 100,000 in the first quarter to 17.7 in the second quarter and 24.3 in the third quarter, but with significant variation across counties.

To capture lockdown policies, we use the non-pharmaceutical intervention (NPI) index from [Olivier Lejeune](#). The NPI index is defined on the state level (there is little to no variation within states), ranging from 0 (no or few containment measures in place) to 6 (harsh lockdown where residents are not allowed to come out of their home) and is computed as the arithmetic average of all days in a quarter. The descriptive statistics in Table 1 shows an increase in the average NPI from 0.74 in the first quarter to 3.27 in the second quarter and a decline to 1.76 in the third quarter, but again with significant variation across states and thus counties.

Not surprisingly, there is a high correlation between COVID-deaths and NPI of 0.67 (see Appendix Table A5) and we therefore run regressions where we introduce the two variables separately and regressions where we include them together.

We rely on unemployment data comes from BLS [Local Area Unemployment Statistics](#). While the average over the period of analysis is 5.5%, it ranges from a 10th percentile of 2.7% to a 90th percentile of 9.9%.

Other county level controls are from Jie Ying Wu's [COVID-19 database](#) and from 2019. We include the number of ICU beds, the shares of persons older than 65, of African-American and Hispanics (all weighted by total county population), median income, population density, 2-digit NAICS and government employment shares.

In all analyses in this paper we winsorize all variables at the 1st and 99th percentiles, unless they are dummies, indexes, or in logarithmic terms.

## *B. Bank-level data*

In our second set of regressions, we focus on a sample of 4,882 banks and their loan losses and lending growth. We construct a measure of bank exposure to COVID-19 related death rates and NPIs from bank branch deposit distributions, and thus only use banks with a “significant branch network”. This excludes, for example, de-facto investment banks like Goldman Sachs, or any bank with \$10 billion or more in assets but less than 10 branches, banks with \$5 billion or more and less than 5 branches, \$3 billion or more and less than 3 branches, or \$1 billion or more and only 1 branch. We also restrict the sample to deposit taking banks, with deposits accounting for at least 10% of total assets. Observations are excluded if zero or missing values are reported for total bank assets, equity capital, deposits, or total loans and leases.

For bank level exposure to COVID-19 deaths, we compute the “average exposure” to areas in which the bank is physically present, using 2019 bank branch deposit shares in total bank deposits as weights for each county (based on Federal Deposit Insurance Corporation’s [Summary of Deposits](#) data). We illustrate this idea visually with the examples of Citibank and Zions Bancorp in Q2 2020 in Figure 1. Citi branches (solid red dots) are concentrated in city centers, with a particularly heavy exposure to the New York City metropolitan area – the early epicenter of the U.S. pandemic. Zions (hollow blue circles) is a counter example, operating a relatively dispersed network of locations across the western U.S. with presence in rural areas and cities less affected by COVID in the first half of 2020.<sup>4</sup> Computed on the bases of new Q2 deaths, this exposure amounts to 67 for Citibank and 13 for Zions. Table A6 in the appendix lists the 35 largest U.S. banks in the sample with their respective COVID exposures. Appendix Figure A1 shows the total branch and deposit intensity across the U.S.

Other bank level variables are from the Federal Financial Institutions Examination

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<sup>4</sup>Notable overlaps are only in California and Las Vegas.

Council’s **Call Reports**. We use a number of dependent variables. First, we use growth in loan loss provisions and NPLs, both measured for each quarter to gauge the effect of the crisis and policy responses on banks’ loan losses. Growth in loan loss provisions relative to the corresponding pre-year quarter varies between -200% (10th percentile) and 200% (90th percentile), with a mean of 15.67%, while growth in NPLs varies between -110% and 118%, with a mean of 0.84%.<sup>5</sup> Second, we use the growth in loans and leases to test the effect of the pandemic and policy responses on banks’ lending activities. Over our sample period, loan growth including (excluding) PPP lending varied between -2.67% (-3.41%) at the 10th percentile and 19.32% (17.32%) at the 90th percentile, with a mean of 7.62% (6.49%). We also analyse small business loans, defined as in Call Reports filings and including small C&I and small agricultural loans (with an original amount of 1 million or less) either excluding or including PPP lending.<sup>6</sup> Finally, we consider growth in two additional categories of lending: commercial and industrial loans including loans secured by commercial real estate (all C&I loans are included irrespectively of their size); household loans including loans secured by real estate and not assigned to C&I or agricultural loans.

Bank controls in Tables 3 to 10 are the logarithm of total assets, income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets; C&I, household, agricultural, and real estate loans in percent of total loans and leases (loan portfolio shares). All bank controls are from the respective pre-year quarter. We augment these covariates in tables 5 to 10 with the percentage change of unused credit commitments and deposits.

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<sup>5</sup>All growth variables used in regressions are computed symmetrically, as “*growth in  $x_t = \frac{x_t - x_{t-1}}{0.5 * x_t + 0.5 * x_{t-1}}$ ”.*

<sup>6</sup>Note that the classifications of “small business loans” differ between PPP and Call Reports. While the former uses a borrower size threshold of 500 employees, the latter uses a loan volume threshold of 1 million USD. However, 88% of all PPP loans in our sample are fall into that loan volume classification.

### *C. Bank-county-level data*

To explore how bank exposure affects granting of Paycheck Protection Program (PPP) loans, we access Small Business Administration PPP loan data and match 4.35 million or 87.8% of all PPP loans to banks in Call Reports or in Summary of Deposits.<sup>7</sup> With 93% of PPP loans in our dataset being extended in Q2 2020 (see Figure 6), we focus on the cross-section in this quarter in the analysis. We form bank-county level aggregates using the number of loans.<sup>8</sup> We combine this with Community Reinvestment Act (CRA) small business and small farm loan origination data from 2017-2019, which is also available on the bank-county level.<sup>9</sup>

In this setting we either analyse an extensive or intensive margin on PPP/small business lending during the COVID recession. The extensive margin is captured with a variable that is the difference of two dummies, where the first (second) is 1 if a bank extended small business and farm loans under the PPP in Q2 2020 (reported under the CRA between 2017 and 2019), implying that a 1 means “entry”, a  $-1$  “exit”, and a 0 “no change”. The sample includes all bank-counties in which a bank had either a branch presence, a CRA small business loan between 2017 and 2019, or a PPP loan in Q2 2020. 19% of county-bank observations in our estimation sample indicate an entry, 34% an exit and 46% no change. The intensive margin is defined only for bank-county cells in which a bank extended at least both one CRA and one PPP loan. It is the percentage change in the total number of loans extended under the Community Reinvestment Act between 2017 and 2019 and in Q2 2020 under the PPP. On average, the number of loans increased by 1.24% for banks that were present in the county with small business lending and also provided PPP loans.

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<sup>7</sup>Almost all others are extended by lenders not regulated by the FDIC or the Federal Reserve and are thus not included in Call Reports.

<sup>8</sup>Loan volume information is only available for the smallest loans.

<sup>9</sup>Under the CRA, banks have to report small business loans (loans at less than 1 million) at a granular, community (county) level.

In addition to the bank- and county-level controls described above we further add bank-county variables indicating branch presence (1/0), the deposit based market share of the bank in the county, and the percentage the county amounts to in the bank’s total branch deposits.

#### *D. Loan-level data*

In our final set, we focus on syndicated loan data to gauge the effect of the pandemic and policy reactions on loan conditionality. Loan level data come from the Thompson Reuters LPC’s DealScan database and company level data are from DealScan and Standard & Poor’s Compustat. We use the DealScan-Compustat linking table used in [Chava & Roberts \(2008\)](#) and made available on [Michael Robert’s homepage](#) to match borrowers in both databases. We also use an updated version of the link extension for their table from [Keil \(2018\)](#) to match DealScan borrowers to Compustat firms for years after 2016. To match banks from DealScan to their financial information from Call Reports and Summary of Deposits we created a linking table where we fuzzy-matched via different name similarity scores and filtered using location variables, year, and other information contained in both files (table, algorithm, and additional technical details are available upon request). Following [Bharath, Dahiya, Saunders & Srinivasan \(2011\)](#), [Schwert \(2018, 2020\)](#), and others a “loan” refers to a “facility” in DealScan. Our broadest estimation sample contains 10,941 loans over the period 2017 Q1 to 2020 Q2.<sup>10</sup>

We focus on the number of syndicated loans per quarter and banks, the average loan amount, the logarithm of 1 plus maturity in months and on the interest rate spread over LIBOR in basis points, defined as the all-in-spread, which is the amount paid by borrowers in basis points for each dollar that is actually drawn-down. On average, a bank in our sample participates in 26 syndicated loans per quarter. The average loan volume in our sample is 436 million and the average borrower has total assets of 66

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<sup>10</sup>Unlike for county and bank-regressions, third quarter 2020 data were not available yet.



billion, reflecting that the syndicated loan market is primarily for large corporates. The interest rate spread varies from 113 (10th percentile) to 400 (90th percentile), with a mean of 235 basis points. The maturity varies from 19 (10th percentile) to 70 months (90th percentile), with a mean of 52 months.

Basic bank controls are defined as above. Loan type fixed effects are for term loans, revolving credit lines, and other (or loans classified as both). Detailed loan controls comprise of the respectively left out loan term, the logarithm of loan volume, fixed effects for loan purpose, collateral, and refinanced loans.

### **III. THE ECONOMIC AND FINANCIAL COST OF COVID-19**

The pandemic has had adverse affects on the U.S. economy as well as the banking sytem. In our first empirical analysis, we assess the impact of COVID-19 on local economies across the U.S. We also differentiate between the impact of national trends, geographic variation in COVID outbreaks and non-pharmaceutical interventions (NPI) on local economies. In a second step, we assess the impact of pandemic and lockdown policies on banks' loan portfolio performance, captured by loan loss provisions and non-performing loans.

#### *A. COVID-19, Lock-down Measures and unemployment across U.S. Counties*

As a graphic illustration of the regional variation, Figure 2 charts quarterly county level exposures to new COVID-19 related deaths (per 100,000 inhabitants), state level NPIs, and county level unemployment rates in the first three quarters of 2020 across contiguous U.S. counties. Panels A-C illustrate the spread of COVID-19 and show that COVID deaths were initially concentrated around population centers, especially along coastal areas and the Great Lakes in Q2, before moving increasingly South and Southwest in Q3. Panels D-F show that NPIs have been tougher in the North and

Northeast and were dramatically higher in Q2 than before or after. Panels G-I show that unemployment rates were the highest in Q2 and elevated especially along coastal areas and the Northeast.

Figure 3 confirms the positive correlation between unemployment and COVID-19 death suggested by the geospatial plots, charting the median monthly unemployment rates over the period March 2019 to September 2020 for U.S. counties with zero deaths and for counties with cumulative Q3 2020 COVID-19 related deaths per 100,000 inhabitants above the median (of all counties with more than zero deaths). While there is no clear difference in unemployment rates between these two groups until March 2020, counties hit hard by COVID death rates experience much steeper and more persistent increases in unemployment rates than counties without COVID-19 deaths. Figure A2 in the appendix shows similar adverse effects of NPIs on economic activities, splitting counties into those below and above the median NPIs in the first three quarters of 2020.

As these results may be driven by other factors, such as population density, infrastructure (travel hubs vs. remote and isolated areas), or clustering of economic sectors (sectors with different cyclicity or import dependence) that correlate with COVID-19 deaths and economic losses, we next turn to regression analysis. Specifically, we run the following regression to assess the impact of COVID-19 deaths and NPIs on unemployment across counties and over the period Q1 2019 to Q3 2020:

$$\begin{aligned}
 Unempl. Rate_{c,t} = & \beta_1 Q1\ 2020_t + \beta_2 Q2\ 2020_t + \beta_3 Q3\ 2020_t + \beta_4 COVID\ Deaths_{c,t} \\
 & + \beta_5 NPIs_{c,t} + \gamma \mathbf{X}_c + \eta_t + \delta_c + \epsilon_{c,t}
 \end{aligned} \tag{1}$$

where subscripts  $c$  and  $t$  indicate counties and quarters. In some specifications, we control for pre-crisis population density, employment shares in different sectors, demographic characteristics, income, ICU bed density (in  $\mathbf{X}_c$ ), while in others we absorb

local factors in county fixed effects,  $\delta_c$  (absorbing  $\mathbf{X}_c$ ). We include year-quarter-fixed effects  $\eta_t$ , but focus our attention on the estimates for the Q1, Q2 and Q3 2020 fixed effects (included separately for emphasis in regression (1) and in most regression tables), with Q4 2019 being the omitted period. We include COVID related death rates and an NPI index jointly or separately, as the two variables are highly correlated (Appendix Table A5). Standard errors  $\epsilon_{c,t}$  are clustered on the county level.

Table 2 suggests that it is both COVID-19 outbreaks *and* NPIs that can explain time and regional variation in unemployment rates. Here we present eight different models, four with county-level controls and four with county-fixed effects, including (i) year-quarter dummies only, (ii) adding COVID deaths per 100,000, (iii) adding NPIs, and (iv) including both. The results in columns (1) and (2) show a significant increase in unemployment in 2020 compared to the last quarter of 2019, with unemployment rates increasing by almost one percentage point in Q1, around 7 percentage points in Q2, and over 3 percentage points in Q3, compared to a 5.5% sample mean. Beyond this general trend, however, there is geographic co-variation in unemployment with COVID outbreaks and lockdown measures. The results in columns (3) and (4) confirm the positive relationship between COVID death rates and unemployment rates, while the three 2020 quarter dummies continue to enter positively and significantly, although of smaller size. When we include NPIs in columns (5) and (6), on the other hand, the dummies for Q2 and Q3 of 2020 lose significance and the Q1 dummy turns negative and significant; the NPI index, on the other hand enters positively and significantly, a finding confirmed in columns (7) and (8) where we include both COVID-19 deaths and NPIs. This suggests that unemployment across the U.S. over the course of 2020 was less driven by national trends, but by exposure to the pandemic and especially to lockdown policies. Even though COVID-19 deaths and NPIs are highly correlated, they enter with similar coefficient sizes and significance across the different specifications, suggesting that they drive increases in unemployment independently.

The findings are not only statistically but also economically significant. The coefficient estimates for COVID deaths in column (8) implies that doubling COVID deaths within a county is associated with increase in the unemployment rate of around 0.3 percentage points. Coefficient estimates imply that an increase in the NPI index by one step (out of six) is associated with an increase in the unemployment rate of more than 2 percentage points within a state.

In the [Online Appendix](#) we show that our findings are robust to the the use of cumulative versions of our exposure variables, and to the exclusion of all controls and the use of state and quarter (1-4) fixed effects (instead of county and year-quarter). Our exposure measures to COVID used in the main analysis also explain declines in county level work place visits and retail and recreation activity. We also find that infections and the maximum quarterly NPI have less explanatory power, while the median NPI generates similar and significant results.

### *B. COVID-19, Loan Loss Provisions and NPLs*

Having shown that both COVID outbreaks and lockdowns can explain geographic variation in unemployment (and thus economic activity) across the U.S., we now turn to the implications of the crisis for the banking sector, gauging the impact on loan losses and NPLs. The tremendous economic shock illustrated in the analysis in the previous section suggests that banks may generally start to experience problems in their loan portfolio. On the other hand, fiscal, monetary and regulatory support measures might either reduce the impact of these problems on banks' balance sheet or might delay their recognition by banks. We exploit regional variation in COVID-19 to construct a measure of the exposure of each bank to COVID outbreaks based on branch locations, as described in section [II](#).

As in the previous section, we first provide a graphic illustration of the impact of COVID-19 on loan losses. Specifically, we plot loss provisions and non-performing

loans (NPLs) indexed to 100 in Q4 2019 in panels A and B in Figure 4. The sample is split into banks below and above the median bank exposure to cumulative September 30th COVID deaths per 100,000. There is a steep increase in loss provisions for all banks, but more so for banks with above median COVID exposure – growing by 80% in Q2 2020 relative to Q4 2019 for highly exposed banks and 50% for less exposed. Similarly, Panel B shows that NPLs increase considerably more for highly exposed banks (9%), while elevating only modestly for banks with below average exposure (less than 5%). Notably, low exposure banks see NPLs decline in Q3 2020, while high exposure banks maintain elevated NPLs. From a difference-in-differences perspective, both graphs suggest parallel trends before the start of the COVID shock.<sup>11</sup> When comparing the development of NPLs during 2020 to the development after Q4 2006 during the Global Financial Crisis, we note that the current increase is relatively muted, while we observe an almost four-time increase in 2007/8 (a considerably longer time period than ours). This difference might be related to both easing of loan classification standards during the current crisis and the expectation that the current crisis is short-lived.

