COVID-19 Impacts on Bank Stability in a Liquidity-Backed Environment

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Abstract

The Great Recession has been more of a bank governance issue. In the COVID-19 crisis, the liquidity needs of firms have been the immediate problem due to lockdowns and banks have responded to these with the support of government and central bank programs. Our paper is the first evaluating the impact of the geographic exposure to COVID-19 on bank stability and performance in such a liquidity-backed environment. We find that bank stability and performance worsen by COVID-19 exposure. The liquidity injections seem to be only helpful for banks with higher equity capital capacity that were able to increase loan supply. We also find that banks operating in locations with high-density black populations suffer from COVID-19 exposure while their peers do not, potentially hinting at differences in accessibility to credit expansion.

KEYWORDS: COVID-19, bank stability, financial performance, credit expansion, liquidity

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1 Introduction

The long-term economic effects of COVID-19 are unclear as there is ongoing uncertainty in the scientific responses to COVID-19, such as vaccination and accordingly the duration of the shock. Governments and central banks responded immediately to the first wave of the pandemic predominantly through liquidity injections. For instance, the Federal Reserve stated that the bank could inject $2.3 trillion into the economy through various programs to support local governments and companies.[1]

Banks constitute one of the main channels through which the Federal Reserve or the government can help rescue the economy. In March 2020, banks opened the credit channels especially to large companies to supply liquidity backed by government and Federal Reserve programs. According to Li et al. (2020), commercial and industrial loans rose by $482 billion until the end of March. So far, the focus in the banking literature has been on loan expansion supplied through banks as the initial reaction to the shock has been observed in loan increases.

The important question of whether credit expansions prevent banks from facing stability and performance problems during the COVID-19 shock remains unanswered. While it is more of a long-term issue despite the current liquidity injections, it is also currently unknown whether such programs have sufficiently avoided bank stability issues during the initial wave of the COVID-19 pandemic. These programs aim to protect jobs and the economy through the liquidity supply to firms. However, there is no straight evidence on how households or small firms are affected in addition to whether the loan expansions can avoid bank stability issues.

In this project, we evaluate the geographic impact of COVID-19 on bank stability and performance in the short term. To our knowledge, this paper is the first testing bank stability in the short-term considering geographic exposure to COVID-19. As the liquidity injections within this very short time interval have never been observed historically, the paper also

[1]For more details, please visit https://www.nytimes.com/2020/04/09/business/economy/fed-economic-rescue-coronavirus.html.

contributes to the banking literature on how successfully such unique and prompt liquidity injections avoid bank stability distortions.

We start our analysis by developing a geographic measure for banks' exposure to COVID-19. Benefiting from Ozsoy et al. (2020) and Ling et al. (2020), we create a weighted COVID-19 exposure measure by bank. We first calculate the number of cases normalized by population by county per day. Using the weights of deposits for each branch of a bank, we calculate the weighted average number of COVID-19 cases per 1,000 people for each bank for each day. Since we use quarterly bank balance sheet data, we use the mean of this measure as a proxy for a bank's exposure to COVID-19.

Importantly, the COVID-19 exposure measure is exogenous as the shock has not been anticipated and the liquidity responses only came in by the end of the first quarter of 2020. In any regression, the COVID-19 exposure measure gets zero if there are no cases so using the COVID-19 exposure measure along with the year-quarter fixed effects is equivalent to a difference-in-difference (diff-in-diff) method and the coefficient of COVID-19 represents the coefficient of an interaction term between the COVID-19 exposure and the quarters that the pandemic is present.

Our focus is the impact on bank stability and performance. We create quarterly bank stability and performance measures such as Z-Score, return on assets (ROA), the ratio of nonperforming loans to total loans (NPL ratio), and equity volatility. In our panel setup, we include quarterly data from the preceding year, 2019, in addition to the first and second quarter of 2020. We relate COVID-19 exposure to these financial measures. We then look into the impact of COVID-19 exposure on the stock price responses whether investors price the magnitude of banks' geographic exposure to COVID-19 cross-sectionally.

We find that as a bank's exposure to COVID-19 increases, Z-Score and ROA decline while equity volatility and NPL ratio go up – all at the 1% significance level. Our findings indicate that COVID-19 exposure worsens bank stability and performance despite the liquidity injections by the government and the Federal Reserve made within only around one

shock-quarter in our sample. We also evaluate stock market reaction to COVID-19 exposure and consistently find that investors react more negatively to the banks that are more exposed to COVID-19.

Our results show that a one standard deviation increase in exposure to COVID-19 decreases Z-Score by 0.02 standard deviations and ROA by 0.05 standard deviations. It increases NPL ratio and equity volatility by 0.03 standard deviations.