To test the effect of COVID-19 exposure on banks' growth in loan loss provisions and NPLs more formally, we run the following bank-quarter panel regression:

$$Y_{b,t} = \beta_1 Q1\ 2020_t + \beta_2 Q2\ 2020_t + \beta_3 Q3\ 2020_t + \beta_4 COVID\ Deaths_{b,t} + \beta_5 NPLs_{b,t} + \gamma \mathbf{X}_{b,t} + \eta_t + \delta_b + \epsilon_{b,t}. \quad (2)$$

where subscripts  $b$  and  $t$  indicate banks and quarters, respectively. We allow for clustering of error terms  $\epsilon_{b,t}$  on the bank level. All regressions absorb time-invariant bank and general year-quarter-specific effects,  $\eta_t$  and  $\delta_b$ , respectively. Fixed effects for the first, second and third quarters of 2020 measure the general effect of the pandemic

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<sup>11</sup>Appendix Figure A3 shows parallel trends also for some of the bank-level variables, notably liquidity, equity, unused commitments and deposits. While equity is higher for above-COVID-19 median exposure banks throughout 2019 and 2020, this gap closes in 2020. There is a somewhat higher increase in unused commitments for low-exposure banks in 2020.

and lockdown measures on all banks (the omitted fixed effect is again for Q4 2019). Time-variant bank controls  $X_{b,t}$  include current percentage changes in deposits and unused credit line commitments and lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets.

The results in columns 2-4 of Table 3 show, in line with the visual findings from Figure 4, that exposure to COVID-19 and to NPIs can explain bank variation in loan loss provisions and NPLs over time. Fixed effects for the first three quarters of 2020 are highly significant with growth in loan loss provisions as the dependent variable in column (1), while the Q2 and Q3 dummies become insignificant once we control for banks' exposure to NPIs in columns (3) to (4). Bank exposure to both COVID outbreaks and NPIs enter positively and significantly, though the coefficient size drops slightly once we also include both exposure variables simultaneously.

The results are not only statistically but also economically significant. The Q2 2020 fixed effect in column (1) suggests a 69% increase in loan loss provisions. Bank exposure to COVID deaths has a considerable additional differential effect on loss provisions (column 2 and 4). The coefficient in column (4) suggests the growth rate of loan loss provisions increases by 5 percentage points when bank exposure to COVID deaths doubles. This is sizeable given the 15.7% sample average. Increasing the NPI index by one notch implies a 20 percentage point increase in the growth rate of loan loss provisions.

The results in column 5 of Table 3 show that there is a significant general increase in NPLs during the first two quarters of 2020. However, significance is lower than in loss provisions regressions and the Q3 2020 quarterly dummy has a negative coefficient sign. Both exposure to COVID-19 deaths and exposure to NPIs enter positively and significantly in columns (6) to (8), (while all 2020 quarter fixed effects turn negative). Using the coefficient in column (8) as a reference, the percentage change in NPLs is 1.6

percentage points higher when the exposure to COVID deaths doubles. An increase in the NPI by one notch implies an increase of around 9 percentage points.

In Table 4 we show that positive effects on NPLs are driven similarly by household loans and by C&I loans.<sup>12</sup> Specifically, we find that exposure to COVID-19 deaths explains an increase in NPLs both in C&I and household lending, as long as we do not control for NPIs, while exposure to NPIs always explains the increase in both lending categories. In the auxiliary regressions in the [Online Appendix](#), we find that results hold when we use bank exposure to cumulative instead of new quarterly COVID deaths and NPIs, compute growth rates from pre-quarter instead of pre-year quarter values, or exclude controls and use lower fixed effects dimensionality. In Figure A3 in the appendix we show that the differential geographical exposure to COVID has primarily effects on the health of bank loan portfolios, while there are only moderate or no differential effects on bank liquidity, capitalization, unused credit commitments outstanding, and deposits. In the [Online Appendix](#) we show that there are no significant negative effects of exposures to COVID deaths and NPIs on deposits and bank liquidity – increasing our confidence that there is a channel working through loan portfolio quality.

#### IV. COVID-19, LENDING, AND THE ROLE OF GOVERNMENT SUPPORT

While so far we have focused on the economic and financial costs of COVID-19 and the lock-down measures, we now turn to the banking system’s role in supporting corporations and households during the pandemic. We will first focus on banks’ lending growth, in- and exclusive of the Paycheck Protection Program (PPP) and across different categories, before focusing on a country-bank panel to disentangle supply and demand-side effects. Finally, we focus on changes in loan conditionality for syndicated

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<sup>12</sup>The reduced observation count takes a toll on estimation power. We do not observe a breakdown for small business NPLs separately.

loans.

### *A. COVID-19 and Lending Growth*

In this subsection we explore if exposure to the pandemic and lockdown measures are associated with any early effects on lending volumes on the bank level. In addition to total loans and leases, we also gauge the impact of the pandemic on small business loans and differentiate each of these aggregates into one with and one without loans under the PPP. As in previous analyses, we first undertake graphic illustration before proceeding to regression analysis, differentiating between banks above and below the average exposure to COVID-19 outbreaks (Figure 5, volumes are indexed to 100 in Q4, 2019). While there are steep increases for total loans and leases including PPP lending in Q2 2020, there is little difference between the two groups of banks (Panel A). Excluding PPP lending (Panel B) causes the generally upward sloping trend in lending to flatten, suggesting that the increase is entirely driven by PPP lending. The general increase in small business loans including PPP (Panel C) is on average considerably larger than the increase in total loans and leases and somewhat larger for banks more exposed to COVID related deaths. However, excluding PPP lending in Panel D reveals that non-PPP small business lending falls off a cliff – and even more so for more exposed lenders. Using the same regression set-up as for loan loss provisions and NPLs, we next explore the relationship between the pandemic and lending volumes more formally.

In Table 5 we run similar regressions as in Table 3, but using percentage changes in total loan volumes (Panel A) and small business loan volume (Panel B), either including (Columns 1-4) or excluding (Columns 5-8) PPP lending. There is a moderately sized (0.3 percentage points) and slightly significant general increase in the growth rate of total lending in Q2 2020 (Column 1, Panel A). All 2020 quarter fixed effects become highly significant and negative with a magnitude of 6-7 percentage points once PPP



lending is excluded (Column 5, Panel A). This is sizable, given the 6.5% sample mean. Regressions show that bank exposure to COVID-19 deaths and to lockdown policies has had only significant positive effects on growth in total loans and leases when PPP lending is included, while there is no significant effects once PPP lending is excluded.

Regressions in Columns 1 and 5 in panel B of Table 5 show that total small business lending volume growth increased significantly in Q2 and Q3 by 12 and 15 percentage points, respectively, when PPP lending is included, while they decreased significantly by 20 and 29 percentage points when we exclude PPP loans. Given the sample means of 7.6 excluding and 1.6 including PPP lending, these are dramatic economic magnitudes. We also confirm in Columns 2-4 and 6-8 the graphical analysis that these changes are driven by differential bank exposures to both COVID-19 deaths per 100,000 and to lockdown measures. In terms of economic significance, we find that a doubling in exposure to COVID-19 deaths is associated with a 2.5 (1.9) percentage point higher (lower) percentage change in small business loans including (excluding) PPP. An increase of the NPI index by one notch implies an increase of 4 percentage points in the growth of total small business lending including PPP loans and a 2.7 percentage point decrease when PPP loans are excluded.

Findings for lending excluding PPP are consistent with an increase in loan demand during the COVID-19 pandemic, which outweighed any possibly negative effect of the crisis on loan supply, and is consistent with Acharya & Steffen (2020), Chodorow-Reich et al. (2020) and Li et al. (2020). The substantially larger effects for small business than overall loans (including PPP) is an indication that loan supply to this specific group was supported by policy measures (in line with findings by Chodorow-Reich et al. (2020)), while smaller firms also rely more on banks than larger firms that have access to public capital markets.

Findings on lending excluding PPP loans, however, are also consistent with a negative supply impact and banks cutting back regular lending. Taking both results on

lending volumes, including and excluding PPP lending, together further supports hypotheses of either a crowding-out effect of regular small business by PPP lending or a successful attempt to step in and make up for the shortfall in supply. Even a supply-side interpretation is possible, where banks harder hit in their loan portfolio may tend to switch towards PPP lending. In this line of thought PPP became essentially a de-facto guarantee and subsidy for banks with deteriorating health.

In Table 6 we show that the effect on total loans and leases including PPP loans is more driven by C&I than by household loans. However, bank exposures to NPIs are insignificant. The results in Column 1 show that there was a positive and significant increase in C&I loan growth in the second and third quarter of 2020 (compared to the last quarter of 2019), while only the bank-level exposure to COVID related deaths enter significantly, but not to lockdown policies. The results in columns (5) to (8) show a decline in lending growth to households, but no significant variation in this decline with banks' exposure to COVID-19 deaths or NPIs.

In our usual set of robustness regressions in the [Online Appendix](#), we confirm that results hold when we use cumulative bank exposures, quarter-over-quarter growth rates, or exclude controls and use lower fixed effects dimensionality. We also show that adding unused commitments to total loans and leases does not alter reported results, while there are little effects on unused commitments alone.

### *B. COVID-19 and Small Business Lending - Supply vs. Demand*

Our results from section [IV.A](#) are consistent with both demand and supply side stories explaining bank lending throughout the pandemic. The advantage is to differentiate not only between lending volumes with and without PPP lending, but also between total, small business, C&I, and household lending. The downside is that bank-quarter aggregates do not allow us to separate demand from supply side effects. In this section we therefore focus only on PPP lending and try to disentangle demand and supply by

analysing PPP lending in the cross-section of Q2 2020, when 93% of all PPP lending in our data took place (see Figure 6). Forming a cross-section of bank-county aggregates and defining these as “borrowers” equivalently to Berg, Saunders, Schäfer & Steffen (2019) and others we can apply county fixed effects that absorb all demand side effects similarly to Khwaja & Mian (2008). This allows us to understand if supply side factors can explain our previous findings. In particular, we estimate the following regression:

$$Y_{b,c} = \beta_1 \text{COVID Deaths Bank}_{b,c} + \beta_2 \text{NPIs Bank}_{b,c} + \gamma \mathbf{X}_b + \theta \mathbf{Y}_c + \eta \mathbf{Z}_{b,c} + \delta_c + \epsilon_{b,c}, \quad (3)$$

where subscripts  $b$  and  $c$  indicate banks and counties, respectively. We allow for bank level clustering of errors  $\epsilon_{b,c}$ .

To measure the extensive margin of PPP lending, the dependent variable is the difference of two dummy variables where the first (second) is one if a bank extended under the PPP in Q2 2020 (small business loans reported under the CRA between 2017 and 2019). Values of minus one thus suggest that a bank undertook small business lending in 2017 to 2019 in this county, but has not lent any resources under the PPP;<sup>13</sup> one suggests new entry of a bank into a county with loans under PPP not having lent to small businesses in 2017 to 19, while zero can suggest two different developments: either no small business lending by this bank at all in the county or a bank lending to small businesses in 2017 to 2019 and then taking up PPP loans in 2020. The intensive margin is measured as the percentage change in the total number of loans extended and included in the CRA database between 2017 and 2019 to the PPP in Q2 2020. In addition to bank controls used above, we also add bank-county controls: branch presence (1/0), market share based on deposits, and the share the county amounts to in the bank’s total branch deposits. Note that county COVID deaths and NPIs are absorbed by county fixed effects in this regression. We explain bank participation in

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<sup>13</sup>Given the time lag in reporting, we do not have cross-county-bank data on CRA lending for 2020.

PPP lending from differential *bank exposure* to COVID outbreaks and NPIs within the same county, assuming similar demand for bank loans in a given county and thus isolating supply-side effects. In some regressions we exclude county fixed effects (and use county controls described above), allowing us to estimate coefficients for county COVID deaths and NPIs.

The results in Table 7 suggest that it is bank rather than real economy exposure to the pandemic and lockdown measures that explains variation in take-up of PPP loans. The weaker association of borrower exposure with PPP lending is consistent with findings from [Granja, Makridis, Yannelis & Zwick \(2020\)](#) suggesting a misallocation, while the finding of a positive association of bank exposure with PPP is novel. Analysing the extensive margin in Panel A, bank exposure to NPIs enters positively and significantly in all regressions while bank exposure to COVID deaths enters positively and significantly when NPIs are excluded and positive throughout all regressions. Analysing the intensive margin in Panel B, the picture is the exact opposite. Bank exposure to COVID deaths is highly significant in all regressions, while bank exposure to NPIs is always positive, but significant only when bank exposure to COVID deaths is excluded. In contrast, county exposure to COVID deaths is significantly negative in one specification. The coefficient sign for county NPIs switches in both panels and is only once significant and positive.<sup>14</sup>

These results are in line with the previous bank level results that banks with direct exposure to COVID related deaths or NPIs are relying more heavily on PPP loans and reduce their regular small business lending; it is also consistent, however, with small businesses requesting substitution of regular loans with PPP loans. While we do not observe non-PPP loans on the bank-county level, findings from this and the preceding section taken together are consistent with the explanation of a crowding out and

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<sup>14</sup>In unreported robustness tests (available on request), we find that our results are robust to the use of cumulative exposure variables. Dropping bank exposure variables we find positive and significant coefficient on county-exposure measures, as reported in the [Online Appendix](#).

de-facto subsidy effect for banks with deteriorating loan portfolios caused by high geographical exposure to COVID. The results are not consistent, however, with higher demand for PPP loans in areas harder hit by COVID-19 and the lockdown measures.

We again show in the [Online Appendix](#) robustness of our results to cumulative bank exposures, exclusion of controls and the use of lower fixed effects dimensionality.

### *C. COVID-19 and Loan Conditionality*

We have shown that banks are adversely affected through their geographical exposure to the pandemic. While providing increasing total loan volumes, especially to small businesses with loan volumes up to 1 million, this effect was entirely driven by government sponsored PPP lending. We now explore if there are effects on the number of loans, average loan amount, interest spreads and maturities in the market for medium and large syndicated loans in the U.S. Two downsides of analyzing the syndicated loan market is that we have a small number of banks and that these are very large and geographically more diversified, working against robustness and the likelihood of finding significant results. The advantages, however, are that larger borrowers in the syndicated loan market and that this market itself are less aggressively targeted by government interventions to counter adverse economic effects of COVID and NPIs. Locations of borrowers in this market are also less likely to correlate with the geographical footprint of lending activities of banks.

We first plot the total number of syndicated loans extended by U.S. banks by quarter in [Figure 7](#), hinting at a small but noticeable decline in the first quarter of 2020. To understand how exactly COVID impacted banks in their activity on the syndicated loan market, we form bank-quarter aggregates of the total number of syndicated loans led by a bank in a quarter, compute the average volume of loans in which a bank led

or participated, and explain these as dependent variables in regression

$$Y_{b,t} = \beta_1 Q1\ 2020_t + \beta_2 Q2\ 2020_t + \beta_3 COVID\ Deaths_{b,t} + \beta_4 NPIs_{b,t} + \gamma X_{b,t} + \eta_t + \delta_b + \epsilon_{b,t}, \quad (4)$$

where the subscripts  $b$  and  $t$  refer to banks and quarters, respectively. Bank controls  $X_{b,t}$  are defined as above and standard errors  $\epsilon_{b,t}$  are clustered by bank.