As even in a couple of weeks, banks increase commercial and industrial loans by half a trillion dollars to support firms and the economy by creating a liquidity-backed shock environment, our findings on stability distortions can be surprising. We further evaluate whether there is any variation in the relationship between COVID-19 exposure and bank stability based on credit channel expansion. We first calculate the increase in total loans from 2019Q4 to the end of 2020Q2 for each bank and rank them according to the percentage increase in total loans. When we divide the sample in two, the stability and performance measures of banks that increase total loans less then the median all worsen statistically significantly. On the other hand, banks that increase credit channel more than the median bank do not experience significant stability worsening measured by Z-Score and equity volatility. ROA and NPL ratio also deteriorate for these banks.

We also add an additional layer based on the equity capital capacity of a bank before the shock. Banks with higher equity capital capacity before the shock and increasing credit channels do not experience any negative impact of COVID-19 exposure on any of the stability and performance measures.

We also investigate NPL ratios by different loan types. Li et al. (2020) state that credit expansion in the early weeks of the pandemics have been through relatively larger commercial and industrial loans. We find that there is no significant increase in NPL ratios for commercial loans and commercial mortgages, indicating that credit expansion effectively supported firms. However, we document that there is a statistically significant increase in NPL ratios for the consumer loans and residential mortgages. Finding no effect of COVID-19 exposure on

commercial loans supports the idea that liquidity injection policies especially on commercial loans are effective. However, consumer loan results indicate that when there is less credit channel expansion, banks suffer performance problems.

Overall, our findings confirm that liquidity injections partially support banks – especially the ones expanding credit channels and having better equity capital capacity. On the other hand, financial stability and performance measures of the banks with lower credit expansion deteriorate during the first wave of the pandemic. Our findings ring a warning bell for the stability of banks if the pandemic has a longer duration than expected and the credit expansion channels are narrowed.

Lastly, we evaluate COVID-19 impact on bank stability based on race. Golestaneh et al. (2020) significantly find that deaths due to COVID-19 are more likely to occur in black populations. To evaluate COVID-19 effects on banks working in locations with larger black populations, we calculate the share of black population by county and create a weighted average share of black population for each bank weighting by branch deposits.

When the weighted share is above the median for a bank, that is the bank operates in a location with larger black population, the bank stability and performance measures worsen in a statistically significant way. However, if a bank operates in locations with lower black population, that is below-median weighted share, there is no significant impact of COVID-19 exposure on bank stability and performance. While we do not have direct evidence on liquidity expansion based on race, these findings can hint at the differences in the accessibility to credit channels by race.

The Great Recession was mainly related to excessive risk taking by banks especially in real estate lending. Accordingly, banking literature focuses on bank governance or bank risk taking following the Great Recession (Aebi et al., 2012; Berger et al., 2016; Ho et al., 2016). However, the COVID-19 crisis is unique as economic activity stops, elevating liquidity needs by firms. Governments and central banks intervened immediately with liquidity injections. Our paper is the first evaluating bank stability in such a shock where the economy is backed

by unseen liquidity expansion in a short period of time. Additionally, our paper also differs from Schüwer et al. (2018) and Ozsoy et al. (2020) evaluating the impact of climate shocks on bank stability, which are local shocks and different in nature than the COVID-19 pandemic.

Our paper also adds to the fast-growing COVID-19 literature. Initial studies focus on stock market reactions to the first wave of the pandemic. Alfaro et al. (2020) find that the losses in the stock market due to COVID-19 deepen for firms with higher capital intensity and leverage and in industries exposed to the transmission of COVID-19. Baker et al. (2020) document that the magnitude of market reaction to COVID-19 was not observed during the previous pandemics and the impact is mainly driven by reactions to government lockdowns and restrictions.

While these studies are on the overall market responses, Ding et al. (2020) evaluate variation in stock market effects across firms. Firms with more cash, less debt, supply chains with lower exposure to COVID-19, and more CSR activities are less affected by the pandemic. Similarly, Ramelli and Wagner (2020) find that firms more involved in international trade suffer larger stock price declines. Conducting a text-based analysis, Hassan et al. (2020) show that firms concern about uncertainty, demand-related issues, and supply chain problems during the pandemic and those firms with low sentiment experience larger stock price declines. In a study of 896 commercial banks from 53 countries, Demirguc-Kunt et al. (2020) compares the performance of bank stocks to non-financial firms during the period between March and April in 2020 and find underperformance of bank stocks. Overall, these two sets of studies on COVID-19 impacts on the stock market ignore geographic exposure of firms or markets to COVID-19.

Different from these studies, our stock return analysis on banks incorporates the geographic exposure of banks to COVID-19. Our paper is among the first testing whether geographic COVID-19 exposure has an impact on stock returns such as the study by Ling et al. (2020). The authors evaluate stock market reaction to the geographic exposure to COVID-19 for the

real estate investment trusts (REITs) using the locations of properties owned by REITs. In our study, we benefit from bank branch locations.

We also contribute to the banking literature on COVID-19. So far, COVID-19 studies mainly focus on the credit channel expansion through either firms' or lenders' perspectives. O'Hara and Zhou (2020) document that there was an immediate liquidity crisis in the bond markets but the intervention by the Federal Reserve has helped but not fully eliminated the liquidity crisis. Relatedly, Li et al. (2020) show that banks are able to accommodate the demand in liquidity by firms with the support of the government and the Federal Reserve. On the other hand, our paper contributes to this evolving literature by focusing on the COVID-19 impacts on bank stability and show whether liquidity injections that are evaluated in the literature so far help avoid bank stability issues in the short run.