Results in Table 8 show that the syndicated loan market was indeed adversely affected in the second quarter (first quarter coefficients are also negative, but insignificant). The coefficient in Column (1) implies a general 22% reduction of loans issued, while the one in Column (2) suggests a 29% decrease in average volumes. In 3 out of 4 regressions, bank exposure to COVID deaths and to NPIs enter significantly and negatively. Column (4) implies that a doubling in the death rate exposure decreases bank loan extensions by 15%, while Column (8) suggests that a doubled exposure to NPIs reduces average volumes by 20%. In the [Online Appendix](#), we find that results are similar when we use cumulative exposure to COVID measures, reduce fixed effects dimensionality, and exclude controls. When running regression on the bank-borrower-quarter level with borrower  $\times$  year-quarter fixed effects, in an analysis in the spirit of [Khwaja & Mian \(2008\)](#), we find that the general negative effects are also present or even slightly stronger, while significance of differential exposure coefficients drops.

We next turn to the effects on interest rate spreads and maturities. Figure 8 provides a graphical illustration. Floating interest quoted as spreads over LIBOR plotted in panel A increase for all loans, but considerably more so for loans issued by banks that are more exposed to areas severely hit by the pandemic. Similarly, maturities on newly granted loans in Panel B drop across the board, but seem to experience a slightly steeper decline for loans issued by banks more present where COVID outbreaks are more severe.

To explore the effect of the pandemic on loan conditionality (interest spreads in percentage points and of maturities in months), we adjust the regression model used in the previous section as follows:

$$Y_{l,i,b,t} = \beta_1 Q1\ 2020_t + \beta_2 Q2\ 2020_t + \beta_3 COVID\ Deaths_{b,t} + \beta_4 NPIs_{b,t} + \gamma X_{b,t} + \tau Z_l + \eta_{f,t} + \delta_b + \epsilon_l, \quad (5)$$

where the subscripts  $l, i, b, f$  and  $t$  refer to loan facilities, industries, banks, borrowers and quarters, respectively. Compared to the previous bank level analysis, this estimation includes not only bank controls, but also loan controls  $Z_l$  and higher dimensionality fixed effects, including bank-fixed effects, loan type fixed effects, and either industry  $\times$  state and industry  $\times$  year-quarter fixed effects (similar to [Berg et al., 2019](#)) or borrower  $\times$  year-quarter fixed effects. Standard errors  $\epsilon_l$  are clustered at the bank level to control for any unobservable bank-specific pricing differences.

The results in columns (1) and (2) of Table 9 show that, in line with the graphical evidence, interest spreads experienced a significant uptick in the second quarter of 2020. Using the coefficient in column 2 as reference they increased by about 65 basis points in Q2 2020 relative to Q4 2019, corresponding to 27% of the sample mean (235 basis points). Columns (3) and (7), however, suggest that this increase is driven by bank exposure to COVID-19 deaths, which enters positively and significantly. However, while being always positive, the coefficient is not significant in all specifications. The magnitude of the coefficient in column (7) implies that the interest spread on a new loan increases by 30 basis points for a doubled exposure to COVID-19 deaths. While this result is similar to findings by [Hasan et al. \(2020\)](#), the economic effect seems significantly larger, though we work with very different samples (U.S. vs. cross-country). The results in columns (5) to (8), on the other hand, show that bank-level exposure to NPIs has no significant measurable effect on interest spreads in all but one specification.

The coefficient sign is not always positive either.

The results in Table 10 show similar though weaker results for maturities. The coefficient of the Q2 2020 fixed effect enters negatively and highly significant in columns (1) and (2), with the coefficient sizes suggesting 27 months shorter loans in Q2. Bank exposures to COVID outbreaks and NPIs are insignificant with the exception of a significant negative coefficient of NPIs in Column (8).

In summary, the loan-level results suggest that there was a tightening of loan conditionality due to COVID-exposures of banks, both in terms of interest spreads and loan maturity. For interest spreads, variation across banks in this tightening is weakly related to their exposure to the pandemic.

For loan level regressions, our usual robustness checks using cumulative bank exposures, excluding controls and using a lower fixed effects dimensionality confirm our findings and are available in the [Online Appendix](#).

## V. CONCLUSION

This paper has documented the impact of the COVID-19 pandemic and lockdown measures on the performance and behavior of the U.S. banking system. We find that counties and states more exposed to COVID-19 deaths and (independently) lockdown measures experience higher increases in unemployment. Both the pandemic and the public-health response also explain variation in loan performance across banks. While overall lending growth increases with bank exposure in COVID-19 deaths, we find especially strong growth in small business lending, which varies with banks' exposure to the pandemic and lockdown policies. However, we also find that this increase in small business lending is primarily driven by government support, which replaced "regular" lending. We observe a similar trend in syndicated lending, with few and smaller loans being granted by banks more exposed to the pandemic. Finally, we find that banks



more exposed to the pandemic increase interest spreads and reduce the maturity more for syndicated loans.

Our findings are consistent with previous papers showing an increase in corporate and small business lending and with work that shows an increase in interest spreads. More generally, our findings are consistent with [Gertler & Gilchrist \(1993\)](#) and [Greenwald et al. \(2020\)](#) of a positive effect of macroeconomic shocks on lending, but also consistent with evidence of an increased risk premium following such a shock. Compared to previous work, however, we show an important role of bank-level factors in driving the increase in small business loans, especially with government support, rather than a demand-driven take-up in such loans. We also look beyond liquidity and solvency factors in explaining bank reaction to pandemic and lockdown to the exposure of banks to pandemic and lockdown.

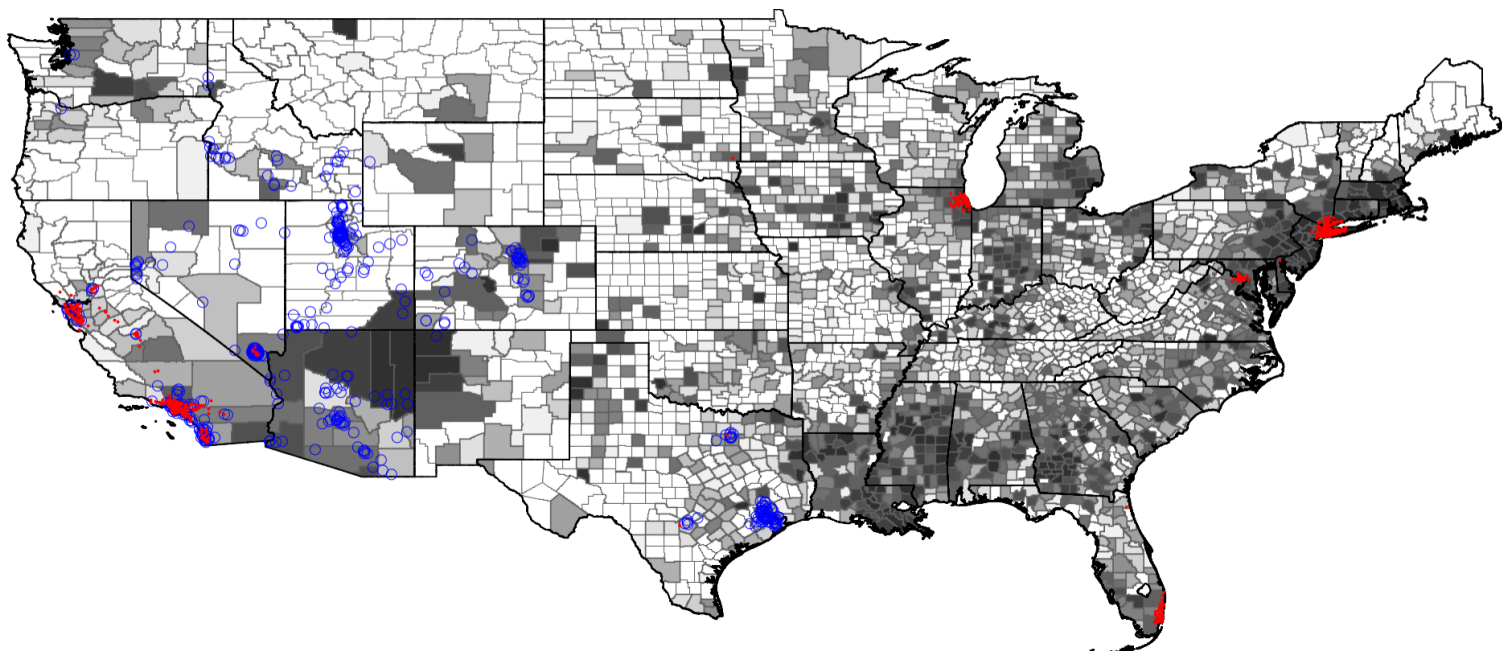
## REFERENCES

- Acharya, V. V. & Steffen, S. (2020). The Risk of Being a Fallen Angel and the Corporate Dash for Cash in the Midst of COVID. *The Review of Corporate Finance Studies*.
- Berg, T., Saunders, A., Schäfer, L., & Steffen, S. (2019). 'Brexit' and the contraction of syndicated lending. *Available at SSRN*.
- Bharath, S. T., Dahiya, S., Saunders, A., & Srinivasan, A. (2011). Lending relationships and loan contract terms. *Review of Financial Studies*, 24(4), 1141–1203.
- Chava, S. & Roberts, M. R. (2008). How does financing impact investment? The role of debt covenants. *The Journal of Finance*, 63(5), 2085–2121.
- Chodorow-Reich, G., Darmouni, O., Luck, S., & Plosser, M. C. (2020). Bank liquidity provision across the firm size distribution. *National Bureau of Economic Research Working Paper 27945*.

- Cornett, M. M., McNutt, J. J., Strahan, P. E., & Tehranian, H. (2011). Liquidity risk management and credit supply in the financial crisis. *Journal of Financial Economics*, 101(2), 297–312.
- Darmouni, O. & Siani, K. (2020). Crowding out bank loans: Liquidity-driven bond issuance. *CEPR Covid Economics*, 51(7), 74–133.
- Duchin, R. & Hackney, J. (2020). Electoral politics and the allocation of government capital. *Available at SSRN 3708462*.
- Gertler, M. & Bernanke, B. (1989). Agency costs, net worth and business fluctuations. In *Business Cycle Theory*. Edward Elgar Publishing Ltd.
- Gertler, M. & Gilchrist, S. (1993). The cyclical behavior of short-term business lending: Implications for financial propagation mechanisms. *European Economic Review*, 37(2), 623 – 631.
- Granja, J., Makridis, C., Yannelis, C., & Zwick, E. (2020). Did the Paycheck Protection Program hit the target? Technical report, National Bureau of Economic Research.
- Greenwald, D. L., Krainer, J., & Paul, P. (2020). The credit line channel. Federal Reserve Bank of San Francisco.
- Halling, M., Yu, J., & Zechner, J. (2020). How Did COVID-19 Affect Firms' Access to Public Capital Markets?\*. *The Review of Corporate Finance Studies*, 9(3), 501–533.
- Hasan, I., Politsidis, P., & Sharma, Z. (2020). Bank lending during the COVID-19 pandemic. *MPRA Paper No. 103565*.
- Ivashina, V. & Scharfstein, D. (2010). Bank lending during the financial crisis of 2008. *Journal of Financial Economics*, 97(3), 319–338.

- Kahle, K. M. & Stulz, R. M. (2013). Access to capital, investment, and the financial crisis. *Journal of Financial Economics*, 110(2), 280–299.
- Keil, J. (2018). The value of lending relationships when creditors are in control? *Working Paper*, available [online](#).
- Khwaja, A. I. & Mian, A. (2008). Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market. *American Economic Review*, 98(4), 1413–42.
- Li, L., Strahan, P. E., & Zhang, S. (2020). Banks as lenders of first resort: Evidence from the COVID-19 crisis. *The Review of Corporate Finance Studies*, 9(3), 472–500.
- Romer, C. D. & Romer, D. H. (2004). A new measure of monetary shocks: Derivation and implications. *American Economic Review*, 94(4), 1055–1084.
- Santos, J. A. C. (2010). Bank Corporate Loan Pricing Following the Subprime Crisis. *The Review of Financial Studies*, 24(6), 1916–1943.
- Schwert, M. (2018). Bank capital and lending relationships. *The Journal of Finance*, 73(2), 787–830.
- Schwert, M. (2020). Does borrowing from banks cost more than borrowing from the market? *The Journal of Finance*, 75(2), 905–947.

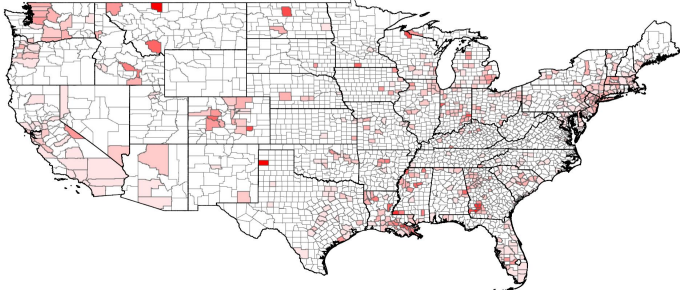
**FIGURE 1: EXAMPLES FOR DIFFERENTIAL EXPOSURES – CITIBANK AND ZIONS BANKCORP**



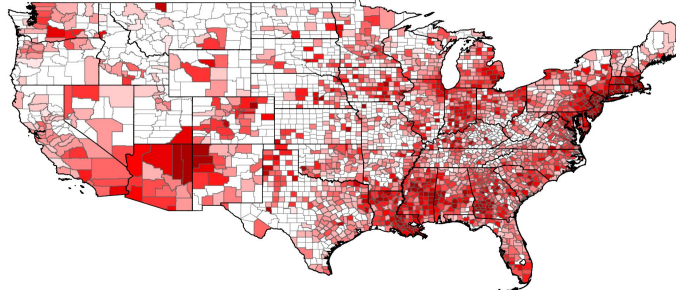
Red dots (blue circles) represent June 2019 Citibank (Zions Bancorp) branches. Citibank (Zions) is an example for a commercial bank with a relatively high (low) geographical exposure to COVID deaths, especially in the first half of 2020. Coloring of contiguous U.S. counties follows a heat map scheme, corresponding to the number of new Q2 2020 COVID-19 related deaths per 100,000 inhabitants. The darker the gray, the higher the death rate.