The paper continues as follows: Section 2 explains how we create our COVID-19 exposure measure and discusses the geographic exposure to COVID-19. In Section 3, we explain our data and model. We present and discuss our findings in Section 4. In the final section, we conclude.

2 Geographic Exposure to COVID-19

To construct our measure for banks' geographic exposure to COVID-19, we collect daily COVID-19 data at US county level from the COVID-19 database of Johns Hopkins University.[2] We use COVID-19 daily data starting from March 22, 2020 and ending on June 30, 2020, the end of second quarter. After collecting the daily COVID-19 cases by county, we normalize them by the population of a county. We obtain population data from the US Census Bureau and calculate daily COVID-19 cases per 1,000 people.

To quantify the geographic exposure to COVID-19 of each bank, we create a weighted average of daily cases per 1,000 people using banks' branch deposits. We gather the annual deposit data at branch level from S&P Global Market Intelligence (formerly SNL Financial).

[2]For more details, please visit https://github.com/CSSEGISandData/COVID-19.

We match the deposit data of bank branches with the number of cases per 1,000 people using the counties of bank branches. We then define the daily weighted COVID-19 exposure for each bank proxied by the weighted number of cases per 1,000 people using the following formula:

$$COVID\text{-}19\ Exposure_{i,t} = \frac{\sum_j Deposits_{i,j,t} * COVID\text{-}19_{i,j,t}}{Deposits_{i,t}} \quad (1)$$

where i denotes bank i, j denotes branch j, and t denotes day t.

COVID-19 exposure measure is set to zero if there are no cases observed in the counties that a bank operates. The variable captures cross-sectional variation in the COVID-19 exposure across banks instead of using time dummies capturing COVID-19 days or quarters as in most recent studies. Overall, our COVID-19 exposure measure helps us quantify the geographic exposure of banks individually.

Figure 1 shows the evolution of the weighted average number of COVID-19 cases per 1,000 people for the banks that are at the 25th, 50th, and 75th percentile based on COVID-19 exposure. The figure reflects the daily variation in the COVID-19 exposure across banks. The differentials between these selected three banks widen as COVID-19 cases increase.

[Figure 1 about here.]

We use the quarterly mean of the COVID-19 exposure measure as our aim is to relate COVID-19 exposure to bank financial stability and performance, which are quarterly available. We have two shock quarters, the first and second quarters of 2020, captured by the positive values of COVID-19 exposure. Many papers on COVID-19 focus on the first quarter of 2020 but in our analysis, it is zero for many banks as the pandemic started in a small number of counties in late March and very close to zero for the rest. We create a panel setup for this purpose and also include pre-shock quarters starting from 2019Q1. Overall, our sample covers data from 2019Q1 to 2020Q2.

3 Data and Model

3.1 Data

We collect our banking data from S&P Global Market Intelligence. We first create our bank stability and performance measures. In our analysis, our dependent variables are Z-Score, ROA, NPL ratio, and equity volatility. Following Demirgüç-Kunt and Huizinga (2010), we define Z-Score as the natural logarithm of return on assets plus equity capital ratio divided by the standard deviation of return on assets over the last 4 quarters.[3] ROA is the return on average assets. NPL ratio is the summation of total non-accrual loans and total loans that are past due 30 to 89 days but still accruing interest and loans that are past due 90 or more days but still accruing interest, divided by the first lag of a bank's total loans. In order to calculate equity volatility for the publicly listed banks, we collect daily stock return data from the Center for Research in Security Prices (CRSP). Equity volatility is the annualized volatility of daily stock returns of a bank computed within a quarter.

Similar to the existing literature on COVID-19, we relate our geographic COVID-19 measure to cumulative abnormal returns (CARs). We run a capital asset pricing model for the daily period between May 9, 2019 and Feb 3, 2020 for the 270-day period before the shock starts in order to calculate abnormal returns during the COVID-19 shock period until June 30, 2020. We calculate CARs for the next day, days [0,1], and days [0,2] from the observation of the first case in our sample, that is March 22, 2020.

We also study NPL ratios by loan categories. We specifically analyze NPL ratios for consumer loans, residential mortgages calculated for one-to-4-family residential properties, commercial loans, and commercial mortgages including multifamily properties.

In all of our regressions, we use multiple firm- and state-level macro controls. Firm controls include the ratio of equity capital to total assets, the ratio of total loans and leases to

[3]Our shock quarter is mainly one quarter so the impact of the shock quarter is limited to the volatility in ROA. To capture the impact of the shock, we limit our Z-score calculations to 4 quarters. Our results are also robust to using 6 quarters.

total assets, and the natural logarithm of total assets. We weight deposit shares by branches by state and create weighted average state-level controls. The state-level controls are GDP growth rate, housing price index return, home ownership rate, and unemployment rate. We obtain macro variables from the Federal Reserve Economic Data (FRED). All variables are winsorized at 1% and 99% levels.

After merging COVID-19 exposure data with bank financials and cleaning for missing observations, we have data on 4,626 banks. In our larger sample, we have 8,662 firm-quarters during the shock period and 19,026 firm-quarters covering the pre-shock quarters. We have fewer observations for equity volatility as it only covers publicly listed banks. The number of observations is also lower for the NPL ratios by loan types due to the availability of the variables.

[Table 1 about here.]

Table 1 summarizes the descriptive statistics. The weighted average number of COVID-19 cases per 1,000 is 1.94. The mean of Z-Score statistically significantly declines from 4.16 to 3.85 during the pandemic quarters. Similarly, ROA goes down by 11 bps at the 1% significance level. We do not observe a significant change in NPL ratio in the univariate analysis. Equity volatility more than doubles during the pandemic. Banks generate negative CARs during the pandemic, as expected. The NPL ratios for consumer loans and residential mortgages decline, while the change is not statistically significant for commercial loans and commercial mortgages.

Among control variables, we do not see a significant change in equity capital to total assets ratio and loan to assets ratio. The mean of weighted average GDP in the states that bank operations decline potentially due to the shutdown in the economies, while in our sample the decline is limited as it covers the lagged GDP growth. We also observe a decrease in the mean of the returns on housing price indices, but an increase in home ownership ratio. Unemployment statistically significantly increases, as expected.

3.2 Model

We develop a panel setup merging financials observed in the quarters of 2019 with 2020Q1 and 2020Q2. Then, relating geographic exposure to COVID-19 to our financial stability and performance measures, we run the following model:

$$y_{i,t} = \beta_0 + \beta_1 \textit{COVID-19 Exposure}_{i,t} + \beta_2 x_{i,t-1} + \gamma_t + \delta_i + u_i \tag{2}$$

where y_i is the financial stability and performance indicator for bank i. Our dependent variables are Z-Score, ROA, NPL ratio, and equity volatility. $x_{i,t-1}$ is a matrix of covariates: bank characteristics and macro controls. γ_t are year-quarter fixed effects and δ_i are state- and bank-fixed effects.

Our main variable of interest is COVID-19 Exposure calculated as in Equation (1). Model (2) represents a diff-in-diff model. COVID-19 exposure is set to zero if there are no cases that bank is exposed to. Before 2020Q1, there are no observed cases so it is the same as interacting those quarters by a treatment dummy which will be set to zero for those quarters. In a typical diff-in-diff model, we are interested in the interaction term between shock period dummies and the continuous treat variable. COVID-19 exposure variable in Model (2) represents the interaction term as we control for year-quarter fixed effects. We expect that β_1 is negative in Z-Score, ROA, and CAR regressions and positive in NPL ratio and equity volatility regressions indicating that as a bank becomes more exposed to COVID-19, Z-Score, ROA, and CARs will decline and NPL ratios and equity volatility will go up.

$x_{i,t-1}$ cover bank characteristics such as the ratio of equity capital to total assets, the ratio of total loans and leases to total assets, and the natural logarithm of total assets and macro variables such as GDP growth rate, housing price index return, home ownership rate, and unemployment rate. In all regressions, we control for bank fixed effects, state fixed effects, and year-quarter fixed effects. In our CAR regressions, CAR and COVID-19 exposure

variables are daily while we still use quarterly observations for the control variables. We control for day fixed effects instead of quarter fixed effects in CAR regressions.

4 Results

4.1 Main Results

We start our analysis by evaluating the impact of COVID-19 exposure on bank stability and performance. Table 2 presents the results. We find that as the COVID-19 exposure of a bank increases, Z-Score and ROA go down at the 1% significance level. Similarly, NPL ratio and equity volatility increase statistically significantly at the 1% level. To put this into perspective, one-standard-deviation increase in COVID-19 exposure lowers Z-score by 0.02 and ROA by 0.05 standard deviations. NPL ratio and equity volatility decrease by 0.03 standard deviations if COVID-19 exposure increases by one standard deviation.

[Table 2 about here.]

These findings indicate that bank stability and performance deteriorate even in one quarter despite the unseen levels of liquidity injections. We observe that the coefficients of loans to assets ratio in ROA and NPL ratio regressions are statistically significant, indicating that a higher value of loans to assets ratio increase ROA and decrease NPL ratio. However, there is no significant effect of loan to assets ratio on Z-Score or equity volatility. Overall, while supplying more loans help firms perform better and lower NPL ratios, it does not eliminate the negative impact of COVID-19 exposure. These findings demonstrate a warning sign for the impact of COVID-19 exposure on bank stability. Our general findings indicate that there are significant stability concerns due to the pandemic even in a liquidity-backed environment.

[Table 3 about here.]