FIGURE 2: GEOGRAPHIC VARIATION IN EXPOSURE TO COVID-19, NPIS AND UNEMPLOYMENT

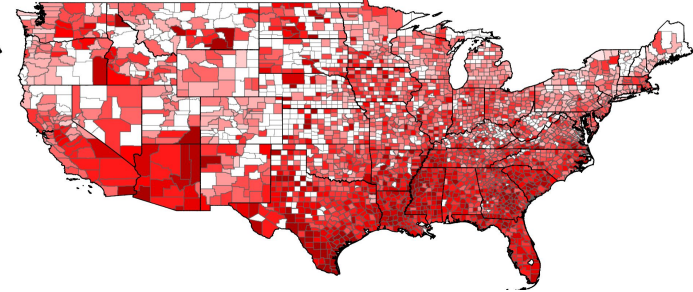
(A) Q1 Covid Deaths/100,000



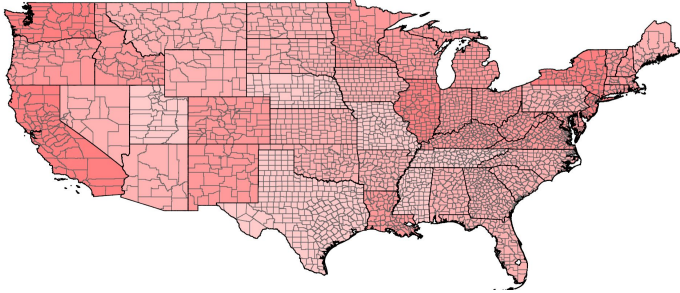
(B) Q2 Covid Deaths/100,000



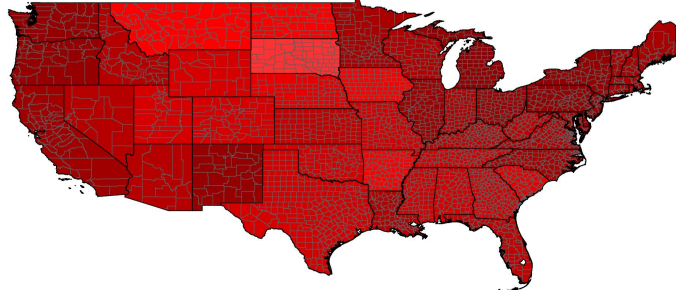
(C) Q3 Covid Deaths/100,000



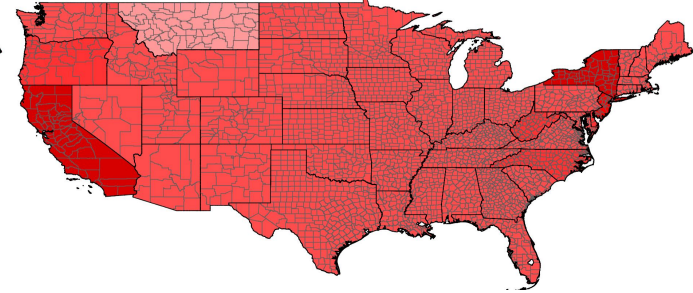
(D) Q1 NPI Index



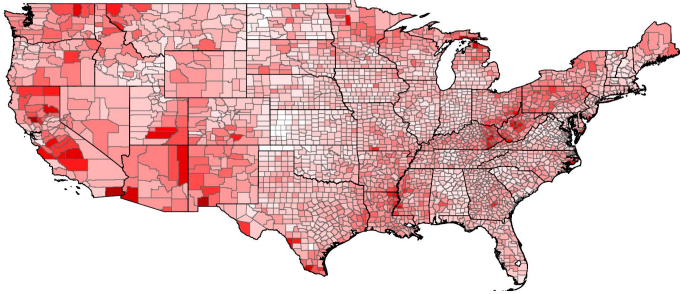
(E) Q2 NPI Index



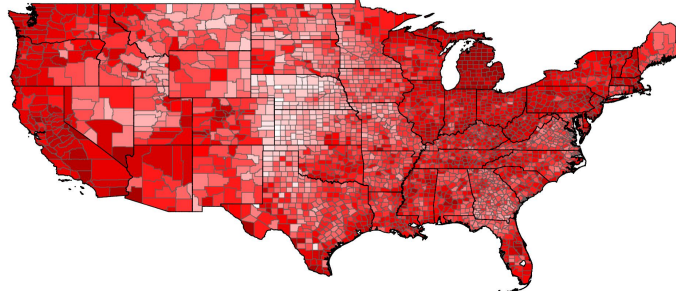
(F) Q3 NPI Index



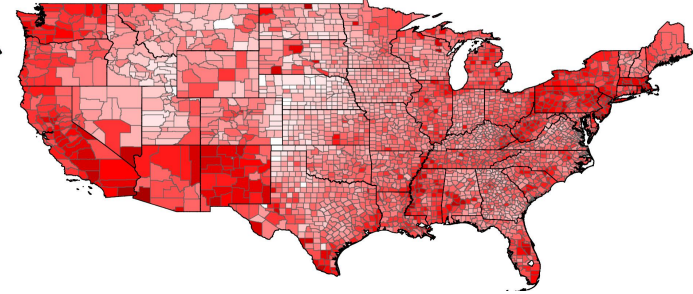
(G) Q1 Unemployment Increase



(H) Q2 Unemployment Increase



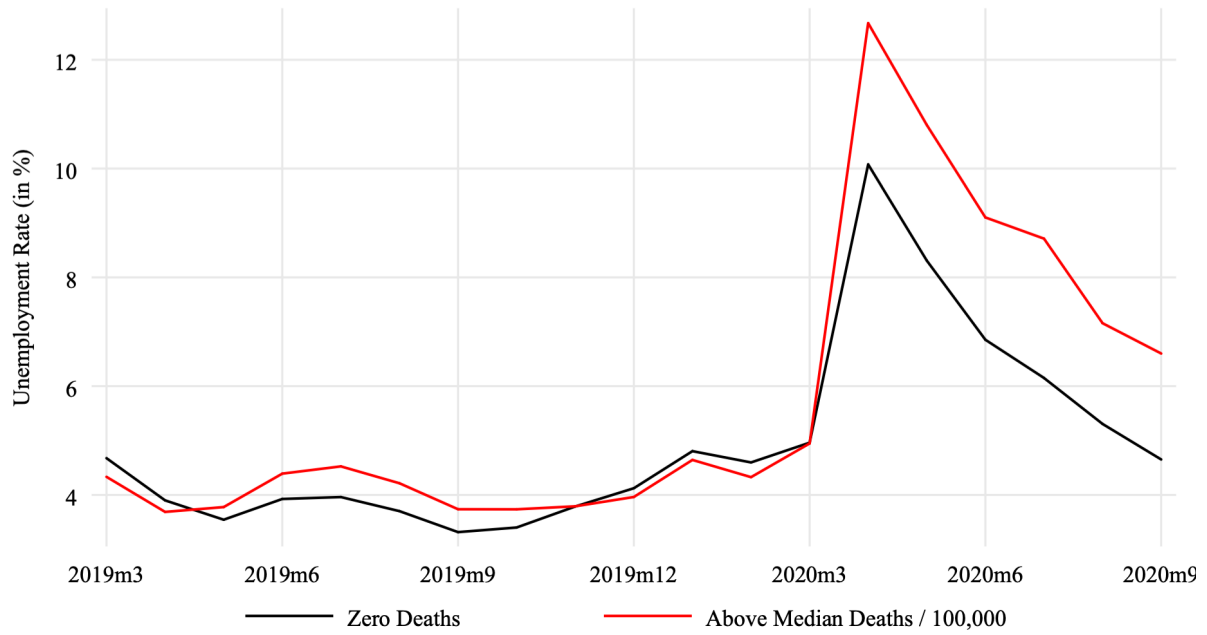
(I) Q3 Unemployment Increase



Coloring of contiguous U.S. counties follows a heat map scheme with identical thresholds across all panels. The darker the red in panels A-C, the higher the number of new quarterly COVID-19 related deaths per 100,000 inhabitants in a county. The darker the red in panels D-F, the more restrictive the average quarterly NPIS as measured by a state level index from [Olivier Lejeune](#). The darker the red in panels G-I, the larger the increase in county unemployment rates.

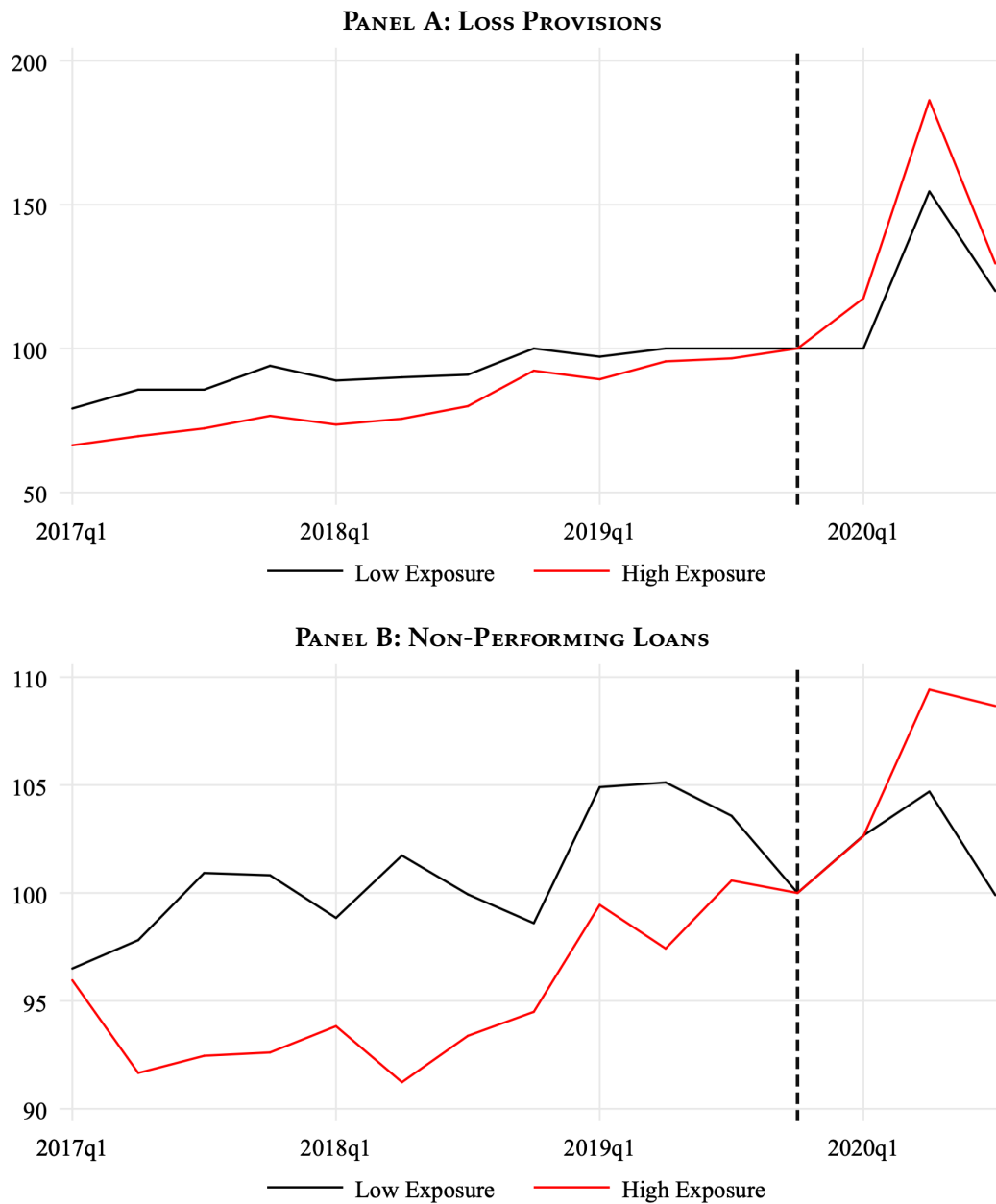


**FIGURE 3: UNEMPLOYMENT IN COUNTIES WITH DIFFERENT EXPOSURES TO COVID DEATHS**



This figure displays median monthly unemployment rates for U.S. counties, dividing them into groups with zero deaths and cumulative Q3 2020 COVID-19 related deaths / 100,000 inhabitants above the median of counties with more than 0 deaths.

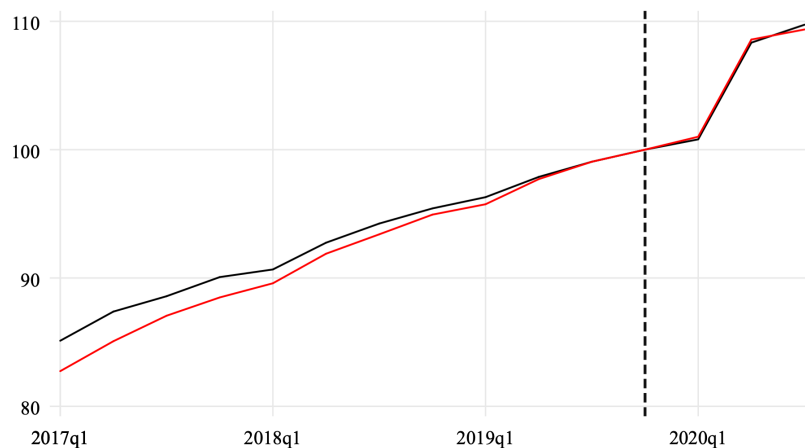
**FIGURE 4: HEALTH OF BANK WITH DIFFERENTIAL EXPOSURES TO COVID**



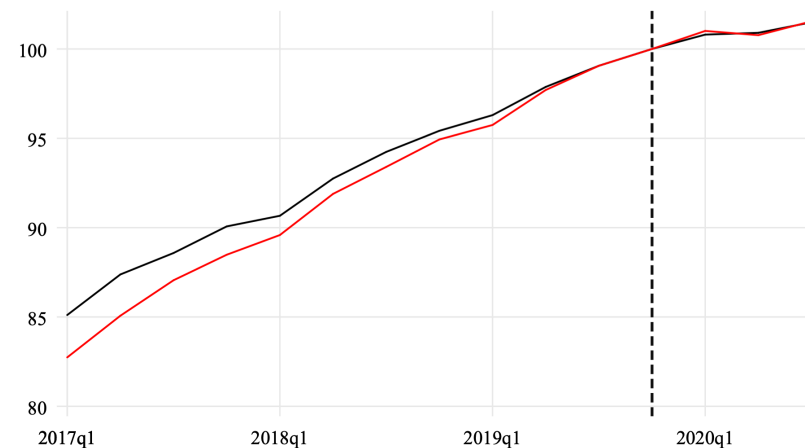
This figure shows U.S. banks' median quarterly loan loss provisions in panel A and non-performing loans in panel B (all indexed to 100 in Q4 2019). The figure differentiates according to banks' geographical exposure to COVID. The latter is the deposit weighted number of cumulative COVID-19 related deaths / 100,000 inhabitants during the three quarters of 2020. The black (red) line represents the group of banks below (above) the median exposure. The vertical black dashed line indicates the pre-COVID quarter Q4 2019.

**FIGURE 5: LENDING VOLUMES BY BANKS WITH DIFFERENTIAL GEOGRAPHICAL EXPOSURES TO COVID**

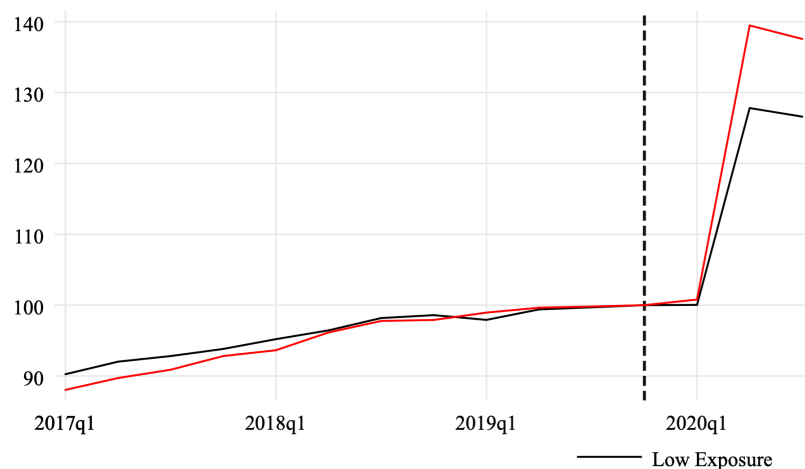
**(A) Total Loans & Leases (Including PPP)**



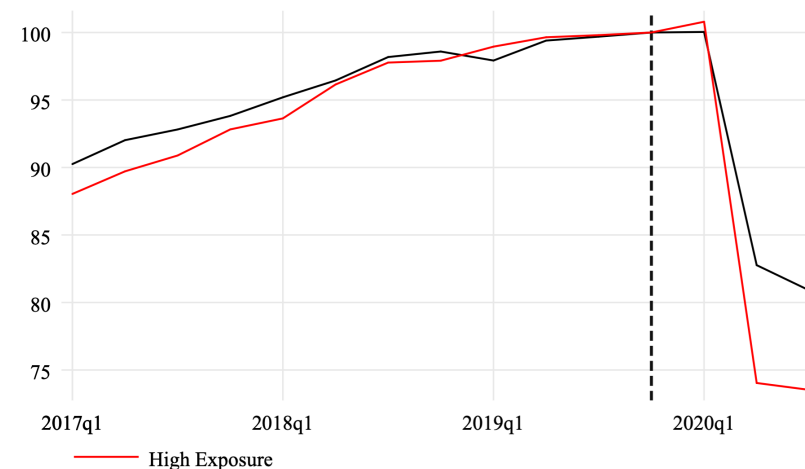
**(B) Total Loans & Leases (Excluding PPP)**



**(C) Small Business Loans (Including PPP)**



**(D) Small Business Loans (Excluding PPP)**

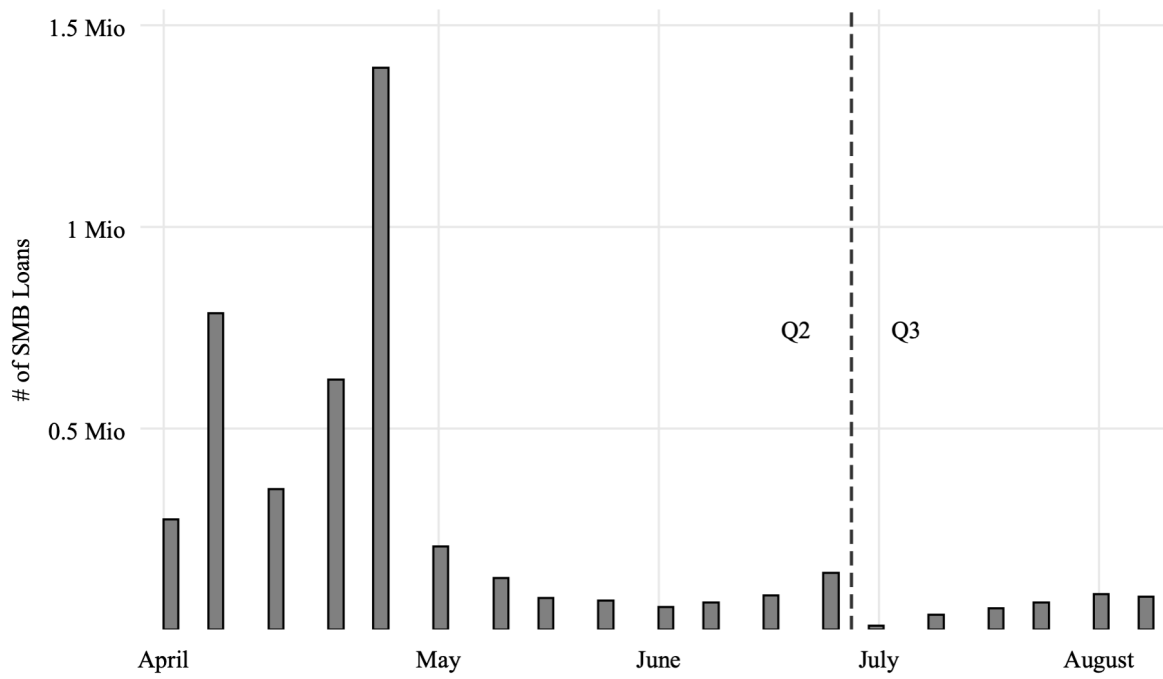


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This figure shows U.S. banks' median total (panels A-B) and small business (C-D) lending volumes in panels (all indexed to 100 in Q4 2019). Panels A and C include PPP loans, while panels B and D excludes them. The figure differentiates according to banks' geographical exposure to COVID. The latter is the deposit weighted number of cumulative COVID-19 related deaths / 100,000 inhabitants during the three quarters of 2020. The black (red) line represents the group of banks below (above) the median exposure. The vertical black dashed line indicates the pre-COVID quarter Q4 2019.

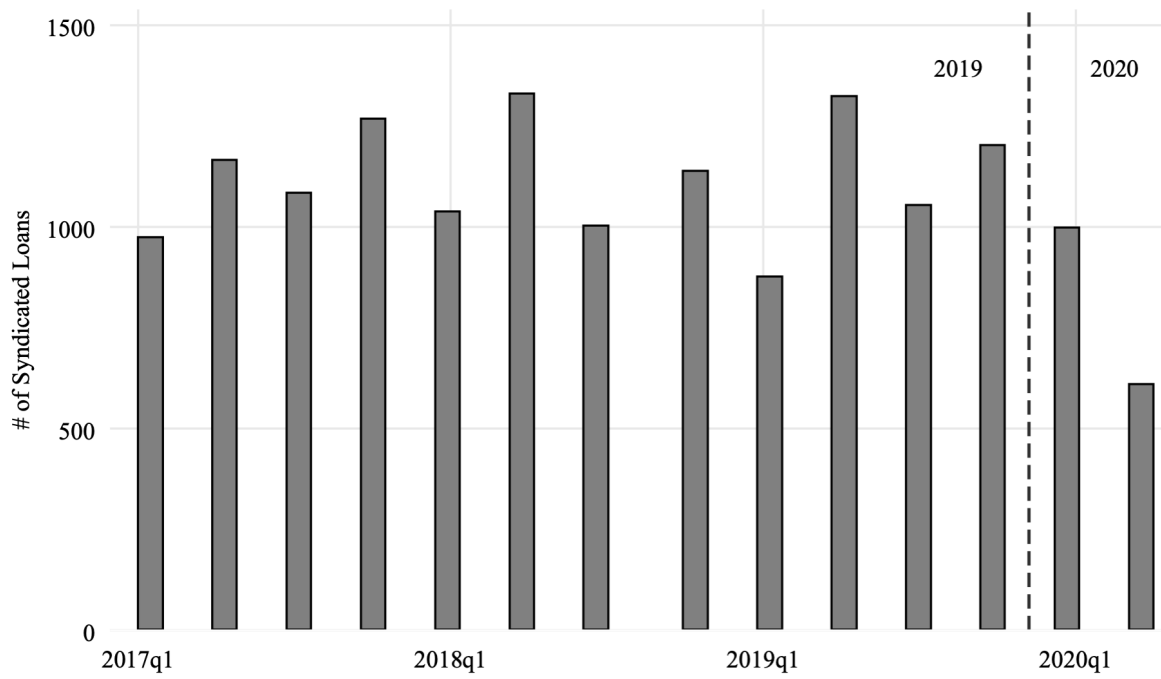


**FIGURE 6: PAYCHECK PROTECTION PROGRAM LENDING**



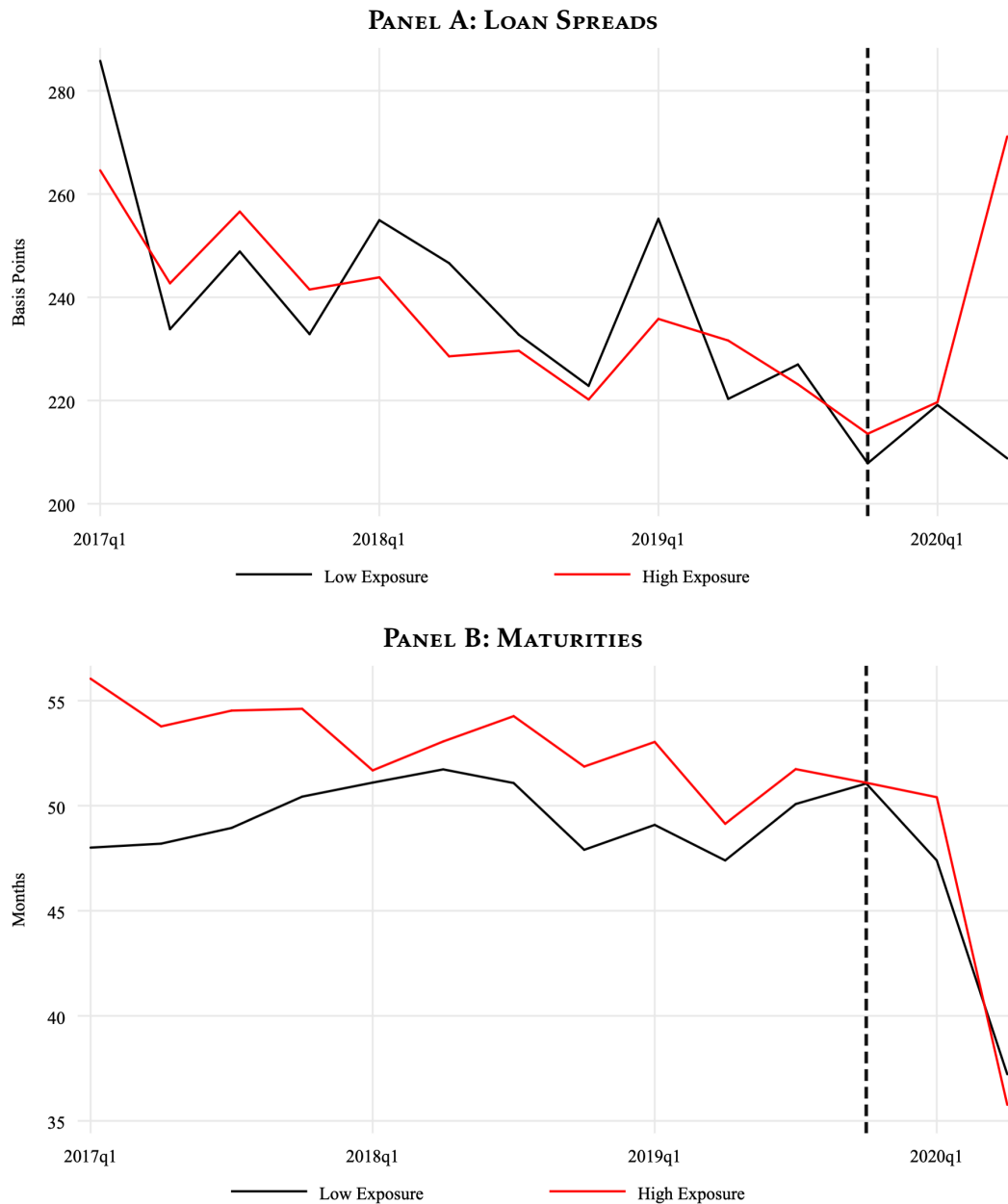
Bars represent the weekly number of loans extended under the paycheck protection program (PPP).

**FIGURE 7: SYNDICATED LOAN ISSUANCES**



Bars represent the quarterly number of loans extended by U.S. banks in the syndicated loan market.

**FIGURE 8: SYNDICATED LOANS AND EXPOSURE TO COVID**



This figure shows quarterly basis point spreads over LIBOR for syndicated loans (panel A) and maturities in months (B). It differentiates according to banks' geographical exposure to COVID. The latter is the deposit weighted number of cumulative COVID-19 related deaths / 100,000 inhabitants during the first half of 2020. The black (red) line represents the group of banks below (above) the mean exposure. The vertical black dashed line indicates the pre-COVID quarter Q4 2019.

**TABLE 1: DESCRIPTIVE STATISTICS**

Variable	N	10th Perc.	Median	90th Perc.	Mean	SD
<b>Panel A: County-Level</b>						
Covid Deaths	15,589	0	0	17.3	6.1	19.3
Q1 2020 Covid Deaths	15,589	0	0	1.17	.439	1.664
Q2 2020 Covid Deaths	15,589	0	5.7	49.2	17.7	32.1
Q3 2020 Covid Deaths	15,589	0	14	58.2	24.3	30.7
NPIs	15,589	0	0	2.967	.825	1.201
Q1 2020 NPIs	15,589	.464	.739	1.029	.736	.223
Q2 2020 NPIs	15,589	2.604	3.077	4.011	3.273	.581
Q3 2020 NPIs	15,589	1.674	1.674	2	1.762	.318
Unemployment Rate	15,589	2.7	4.3	9.9	5.5	3.3
<b>Panel B: Bank-Level (PPP Lending)</b>						
Covid Deaths	57,903	0	0	6.32	3.47	15.35
Q1 2020 Covid Deaths	3,934	0	.01	1.36	.62	1.8
Q2 2020 Covid Deaths	4,092	0	9.68	71.57	25.01	39.42
Q3 2020 Covid Deaths	4,025	2.77	15.28	53.81	23.95	27.75
NPIs	57,903	0	0	1.67	.4	.94
Q1 2020 NPIs	3,934	.46	.72	1.06	.73	.24
Q2 2020 NPIs	4,092	2.6	3.08	4.01	3.28	.57
Q3 2020 NPIs	4,025	1.67	1.67	1.92	1.76	.31
Growth in Loss Provisions	57,903	-200	6.45	200	15.67	145.58
Growth in NPLs	55,566	-110.34	-2.44	118.74	.84	88.2
Growth in L&L (in. PPP)	57,903	-2.67	5.97	19.32	7.62	10.66
Growth in L&L (ex. PPP)	57,903	-3.41	5.19	17.32	6.49	10.01
Growth in Sm Bus Loans (in. PPP)	36,494	-9.32	4.01	30.66	7.56	19.66
Growth in Sm Bus Loans (ex. PPP)	36,494	-15.93	2.04	20.16	1.6	21.8
Growth in C&I Loans	57,701	-7.52	7.85	29.71	9.92	16.98
Growth in Household Loans	57,889	-7.92	4.28	21.25	5.85	13.74
<b>Panel C: Bank-County-Level</b>						
Bank Covid Deaths	105,051	7.52	25.47	87.45	41.75	38.35
Bank NPIs	105,051	2.86	3.65	4.01	3.52	.52
County Covid Deaths	105,051	0	8.94	69.05	24.77	39.2
County NPIs	105,051	2.79	3.3	4.11	3.36	.58
Extensive Margin	105,051	-1	0	1	-.15	.72
Intensive Margin	27,640	.07	1.56	1.89	1.24	.83
<b>Panel D: Bank-Level (Syndicated Lending)</b>						
Covid Deaths	713	0	0	1.01	3.08	12.84
Q1 2020 Covid Deaths	51	.21	.91	2.77	1.36	1.61
Q2 2020 Covid Deaths	50	12.16	35.94	82.8	42.47	26.22
NPIs	713	0	0	.89	.31	.92
Q1 2020 NPIs	51	.53	.85	1.04	.82	.18
Q2 2020 NPIs	50	2.94	3.63	3.96	3.53	.45
Number of Loans	713	0	1	57	25.79	65.46
Average Loan Volume (M)	594	82.23	352.69	915.16	435.89	349.87
<b>Panel E: Loan-Level</b>						
Covid Deaths	10,941	0	0	.78	2.87	12.96
Q1 2020 Covid Deaths	716	.62	1.36	4.16	1.87	1.36
Q2 2020 Covid Deaths	536	31.2	49.2	83.1	56.1	20.9
NPIs	10,941	0	0	.77	.234	.802
Q1 2020 NPIs	716	.77	.869	.923	.861	.087
Q2 2020 NPIs	536	3.126	3.639	3.915	3.621	.342
Spread over LIBOR (BPS)	10,941	113	200	400	235	135
Maturity (Months)	10,911	19	60	70	52	19

This table contains summary statistics for main variables of interest used in the county-, bank- (PPP), bank-county, bank- (syndicated lending), and loan-level analyses (panels A, B, C, D, and E, respectively). Observations are those used in regressions 1 in tables 2, 3, 7, 8, and 9. “COVID Deaths” variables and “NPI Index” in panels B - E refer to the bank level exposures to COVID, computed as the deposit weighted number of new COVID-19 related deaths/100,000 inhabitants (or the NPI index value) during a quarter in a U.S. county.