We next turn our attention to market reaction and test whether markets price the geographic variation in COVID-19 exposure for US banks. We present our findings in Table 3. We calculate CARs using daily data by the next day, from day zero to day one, and from day zero to day two and then regress on daily COVID-19 exposure. Our findings reflect that increase in COVID-19 exposure decreases all CAR variables at the 1% significance level.

A one-standard-deviation increase in COVID-19 lowers CARs by 0.24 standard deviations for CAR[1], 0.32 standard deviations for CAR[0,1], and 0.41 standard deviations for CAR[0,2]. These findings are comparable to Ling et al. (2020), who evaluate the geographic exposure to COVID-19 of US REITs. The authors find that one-standard-deviation increase in COVID-19 exposure decreases next-day abnormal return by 0.24 standard deviations. Overall, our results reflect that while the geographic exposure to COVID-19 matter for bank stability and performance, investors also price the cross-sectional variation in the geographic exposure of COVID-19 across banks.

[Figure 2 about here.]

Figure 2 shows the evolution of CARs for the banks which are at the 25th, 50th, and 75th percentile based on COVID-19 exposure. While the bank in the 25th percentile does not experience much declines in stock prices based on CARs, the banks at the 50th and 75th percentiles based on COVID-19 exposure have larger stock price declines. All three banks show monotonic declines in stock prices based on COVID-19 exposure.

4.2 Variation in COVID-19 Impacts

The main focus in the banking literature has been on the credit expansion by banks with the support of the government and the Federal Reserve (Li et al., 2020). Our paper deals with the effects of COVID-19 on financial stability and performance. Our main findings reflect that banks are negatively affected by the pandemic and the magnitude of their geographic exposure to COVID-19 matters. While the results in Table 2 demonstrate that liquidity

injections are not sufficient to avoid bank stability issues, we further analyze the credit channel expansion.

We first calculate the growth in loan size from 2019Q4 to 2020Q2 for each bank. This measure reflects how a bank has increased their loan supply to firms with the start of the pandemic. In Figure 3, we compare banks' COVID-19 exposure to banks' loan growth by states. In Panel A, we obtain the mean of weighted COVID-19 exposure by banks for each state and map it. In Panel B, we calculate the mean of loan growth from 2019Q4 to 2020Q2 by state and map it. It can be expected that loan growths should be more prominent in the states in which more COVID-19 exposed banks operate. However, the comparison of the two heat maps do not reflect much correlation. COVID-19 cases are more dominant on the East Coast but loan growth is more apparent on the West Coast.

[Figure 3 about here.]

We then rank banks based on the loan growth and divide the sample in two based on the median loan growth and rerun our regressions. We expect that banks that can increase loan supply more are less affected than the banks that can increase loan supply less. Table 4 presents the results.

[Table 4 about here.]

Our findings demonstrate that the banks in the above-median credit expansion group do not experience significant stability distortions measured by Z-Score and equity volatility. They still suffer a decline in ROA and increase in NPL ratio. On the other hand, the stability and performance measures of the banks in the below-median credit expansion group all worsen statistically significantly.

[Table 5 about here.]

We add one additional layer to the bank groups with above- and below-median credit expansion. We also group banks based on their equity capital capacity. We first estimate equity

capital to total assets ratio on the $x_{i,t-1}$ covariates for the quarters in 2019 to determine a bank's equity capital capacity. We then divide the firms into banks with above- and below-median equity capital capacity. We rerun our specification based on the intersection of these two groupings: Banks with above-median equity capital capacity and above-median credit expansion vs. banks with below-median equity capital capacity and below-median credit expansion. Financial stability and performance of banks with low credit expansion and low equity capital capacity are negatively affected by more COVID-19 exposure. On the other hand, COVID-19 exposure does not have any significant impact on stability and performance for banks with high equity-capital capacity making larger credit expansion.

These findings indicate that banks with limited credit expansion have more severe distortions in bank stability and performance. However, banks with flexibility to expand credit channels are able to avoid stability issues if their equity capital capacity is also larger. Our results support that credit expansion policies are helpful but might not be sufficient to protect bank stability and banks experience bank stability issues even in liquidity-backed environment.

Li et al. (2020) show that liquidity expansions have occurred mainly in commercial and industrial loans rather than consumer loans in the first weeks of the pandemic. Benefiting from this, we also investigate the NPL ratios by loan type. Our prior is that since there are larger and prompt credit expansions for commercial loans, we expect a lower COVID-19 effect on the NPL ratios of those loans than consumer loans or residential mortgages. Our results are shown in Table 6.

[Table 6 about here.]

As expected, our findings reflect that there is no statistically significant increase in the NPL ratios of commercial loans and commercial mortgages. On the other hand, the NPLs of consumer loans and residential mortgages significantly increase if a bank's geographic exposure to COVID-19 increases. A one-standard deviation increase in COVID-19 increases NPL ratios of consumer loans and residential mortgages by 0.28 and 0.04 standard deviations,

respectively. These findings also support that credit channel expansion helps banks protect their financial performance.

[Table 7 about here.]