**TABLE 2: COUNTY UNEMPLOYMENT RATES AND EXPOSURE TO COVID**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE		Yes		Yes		Yes		Yes
County Controls	Yes	–	Yes	–	Yes	–	Yes	–
Q1 2020 FE	0.909*** (0.000)	0.907*** (0.000)	0.835*** (0.000)	0.846*** (0.000)	-1.176*** (0.005)	-0.681* (0.076)	-1.157*** (0.005)	-0.627 (0.100)
Q2 2020 FE	7.391*** (0.000)	6.724*** (0.000)	6.650*** (0.000)	6.090*** (0.000)	-1.877 (0.227)	-0.392 (0.795)	-2.087 (0.171)	-0.431 (0.771)
Q3 2020 FE	3.419*** (0.000)	3.111*** (0.000)	2.416*** (0.000)	2.192*** (0.000)	-1.571* (0.084)	-0.757 (0.401)	-2.117** (0.021)	-1.225 (0.171)
Covid Deaths			0.395*** (0.000)	0.377*** (0.000)			0.283*** (0.000)	0.293*** (0.000)
NPIs					2.831*** (0.000)	2.226*** (0.000)	2.733*** (0.000)	2.084*** (0.000)
Adj. R <sup>2</sup>	0.64	0.77	0.65	0.77	0.69	0.79	0.69	0.80
Observations	15,589	21,987	15,589	21,987	15,589	21,987	15,589	21,987

This table contains county panel regressions from Q1 2019 to Q3 2020. The dependent variable is the average quarterly unemployment rate. Independent variables of interest are the logarithm of 1 + the number of new quarterly COVID-19 related deaths / 100,000 inhabitants and a state level NPIs index. Controls are from 2019 and include the number of ICU beds, persons older than 65, blacks and hispanics weighted by total county population, median income, population density, 2-digit NAICS and government employment shares. Standard errors are clustered by state. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

**TABLE 3: BANK HEALTH AND THE COVID SHOCK**

	Loss Provisions				Non-Performing Loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q1 2020 FE	42.460*** (0.000)	40.582*** (0.000)	25.564*** (0.000)	26.258*** (0.000)	3.350** (0.013)	2.711** (0.050)	-4.121* (0.080)	-3.872 (0.100)
Q2 2020 FE	68.862*** (0.000)	53.364*** (0.000)	-6.588 (0.602)	-8.858 (0.482)	3.564** (0.038)	-1.715 (0.521)	-29.588*** (0.001)	-30.180*** (0.000)
Q3 2020 FE	42.465*** (0.000)	24.661*** (0.000)	1.934 (0.792)	-6.440 (0.395)	-3.714* (0.062)	-9.821*** (0.001)	-21.473*** (0.000)	-24.063*** (0.000)
Covid Deaths		6.579*** (0.000)		4.966*** (0.000)		2.294*** (0.006)		1.590* (0.063)
NPIs			23.009*** (0.000)	20.134*** (0.000)			10.139*** (0.000)	9.201*** (0.000)
Adj. R <sup>2</sup>	0.03	0.03	0.03	0.03	0.05	0.05	0.05	0.05
Observations	57,903	57,903	57,903	57,903	69,037	69,037	69,037	69,037
Banks	4,622	4,622	4,622	4,622	4,818	4,818	4,818	4,818

This table contains bank panel regressions from Q1 2017 to Q3 2020. Dependent variables are symmetric %-changes in loan loss provisions and total non-performing loans and leases relative to the pre-year quarter. Independent variables of interest are fixed effects for 2020 quarters, the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Controls include lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets. Standard errors are clustered by bank. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

**TABLE 4: BANK HEALTH AND THE COVID SHOCK – DECOMPOSITION OF NPLs**

	C&I Loan NPLs				Household Loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q1 2020 FE	4.329** (0.024)	3.634* (0.062)	-6.578** (0.045)	-6.394* (0.052)	2.660* (0.075)	2.129 (0.162)	-6.328** (0.013)	-6.177** (0.015)
Q2 2020 FE	4.102* (0.080)	-1.590 (0.672)	-44.361*** (0.000)	-45.016*** (0.000)	1.813 (0.337)	-2.558 (0.395)	-38.095*** (0.000)	-38.494*** (0.000)
Q3 2020 FE	-1.114 (0.685)	-7.726* (0.074)	-27.095*** (0.000)	-29.461*** (0.000)	-6.877*** (0.002)	-11.913*** (0.000)	-28.170*** (0.000)	-29.816*** (0.000)
Covid Deaths		2.445** (0.048)		1.383 (0.274)		1.879** (0.044)		0.996 (0.294)
NPIs			14.806*** (0.000)	14.022*** (0.000)			12.166*** (0.000)	11.581*** (0.000)
Adj. R <sup>2</sup>	0.06	0.06	0.06	0.06	0.04	0.04	0.04	0.04
Observations	57,637	57,637	57,637	57,637	65,890	65,890	65,890	65,890
Banks								

This table contains bank panel regressions from Q1 2017 to Q3 2020. Dependent variables are symmetric %-changes in C&I and household loan non-performing loans relative to the pre-year quarter. Independent variables of interest are fixed effects for 2020 quarters, the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Standard errors are clustered by bank. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

**TABLE 5: LENDING VOLUMES AND THE COVID SHOCK**

	Including PPP Loans				Excluding PPP Loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Panel A: Total Loans and Leases</b>								
Q1 2020 FE	-0.397*** (0.000)	-0.519*** (0.000)	-1.200*** (0.000)	-1.140*** (0.000)	-0.308*** (0.000)	-0.324*** (0.000)	-0.364** (0.023)	-0.355** (0.027)
Q2 2020 FE	0.327* (0.051)	-0.685*** (0.003)	-3.243*** (0.000)	-3.375*** (0.000)	-6.335*** (0.000)	-6.464*** (0.000)	-6.582*** (0.000)	-6.601*** (0.000)
Q3 2020 FE	-0.351* (0.066)	-1.527*** (0.000)	-2.269*** (0.000)	-2.876*** (0.000)	-6.944*** (0.000)	-7.095*** (0.000)	-7.077*** (0.000)	-7.163*** (0.000)
Covid Deaths		0.444*** (0.000)		0.376*** (0.000)		0.057 (0.393)		0.053 (0.435)
NPIs			1.094*** (0.000)	0.872*** (0.000)			0.076 (0.696)	0.044 (0.825)
Adj. R <sup>2</sup>	0.67	0.67	0.67	0.67	0.66	0.66	0.66	0.66
Observations	72,679	72,679	72,679	72,679	72,679	72,679	72,679	72,679
Banks	4,857	4,857	4,857	4,857	4,857	4,857	4,857	4,857
<b>Panel B: Small Business Loans</b>								
Q1 2020 FE	-1.249*** (0.000)	-2.214*** (0.000)	-5.739*** (0.000)	-5.261*** (0.000)	1.786*** (0.000)	2.513*** (0.000)	4.779*** (0.000)	4.407*** (0.000)
Q2 2020 FE	11.735*** (0.000)	4.959*** (0.000)	-7.960*** (0.000)	-7.984*** (0.000)	-19.796*** (0.000)	-14.694*** (0.000)	-6.667** (0.018)	-6.646** (0.019)
Q3 2020 FE	15.007*** (0.000)	7.145*** (0.000)	4.182*** (0.001)	0.712 (0.563)	-29.163*** (0.000)	-23.242*** (0.000)	-21.947*** (0.000)	-19.242*** (0.000)
Covid Deaths		2.955*** (0.000)		2.468*** (0.000)		-2.225*** (0.000)		-1.923*** (0.000)
NPIs			6.032*** (0.000)	4.306*** (0.000)			-4.021*** (0.000)	-2.677*** (0.003)
Adj. R <sup>2</sup>	0.36	0.37	0.36	0.37	0.30	0.30	0.30	0.30
Observations	44,489	44,489	44,489	44,489	44,490	44,490	44,490	44,490
Banks	4,710	4,710	4,710	4,710	4,710	4,710	4,710	4,710

This table contains bank panel regressions from Q1 2017 to Q3 2020. Dependent variables are symmetric %-changes in total loans and lease volumes in panel A (small business loan volumes in panel B) either with or without Paycheck Protection Program loans relative to the pre-year quarter. Independent variables of interest are fixed effects for 2020 quarters, the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Controls include lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets. We also include current year-over-year percentage changes in deposits and in undrawn commitments. Standard errors are clustered by bank. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.



**TABLE 6: LENDING VOLUMES AND THE COVID SHOCK – DECOMPOSITION OF LOANS**

	C&I Loans				Household Loans			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q1 2020 FE	0.035 (0.823)	-0.089 (0.588)	0.275 (0.483)	0.355 (0.368)	0.008 (0.951)	0.005 (0.972)	0.117 (0.692)	0.121 (0.683)
Q2 2020 FE	15.630*** (0.000)	14.594*** (0.000)	16.695*** (0.000)	16.515*** (0.000)	-0.657*** (0.001)	-0.684** (0.038)	-0.170 (0.888)	-0.179 (0.882)
Q3 2020 FE	15.609*** (0.000)	14.405*** (0.000)	16.181*** (0.000)	15.369*** (0.000)	-0.766*** (0.003)	-0.797** (0.042)	-0.504 (0.455)	-0.544 (0.439)
Covid Deaths		0.452*** (0.008)		0.500*** (0.004)		0.012 (0.923)		0.024 (0.842)
NPIs			-0.326 (0.503)	-0.622 (0.214)			-0.149 (0.681)	-0.164 (0.657)
Adj. R <sup>2</sup>	0.41	0.41	0.41	0.41	0.38	0.38	0.38	0.38
Observations	72,959	72,959	72,959	72,959	73,228	73,228	73,228	73,228
Banks	4,869	4,869	4,869	4,869	4,882	4,882	4,882	4,882

This table contains bank panel regressions from Q1 2017 to Q3 2020. Dependent variables are symmetric %-changes in C&I (household) loan volumes relative to the pre-year quarter in columns 1-4 (5-8). Independent variables of interest are fixed effects for 2020 quarters, the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Controls include lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets. We also include current year-over-year percentage changes in deposits and in undrawn commitments. Standard errors are clustered by bank. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

**TABLE 7: PPP LOANS EXTENDED BY BANKS IN Q2 2020**

	(1)	(2)	(3)	(4)	(5)	(6)
County FE		Yes		Yes		Yes
County Controls	Yes	–	Yes	–	Yes	–
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank-County Controls	Yes	Yes	Yes	Yes	Yes	Yes
<b>Panel A: Extensive Margin</b>						
County Covid Deaths	0.004 (0.279)		0.007*** (0.008)		0.005* (0.097)	
Bank Covid Deaths	0.090*** (0.007)	0.099*** (0.004)			0.044 (0.225)	0.051 (0.168)
County NPIs	0.011 (0.342)		-0.016 (0.252)		-0.012 (0.389)	
Bank NPIs			0.209*** (0.000)	0.219*** (0.000)	0.165*** (0.007)	0.168*** (0.006)
Adj. R <sup>2</sup>	0.17	0.19	0.17	0.20	0.17	0.20
Observations	105,051	122,482	105,051	122,482	105,051	122,482
Banks	510	510	510	510	510	510
<b>Panel B: Intensive Margin</b>						
County Covid Deaths	-0.015* (0.088)		0.005 (0.391)		-0.011 (0.206)	
Bank Covid Deaths	0.159*** (0.009)	0.181*** (0.008)			0.125** (0.042)	0.154** (0.025)
County NPIs	0.063** (0.013)		-0.011 (0.788)		0.009 (0.807)	
Bank NPIs			0.245** (0.013)	0.236** (0.028)	0.148 (0.130)	0.113 (0.272)
Adj. R <sup>2</sup>	0.22	0.26	0.22	0.25	0.23	0.26
Observations	27,640	30,424	27,640	30,424	27,640	30,424
Banks	508	508	508	508	508	508

This table contains bank-county panel regressions for Paycheck Protection Program loans extended in Q2 2020. Dependent variable in panel A is the difference of two dummy variables where the first (second) is 1 if a bank extended small business loans under the Community Reinvestment Act between 2017 and 2019 (under the Paycheck Protection Program in Q2 2020). In panel B it is the percentage change in the total number of loans extended under the Community Reinvestment Act between 2017 and 2019 and under the Paycheck Protection Program in Q2 2020. The independent variables of interest are the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Bank exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Bank controls include lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets. We also include current year-over-year percentage changes in deposits and in undrawn commitments, and bank-county variables for the presence of any bank branch (a 1/0 dummy), the branch deposit market share, and the share of bank-county deposits inside the bank. County controls are from 2019 and include the number of ICU beds, persons older than 65, blacks and hispanics weighted by total county population, median income, population density, 2-digit NAICS and government employment shares. Standard errors are clustered by bank. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

**TABLE 8: SYNDICATED LOAN ISSUANCES AND VOLUMES**

	Number of Loans				Average Loan Volume			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q1 2020 FE	-0.105 (0.285)				-0.042 (0.699)			
Q2 2020 FE	-0.216** (0.016)				-0.291** (0.017)			
Covid Deaths		-0.060*** (0.009)		-0.155* (0.087)		-0.050* (0.076)		0.125 (0.119)
NPIs			-0.055** (0.046)	0.106 (0.311)			-0.077** (0.018)	-0.200** (0.029)
Adj. R <sup>2</sup>	0.94	0.94	0.94	0.94	0.68	0.68	0.68	0.68
Observations	713	713	713	713	1,284	1,284	1,284	1,284
Banks	51	51	51	51	162	162	162	162

This table contains bank-quarter-level regressions from Q1 2017 to Q2 2020. The dependent variable is the logarithm of 1 + the number of syndicated loans where a bank acted as a leader in Columns 1-4 and the logarithm of 1 + the average volume of syndicated loans where a bank lead or participated in Columns 5-8. Independent variables of interest are fixed effects for the first two quarters of 2020, the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Bank controls include current %-changes in deposits and unused credit line commitments and lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets. Standard errors are clustered by bank. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

**TABLE 9: INTEREST SPREADS OF SYNDICATED LOANS AND THE COVID SHOCK**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	–	–	–	–	–	–
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry * State FE	Yes	–	Yes	–	Yes	–	Yes	–
Industry * Quarter FE			Yes	–	Yes	–	Yes	–
Borrower FE		Yes		–		–		–
Borrower * Quarter FE				Yes		Yes		Yes
Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q1 2020 FE	-1.344 (0.864)	3.004 (0.688)						
Q2 2020 FE	43.685*** (0.000)	65.066*** (0.000)						
Covid Deaths			29.451** (0.037)	176.334 (0.296)			30.443** (0.031)	199.874 (0.194)
NPIs					-0.471 (0.979)	166.812 (0.120)	-9.325 (0.571)	224.939** (0.020)
Adj. R <sup>2</sup>	0.45	0.74	0.47	0.77	0.47	0.77	0.47	0.77
Observations	10,941	9,452	10,819	6,544	10,819	6,544	10,819	6,544
Borrowers	4,711	2,953	4,663	2,164	4,663	2,164	4,663	2,164
Banks	32	30	32	29	32	29	32	29

This table contains syndicated loan-level regressions from Q1 2017 to Q2 2020. The dependent variable is the interest spread over LIBOR (BPS). Independent variables of interest are fixed effects for the first two quarters of 2020, the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Loan type fixed effects are for term loans, revolving credit lines, and other or both. Loan controls comprise of maturity, loan volume, fixed effects for loan purpose, collateral, and refinanced loans. Bank controls include current %-changes in deposits and unused credit line commitments and lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets. Standard errors are clustered by the bank's headquarter state. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

**TABLE 10: MATURITIES OF SYNDICATED LOANS AND THE COVID SHOCK**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Year-Quarter FE	Yes	Yes	–	–	–	–	–	–
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry * State FE	Yes	–	Yes	–	Yes	–	Yes	–
Industry * Quarter FE			Yes	–	Yes	–	Yes	–
Borrower FE		Yes		–		–		–
Borrower * Quarter FE				Yes		Yes		Yes
Loan Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Q1 2020 FE	-0.101** (0.020)	-0.130 (0.108)						
Q2 2020 FE	-0.570*** (0.000)	-0.527*** (0.000)						
Covid Deaths			0.096 (0.248)	0.354 (0.513)			0.080 (0.378)	0.265 (0.583)
NPIs					0.170 (0.222)	-1.292 (0.116)	0.146 (0.284)	-1.203* (0.085)
Adj. R <sup>2</sup>	0.28	0.58	0.30	0.66	0.30	0.66	0.30	0.66
Observations	10,800	9,273	10,678	6,387	10,678	6,387	10,678	6,387
Borrowers	4,674	2,910	4,625	2,121	4,625	2,121	4,625	2,121
Banks	31	29	31	28	31	28	31	28

This table contains syndicated loan-level regressions from Q1 2017 to Q2 2020. The dependent variable is the logarithm of 1 + maturity in months. Independent variables of interest are fixed effects for the first two quarters of 2020, the logarithm of 1 + the bank level exposure to COVID related deaths, and an NPI index. Exposure to COVID deaths is the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants during a quarter in a U.S. county. The state level NPI index is linked to banks equivalently. Loan type fixed effects are for term loans, revolving credit lines, and other or both. Loan controls comprise of interest spread, loan volume, fixed effects for loan purpose, collateral, and refinanced loans. Bank controls include current %-changes in deposits and unused credit line commitments and lagged values of the logarithm of total assets, loan portfolio shares, and income, equity, deposits, liquidity, unused commitments, and loans and leases in percent of total assets. Standard errors are clustered by the bank's headquarter state. \*\*\*, \*\*, and \* indicate statistical significance at 1%, 5%, and 10%. P-values are in parenthesis.

## APPENDIX

**TABLE A1: COUNTY-LEVEL DESCRIPTIVE STATISTICS**

Variable	N	10th Perc.	Median	90th Perc.	Mean	SD
Unemployment Rate	15,589	2.7	4.3	9.9	5.5	3.3
Covid Deaths	15,589	0	0	17.3	6.1	19.3
Q1 2020 Covid Deaths	15,589	0	0	1.17	.439	1.664
Q2 2020 Covid Deaths	15,589	0	5.7	49.2	17.7	32.1
Q3 2020 Covid Deaths	15,589	0	14	58.2	24.3	30.7
NPIs	15,589	0	0	2.967	.825	1.201
Q1 2020 NPIs	15,589	.464	.739	1.029	.736	.223
Q2 2020 NPIs	15,589	2.604	3.077	4.011	3.273	.581
Q3 2020 NPIs	15,589	1.674	1.674	2	1.762	.318
ICU Beds	15,589	0	12.2	37.1	16.9	60.3
Share of Elderly (above 65)	15,589	.134	.185	.243	.187	.043
Median Income	15,589	10.6	10.9	11.2	10.9	.2
Population Density	15,589	11.6	64.5	480.4	313.6	2,000.6
Share of Black and Hispanic	15,589	.014	.047	.29	.103	.129
Emp Share Primary Sector	15,589	.003	.02	.109	.044	.065
Emp Share Construction	15,589	.03	.056	.104	.063	.033
Emp Share Manufacturing	15,589	.036	.136	.324	.161	.114
Emp Share Trade, Transp, Util	15,589	.18	.234	.313	.241	.056
Emp Share Information	15,589	.004	.01	.022	.012	.009
Emp Share FIRE	15,589	.026	.042	.072	.046	.02
Emp Share Professional Services	15,589	.037	.08	.161	.091	.051
Emp Share Education + Health	15,589	.093	.167	.257	.172	.066
Emp Share Leisure Hospitality	15,589	.078	.123	.197	.134	.059
Emp Share Other Services	15,589	.018	.032	.048	.033	.012
Emp Share Government	15,589	.115	.188	.311	.202	.08

This table contains summary statistics for variables used in county-level regressions, in figures, or for bank exposure calculations. Observations are those used in regression 1, table 2.

**TABLE A2: BANK-LEVEL DESCRIPTIVE STATISTICS**

Variable	N	10th Perc.	Median	90th Perc.	Mean	SD
Covid Deaths	57,903	0	0	6.32	3.47	15.35
Q1 2020 Covid Deaths	3,934	0	.01	1.36	.62	1.8
Q2 2020 Covid Deaths	4,092	0	9.68	71.57	25.01	39.42
Q3 2020 Covid Deaths	4,025	2.77	15.28	53.81	23.95	27.75
NPIs	57,903	0	0	1.67	.4	.94
Q1 2020 NPIs	3,934	.46	.72	1.06	.73	.24
Q2 2020 NPIs	4,092	2.6	3.08	4.01	3.28	.57
Q3 2020 NPIs	4,025	1.67	1.67	1.92	1.76	.31
Growth in Loss Provisions	57,903	-200	6.45	200	15.67	145.58
Growth in NPLs	55,566	-110.34	-2.44	118.74	.84	88.2
Growth in NPLs (C&I)	47,967	-188.6	-6.9	192.1	-.9	117
Growth in NPLs (Households)	53,406	-129.48	-4.68	129.49	-2.29	94.71
Growth in L&L (in. PPP)	57,903	-2.67	5.97	19.32	7.62	10.66
Growth in L&L (ex. PPP)	57,903	-3.41	5.19	17.32	6.49	10.01
Growth in Sm Bus Loans (in. PPP)	36,494	-9.32	4.01	30.66	7.56	19.66
Growth in Sm Bus Loans (ex. PPP)	36,494	-15.93	2.04	20.16	1.6	21.8
Growth in C&I Loans	57,701	-7.52	7.85	29.71	9.92	16.98
Growth in Household Loans	57,889	-7.92	4.28	21.25	5.85	13.74
Income/Assets	39,302	.08	.26	.45	.26	.17
Equity/Assets	39,302	8.63	10.83	14.86	11.47	3.04
Liquidity/Assets	39,302	10.64	22.56	44.88	25.48	13.84
Deposits/Assets	39,302	75.74	84.87	89.76	83.59	5.87
Loans and Leases/Assets	39,302	48.4	71.2	84.1	68.4	14.2
Undrawn Commitments/Assets	39,302	3.54	10.56	20.78	11.63	7.15
Assets (Bn)	39,302	.07	.26	1.68	3.98	61.97
Growth in Deposits	57,903	-2.7	5.15	19.19	7.16	10.31
Growth in Undrawn Commitm	57,629	-20.05	7.27	38.18	8.39	27.25
C&I/Tot Loans & Leases	39,302	3.33	10.97	24.6	12.85	9.04
Agricul/Tot Loans & Leases	39,302	0	1.05	23.27	6.76	11.28
Househ/Tot Loans & Leases	39,302	.28	2.94	12.63	5.16	6.51
Real Est/Tot Loans & Leases	39,302	48.76	76.04	92.65	73.01	17.18

This table contains summary statistics for variables used in bank-level regressions or figures. Observations are those used in regression 1, table 3. “COVID Deaths” and “NPIs” refer to the bank level exposures to COVID, computed as the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants and the average NPI index value during a quarter in a U.S. county.

**TABLE A3: BANK-COUNTY-LEVEL DESCRIPTIVE STATISTICS (PPP REGRESSIONS)**

Variable	N	10th Perc.	Median	90th Perc.	Mean	SD
Bank Covid Deaths	105,051	7.52	25.47	87.45	41.75	38.35
Bank NPIs	105,051	2.86	3.65	4.01	3.52	.52
County Covid Deaths	105,051	0	8.94	69.05	24.77	39.2
County NPIs	105,051	2.79	3.3	4.11	3.36	.58
Extensive Margin	105,051	-1	0	1	-.15	.72
Intensive Margin	27,640	.07	1.56	1.89	1.24	.83
Deposit Market Share	105,051	0	0	0	.01	.04
County Share in Bank	105,051	0	0	0	0	.04
Branch Presence	105,051	0	0	0	.09	.29
Assets (Bn)	105,051	1.42	6.2	133.51	81.48	322.17
Growth in Deposits	105,051	10.56	20.36	36.85	23.25	14.2
Growth in Undrawn Commitm	105,051	-6.92	10.26	31.12	12.96	19.56
Income/Assets	105,051	.18	.34	.46	.33	.11
Equity/Assets	105,051	9.55	11.54	15.1	12.17	2.45
Liquidity/Assets	105,051	9.55	16.07	27.38	17.58	8.19
Deposits/Assets	105,051	60.59	73.67	82.12	71.83	10.32
Loans and Leases/Assets	105,051	72.58	79.97	86.65	79.76	6.26
Undrawn Commitments/Assets	105,051	12.41	19.37	41.23	25.52	21.67
C&I/Tot Loans & Leases	105,051	9.26	22.43	45.45	27.03	15.9
Agricul/Tot Loans & Leases	105,051	0	.09	3.45	1.13	2.92
Househ/Tot Loans & Leases	105,051	.4	6.73	24.27	10.19	10.85
Real Est/Tot Loans & Leases	105,051	29.88	53.51	81.12	55.42	19.61
ICU Beds	105,051	0	0	0	0	0
Share of Elderly (above 65)	105,051	.13	.17	.23	.18	.04
Median Income	105,051	42,435	56,211	83,591	59,783.93	16,543.75
Population Density	105,051	22.4	138.8	1,463.1	622.18	1,605.82
Share of Black and Hispanic	105,051	.02	.07	.3	.12	.13
Emp Share Primary Sector	105,051	0	.01	.08	.03	.05
Emp Share Construction	105,051	.03	.06	.1	.06	.03
Emp Share Manufacturing	105,051	.03	.11	.28	.14	.1
Emp Share Trade, Transp, Util	105,051	.18	.23	.3	.23	.05
Emp Share Information	105,051	0	.01	.03	.01	.01
Emp Share FIRE	105,051	.03	.05	.08	.05	.02
Emp Share Professional Services	105,051	.05	.1	.2	.11	.06
Emp Share Education + Health	105,051	.1	.17	.26	.18	.06
Emp Share Leisure Hospitality	105,051	.09	.13	.19	.14	.05
Emp Share Other Services	105,051	.02	.03	.05	.03	.01
Emp Share Government	105,051	.1	.16	.28	.18	.07

This table contains summary statistics for variables used in bank-county-level regressions or figures. Observations are those used in regression 1, table 7. “COVID Deaths” and “NPIs” refer either to the county or to the bank level exposures to COVID, where the latter are computed as the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants and the average NPI index value during a quarter in a U.S. county.



**TABLE A4: LOAN-LEVEL DESCRIPTIVE STATISTICS**

Variable	N	10th Perc.	Median	90th Perc.	Mean	SD
Covid Deaths	10,941	0	0	.78	2.87	12.96
Q1 2020 Covid Deaths	716	.62	1.36	4.16	1.87	1.36
Q2 2020 Covid Deaths	536	31.2	49.2	83.1	56.1	20.9
NPIs	10,941	0	0	.77	.234	.802
Q1 2020 NPIs	716	.77	.869	.923	.861	.087
Q2 2020 NPIs	536	3.126	3.639	3.915	3.621	.342
Spread over LIBOR (BPS)	10,941	113	200	400	235	135
Maturity (Months)	10,911	19	60	70	52	19
Facility Amount (M)	10,941	22	200	1,200	494	973
Term Loan (1/0)	10,941	0	0	1	.4	.5
Revolving Loan (1/0)	10,941	0	1	1	.554	.497
Purpose CAPX (1/0)	10,941	0	0	0	.05	.218
Purpose Working Cap (1/0)	10,941	0	0	0	.01	.097
Purpose Corporate (1/0)	10,941	0	0	1	.155	.362
Purpose M&A (1/0)	10,941	0	1	1	.7	.5
Purpose Debt Repaym (1/0)	10,941	0	0	0	.026	.158
Purpose Other (1/0)	10,941	0	0	0	.052	.221
Secured Loan (1/0)	10,941	0	0	1	.353	.478
Refinancing Loan (1/0)	10,941	0	1	1	.652	.476
Assets (Bn)	10,941	122	1,706	2,153	1,358	785
Deposit Growth	10,941	.51	3.86	14.8	6.13	7.05
Unused Commitm Growth	10,941	-1.6	3.71	20.21	8.69	17.34
Deposits/Assets	10,941	56	72	78	68	11
Liquity/Assets	10,941	17	27	32	26	6
Equity/Assets	10,941	9.5	10.5	12.7	10.9	1.3
Income/Assets	10,941	.217	.293	.409	.294	.082
Loans & Leases/Assets	10,941	34	48	67	49	13
Unused Commitm/Assets	10,941	29	44	57	44	14
C&I/Tot Loans & Leases	10,941	21	29	38	28	7
Agricult/Tot Loans & Leases	10,941	.038	.078	.549	.191	.242
Househ/Tot Loans & Leases	10,941	8.4	13.4	21.9	16.1	7.6
Real Est/Tot Loans & Leases	10,941	35.9	42.6	53	45	8.5

This table contains summary statistics for variables used in loan-level regressions or figures. Observations are those used in regression 1, table 9. “COVID Deaths” and “NPIs” refer to the bank level exposures to COVID, computed as the deposit weighted number of new COVID-19 related deaths / 100,000 inhabitants and the average NPI index value during a quarter in a U.S. county.

**TABLE A5: Pairwise Correlations of COVID Related Variables**

Variables	Q1 2020 FE	Q2 2020 FE	Q3 2020 FE	Covid Deaths	NPIs
Q1 2020 FE	1.000				
Q2 2020 FE	-0.167 (0.000)	1.000			
Q3 2020 FE	-0.167 (0.000)	-0.167 (0.000)	1.000		
Covid Deaths	-0.152 (0.000)	0.394 (0.000)	0.608 (0.000)	1.000	
NPIs	-0.030 (0.000)	0.833 (0.000)	0.319 (0.000)	0.670 (0.000)	1.000

This table contains pairwise correlations of all independent variables of interest defined on the county level. COVID deaths refer to the logarithm of 1 plus the number COVID Deaths/100,000. Significance levels are in brackets.

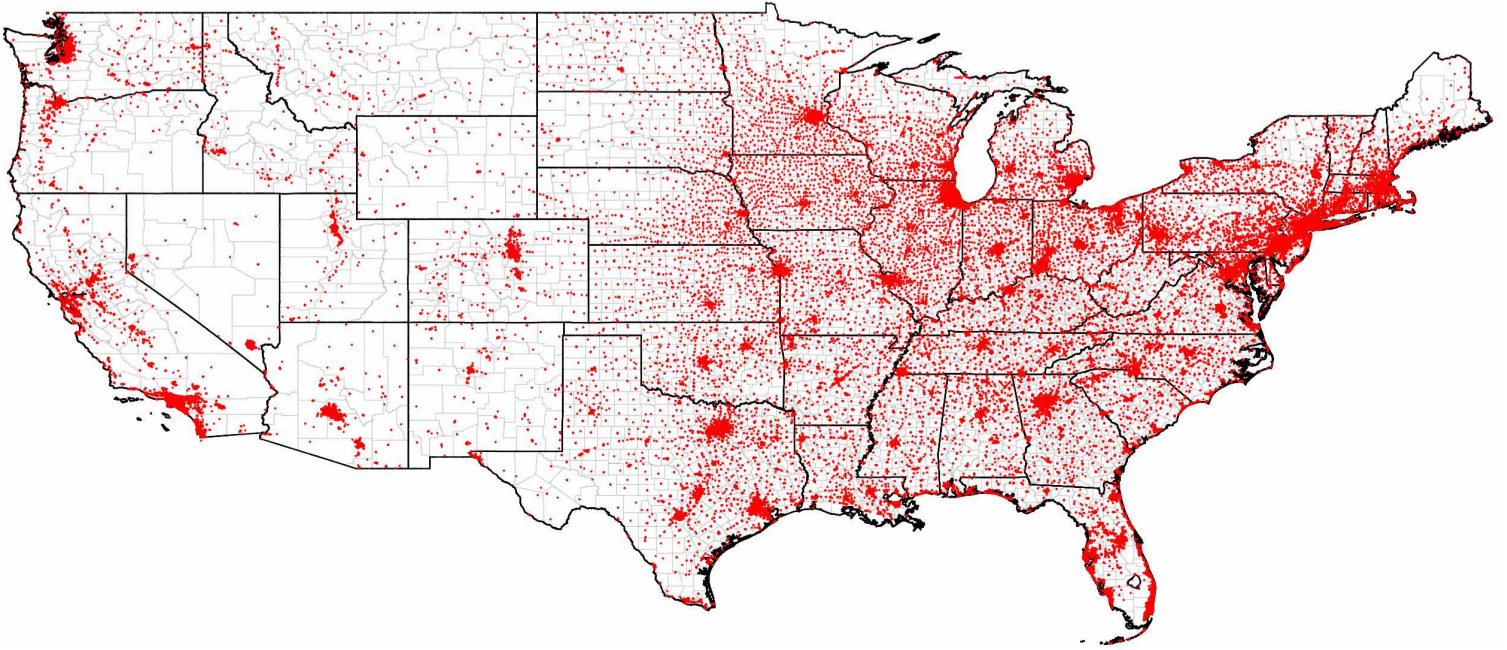
**TABLE A6: EXPOSURE OF THE LARGEST U.S. BANKS TO COVID IN THE FIRST HALF OF 2020**