Lastly, we evaluate COVID-19 impacts on bank stability due to variations in race. To evaluate the impact of race on the relationship, we first calculate the share of black population in each county. We create a weighted average share of black population using the branch deposits for each bank. Then, we rank banks based on this measure and divide our sample into two to determine whether a bank operates in locations with an above-median or below-median proportion of black population. Interestingly, our findings show that the banks operating in locations with an above-median proportion of black population significantly suffer stability and performance deterioration. However, banks operating in the locations with a below-median proportion of black population do not experience any significant worsening in bank stability and performance. While we do not have a prior or an assumption that credit expansion is less available to the black community, our findings might hint that there could be differences in the accessibility to credit channels by race. Accordingly, this finding might be attributed to the effectiveness of liquidity expansion and accessibility to credit expansion.

5 Concluding Remarks

The Great Depression originated from the real estate markets and was more related to excessive risk taking by US banks. Accordingly, the banking literature has evolved based more on governance related issues. On the other hand, the COVID-19 crisis is unique and lockdowns mainly create liquidity concerns for firms. A quick response to the shock has been liquidity injections by central banks and governments through banks to ease the economic effects. Banks expanded credit channels by enormous amounts in a very short time.

Accordingly, the immediate reaction in the literature has been on the liquidity of credit channels (Li et al., 2020; O'Hara and Zhou, 2020). Our focus in this paper is to evaluate the

impact of COVID-19 on bank stability and performance in a liquidity-backed environment. In contrast to many earlier papers on COVID-19, we concentrate on the geographic exposure to COVID-19 of US banks. We mainly find that bank stability measured by Z-Score and equity volatility and performance measured by ROA and NPL ratio worsen if a bank is more exposed to COVID-19 geographically. Our CAR analyses demonstrate that investors price cross-sectional variation in the exposure to COVID-19 across banks.

We then evaluate whether there is any variation across banks based on if they increase credit channels above- or below-median levels during the pandemic. We find that banks that expand credit channels at below-median levels have statistically significant stability and performance distortions. Those banks with above-median credit expansion could avoid significant stability issues from COVID-19 exposure if they have larger equity capital capacity.

Our findings on the NPL ratios of different loan types are consistent with these findings. We find that NPL ratios significantly increase with COVID-19 exposure for consumer and residential mortgages. However, there is no significant increase in NPL ratios due to COVID-19 exposure for commercial loans and commercial mortgages where we observe significant credit expansions for these types of loans. Lastly, we document that the impact of COVID-19 exposure on bank stability and performance is only evident for the banks operating in locations with an above-median proportion of black population as opposed to the banks operating in locations with a below-median proportion of black population. These findings might signal differences in the accessibility to credit expansion across different banks or borrowers.