Bank	Headquarters	Assets	Branches	Covid Deaths/100,000		
				New Q1	New Q2	New Q3
Signature Bank	New York, NY	51	31	8	190	13
New York Community Bank	Westbury, NY	54	241	6	175	19
HSBC Bank USA	Tysons, VA	173	225	7	160	16
Santander Bank	Wilmington, DE	85	613	3	139	16
People's United Bank	Bridgeport, CT	58	414	3	116	9
JPMorgan Chase Bank	Columbus, OH	2,338	5,024	4	102	22
TD Bank	Wilmington, DE	320	1,244	2	92	16
Citizens Bank	Providence, RI	166	1,105	1	84	15
The Northern Trust Company	Chicago, IL	136	56	1	68	24
Capital One	McLean, VA	329	488	3	74	16
City National Bank	Los Angeles, CA	61	71	2	62	26
Comerica Bank	Dallas, TX	73	436	3	67	21
Citibank	Sioux Falls, SD	1,454	709	2	67	16
Manufacturers & Traders Trust Company	Buffalo, NY	119	788	1	71	10
BMO Harris Bank	Chicago, IL	138	590	1	61	15
TCF National Bank	Sioux Falls, SD	47	330	1	60	13
Bank of America	Charlotte, NC	1,853	4,335	1	50	23
PNC Bank	Wilmington, DE	398	2,398	1	52	17
Synovus Bank	Columbus, GA	48	296	1	21	47
First Republic Bank	San Francisco, CA	116	81	2	55	13
East West Bank	Pasadena, CA	44	111	1	35	28
CIT Bank	Pasadena, CA	45	66	1	31	32
Regions Bank	Birmingham, AL	126	1,460	1	23	37
BBVA USA	Birmingham, AL	93	642	0	13	42
Fifth Third Bank	Cincinnati, OH	168	1,224	1	36	17
Wells Fargo Bank	Sioux Falls, SD	1,713	5,570	1	33	21
The Huntington National Bank	Columbus, OH	109	909	1	38	15
KeyBank	Cleveland, OH	143	1,125	1	38	12
MUFG Union Bank	San Francisco, CA	133	350	1	21	28
Branch Banking & Trust Company	Charlotte, NC	461	1,791	0	22	25
TIAA, FSB	Jacksonville, FL	42	13	0	8	37
U.S. Bank	Cincinnati, OH	486	2,979	1	28	17
First Tennessee Bank	Memphis, TN	43	291	0	13	27
Zions Bancorporation	Salt Lake City, UT	69	435	0	13	26
Bank of the West	San Francisco, CA	93	554	1	15	18

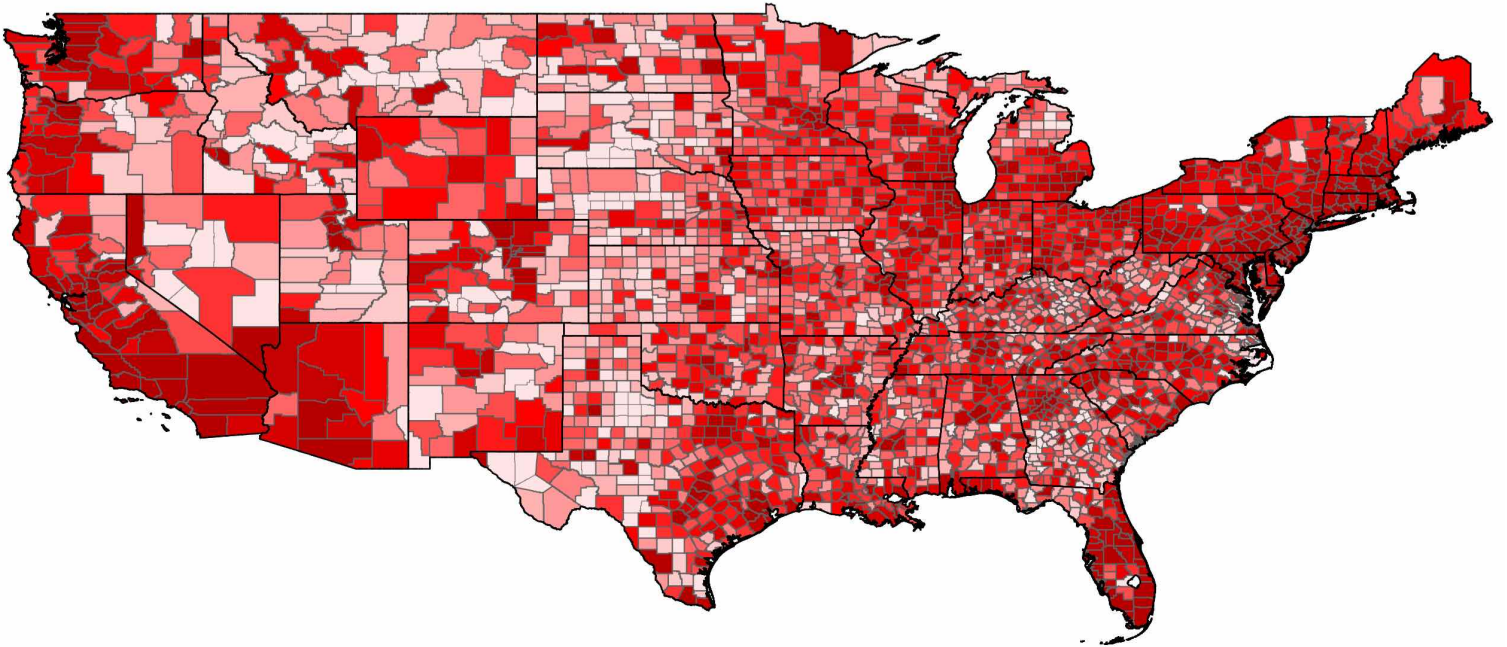
This table contains information on the 35 largest U.S. banks. Total assets (in billion USD) and numbers of branches are from 2019. The exposure to COVID is based on the county-level death rates in new quarterly deaths (COVID-19 related deaths / 100,000 inhabitants). The bank level exposure variables in this table bank's weighted averages using the county-level branch deposit share in the bank's total deposits as weights. The list (and all tables and plots) exclude institutes that are formally commercial banks but do not operate a significant branch network (excluding those banks with \$ 10 Bn or more in assets but less than 10 branches, those with at least 5 Bn and less than 5 branches, 3 Bn and less than 3 branches, or 1 Bn and only 1 branch).

## FIGURE A1: GEOGRAPHICAL FOOTPRINT OF BANKS

### PANEL A: BRANCH OFFICE LOCATIONS

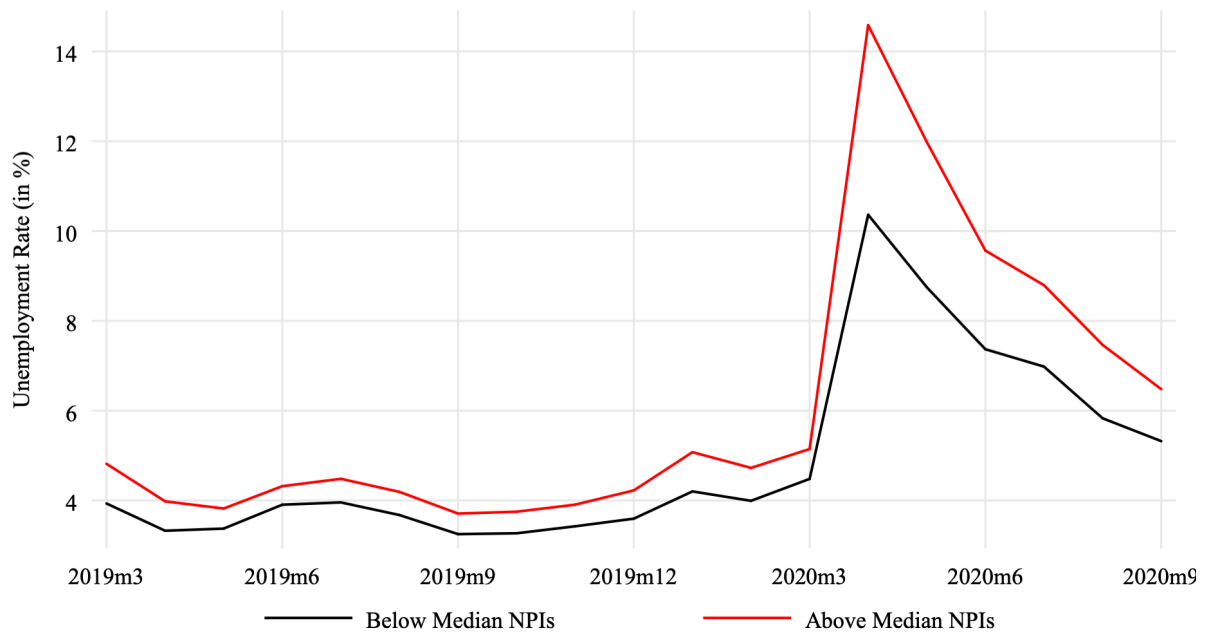


### PANEL B: BRANCH DEPOSIT DISTRIBUTION



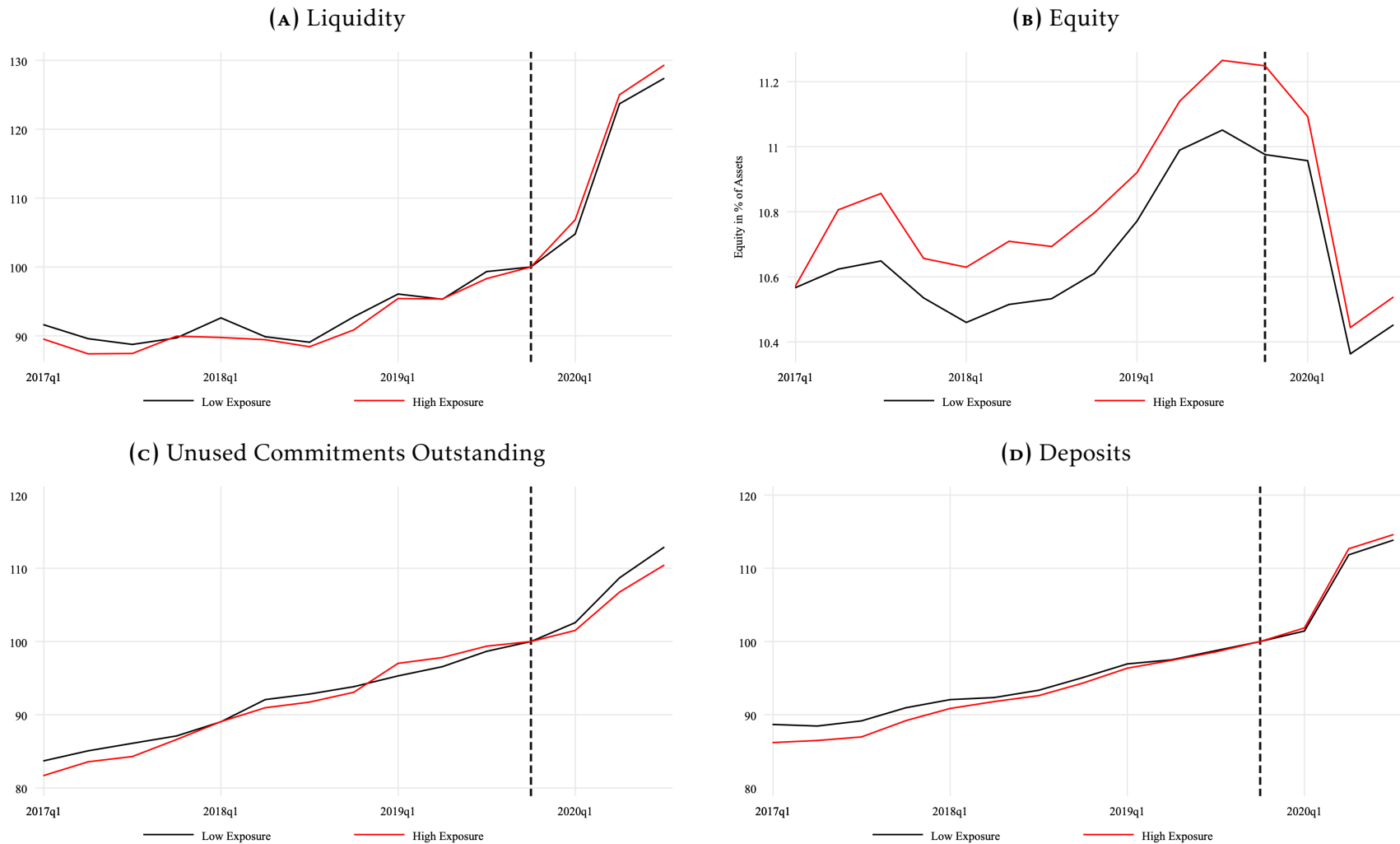
Every dot in panel A represents a bank branch in June 2019 in the contiguous states of the U.S. Coloring of counties in panel B follows a heat map scheme, corresponding to 2019 deposits at bank branches in a county. A darker red means more deposits.

**FIGURE A2: UNEMPLOYMENT IN COUNTIES WITH DIFFERENT EXPOSURES TO COVID DEATHS**



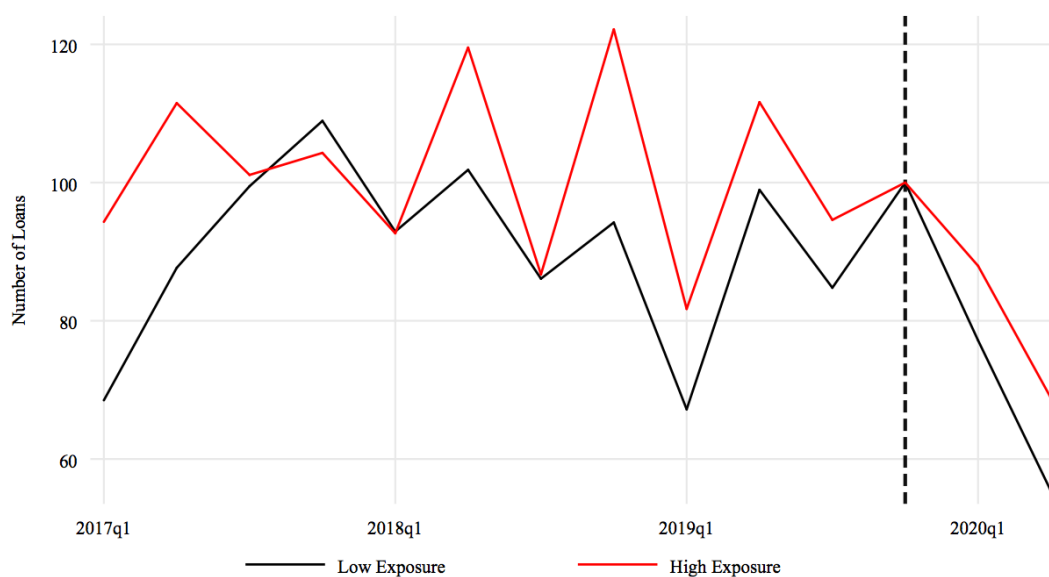
This figure displays median monthly unemployment rates for U.S. counties, dividing them into groups with below and above median NPIs in the first three quarters of 2020.

**FIGURE A3: OTHER VARIABLES OF BANKS WITH DIFFERENTIAL EXPOSURES TO COVID**



Panels A, C, and D shows U.S. banks' mean quarterly liquidity, unused commitments outstanding, and deposits indexed to 100 in Q4 2019 respectively. Panel B shows U.S. banks' mean equity / total assets. The figure differentiates according to banks' geographical exposure to COVID. The latter is the deposit weighted number of cumulative COVID-19 related deaths / 100,000 inhabitants during the first half of 2020. The black (red) line represents the group of banks below (above) the median exposure. The vertical black dashed line indicates the pre-COVID quarter Q4 2019.

**FIGURE A4: SYNDICATED LOAN ORIGINATIONS AND EXPOSURE TO COVID**



This figure shows quarterly number of syndicated loans indexed to 100 in Q4 2019. It differentiates according to banks' geographical exposure to COVID. The latter is the deposit weighted number of cumulative COVID-19 related deaths / 100,000 inhabitants during the first half of 2020. The black (red) line represents the group of banks below (above) the mean exposure. The vertical black dashed line indicates the pre-COVID quarter Q4 2019.