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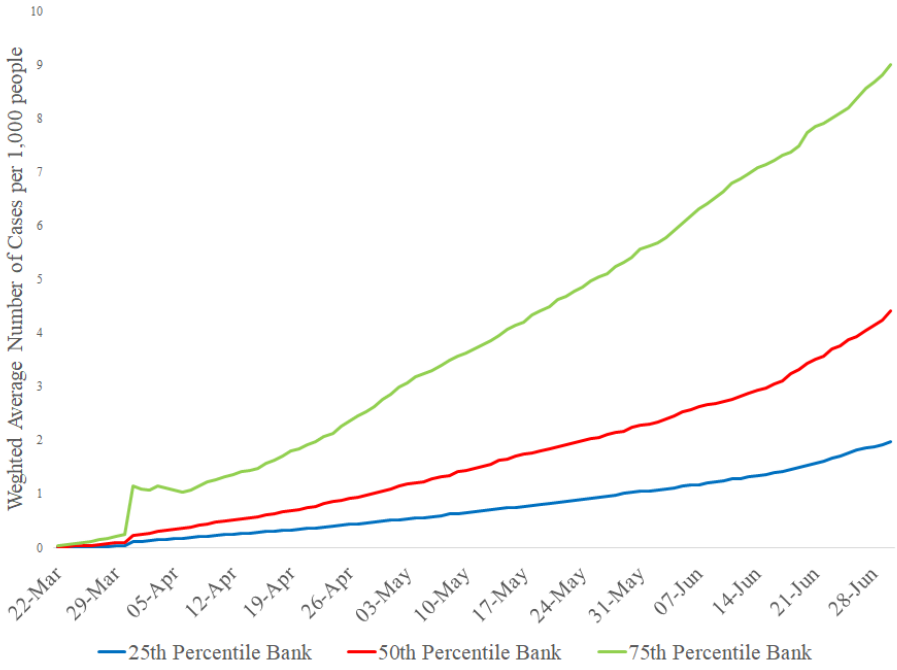
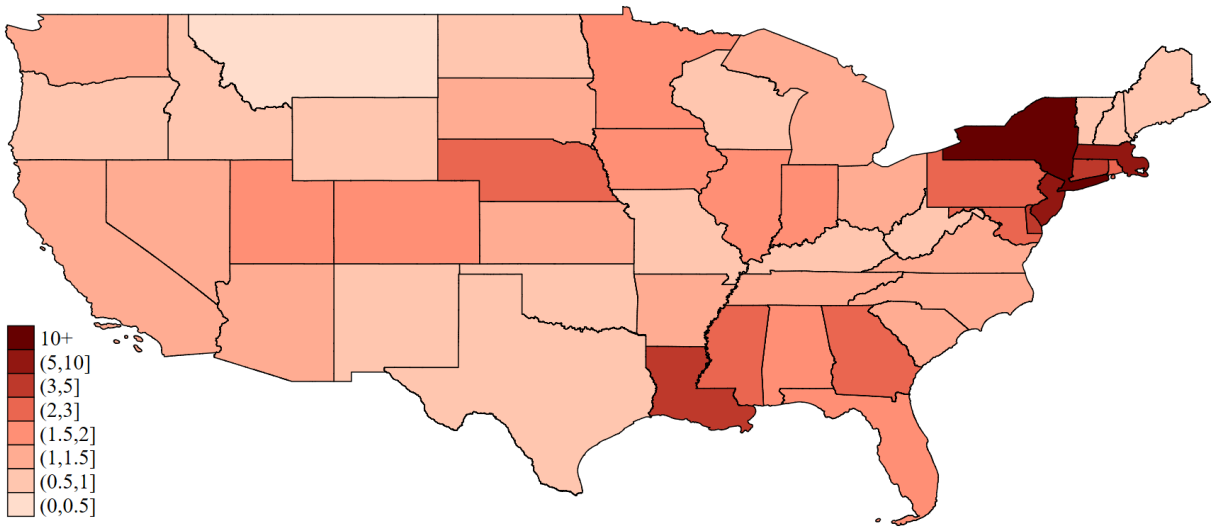
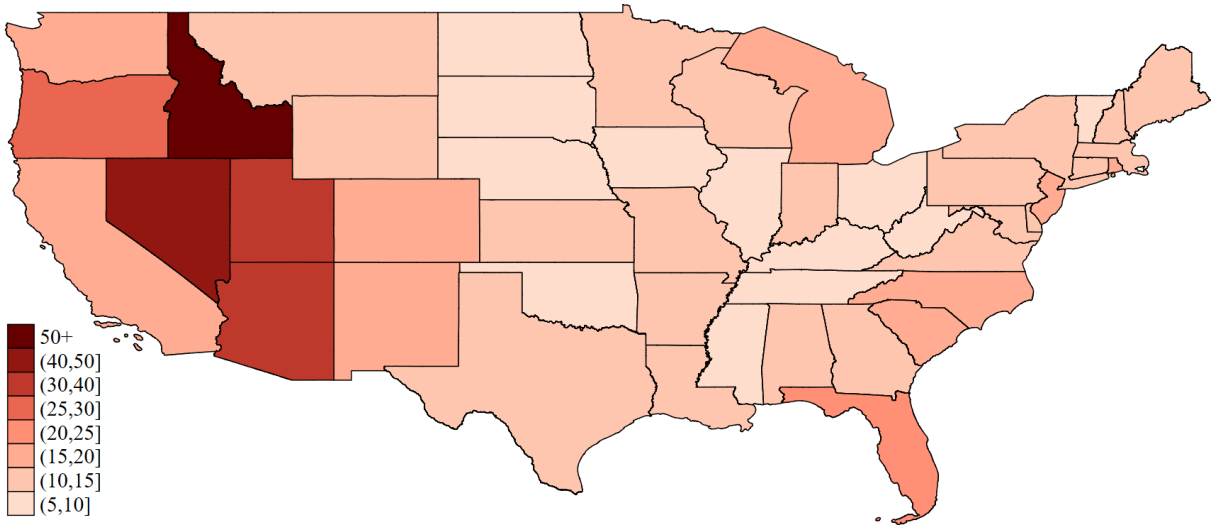


Figure 1. Geographic Exposure to COVID-19 by 25th, 50th, and 75th Percentile Banks

Figure 2. Normalized Stock Price by CARs for the 25th, 50th, and 75th Percentile Banks Ranked by COVID-19 Exposure



Panel A. Banks' Geographic Covid-19 Exposure by States



Panel B. Banks' Loan Growth from 2019Q4 to 2020Q2 by States

Figure 3. Banks' COVID-19 Exposure vs. Loan Growth

Descriptive Statistics

	During COVID-19			Before COVID-19			
	N	Mean	SD	N	Mean	SD	Mean Difference
COVID-19 Exposure	8,662	1.94	2.06	19,026	0.00	0.00	1.94***
Bank Stability and Performance							
Z-Score (%)	8,662	3.85	0.15	19,026	4.16	0.32	-0.31***
ROA (%)	8,662	1.05	0.18	19,026	1.16	0.19	-0.11***
NPL (%)	8,662	1.84	0.27	19,026	1.85	0.37	-0.01
Equity Volatility (annualized, %)	1,557	984.20	147.83	3,110	370.00	90.28	614.20***
Abnormal Returns							
CAR [1] (annualized, %)	49,894	-41.04	422.59				
CAR [0,1](annualized, %)	49,894	-80.21	580.90				
CAR [0,2] (annualized, %)	49,894	-115.03	687.52				
NPL Ratios by Loan Type							
Consumer (%)	8,346	1.50	0.23	18,352	1.61	0.39	-0.11**
Residential Mortgage (%)	8,346	1.94	0.29	18,352	2.09	0.43	-0.15***
Commercial (%)	8,346	2.20	0.28	18,352	2.19	0.54	0.01
Commercial Mortgage (%)	8,346	1.67	0.19	18,352	1.70	0.35	-0.03
Controls							
Equity Capital (%)	8,662	11.97	0.10	19,026	11.94	0.23	0.03
Loans (%)	8,662	66.13	0.50	19,026	66.16	1.58	-0.03
Assets (in logs)	8,662	19.53	0.02	19,026	19.38	0.02	0.15***
GDP Growth (%)	8,662	-1.47	4.88	19,026	1.76	1.09	-3.23***
Housing PI (%)	8,662	0.89	0.15	19,026	1.11	0.59	-0.22***
Home Ownership (%)	8,662	67.36	0.67	19,026	66.77	1.22	0.59***
Unemployment (%)	8,662	3.60	0.57	19,026	3.53	0.37	0.07***

Table 1. The table presents the descriptive statistics. Z-Score is defined as the natural logarithm of return on assets plus equity capital ratio divided by the standard deviation of return on assets over the last 4 quarters. ROA is calculated as the return on average assets. NPL ratio is the summation of total non-accrual loans and total loans that are past due 30 to 89 days but still accruing interest and loans that are past due 90 or more days but still accruing interest, divided by the first lag of a bank's total loans. Equity volatility is the annualized volatility of the equity returns of the bank, computed using daily data for each quarter. CAR [1] is the abnormal return by the next day. CAR [0,1] is the cumulative abnormal return from day zero to one. CAR [0,2] is the cumulative abnormal return from day zero to two. All CARs have annualized values. Bank-level characteristics are asset size, equity capital to assets and loans to assets. State-level characteristics include GDP growth, percentage change in housing price index, home ownership rate, and unemployment rate. NPL ratio and its subcategories, equity capital to assets, loans to assets, GDP growth, home ownership rate, and unemployment rate are reported in percentages. Standard deviations in the table are for the median bank. t-statistics for the mean difference test uses standard deviations from the whole sample. Significance is indicated as follows: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

COVID-19 Impacts on Bank Stability and Performance

VARIABLES	(1) Z-Score	(2) ROA	(3) NPL	(4) Equity Volatility
COVID-19 Exposure	-0.004***	-0.006***	0.006***	5.270***
	(-2.695)	(-2.859)	(2.654)	(2.952)
Equity Capital	-0.015***	-0.088***	-0.008	-30.940***
	(-2.593)	(-8.884)	(-0.846)	(-2.857)
Loans	0.001	0.016***	-0.017***	1.809
	(0.679)	(6.776)	(-7.437)	(0.707)
Assets	-0.152**	0.786***	-0.417***	99.797
	(-2.183)	(6.735)	(-3.576)	(0.954)
GDP Growth	0.007**	0.035***	-0.005	-12.734**
	(1.971)	(5.968)	(-0.823)	(-1.968)
Home Ownership	-0.009***	-0.015***	-0.003	12.440**
	(-3.374)	(-3.230)	(-0.596)	(2.489)
Housing Price Index	-0.033***	-0.026	0.004	23.369
	(-2.657)	(-1.252)	(0.169)	(0.947)
Unemployment	-0.019	0.025	0.040	20.506
	(-1.209)	(0.932)	(1.510)	(0.831)
Constant	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	27,688	27,688	27,688	4,667
Adjusted R-squared	0.640	0.585	0.795	0.478

Table 2. The table presents the main results for the impact of COVID-19 on bank stability and financial performance. Variable descriptions are as in Table 1. The regressions include state, year-quarter, and bank fixed effects. Heteroskedasticity-robust standard errors are reported in parentheses. Significance is indicated as follows: * p<0.1; ** p<0.05; *** p<0.01.

COVID-19 Impacts on Abnormal Returns

VARIABLES	(1) CAR [1]	(2) CAR [0,1]	(3) CAR [0,2]
COVID-19 Exposure	-0.495***	-0.905***	-1.381***
	(-2.659)	(-3.726)	(-4.680)
Equity Capital	6.654***	11.356***	17.489***
	(4.581)	(5.989)	(7.591)
Loans	-0.165	-0.146	-0.356
	(-0.459)	(-0.312)	(-0.623)
Assets	-6.074	-13.348	-17.053
	(-0.384)	(-0.646)	(-0.680)
GDP Growth	-1.017	-1.799	-2.926*
	(-1.057)	(-1.432)	(-1.917)
Home Ownership	-0.881	-1.602*	-2.428**
	(-1.277)	(-1.780)	(-2.219)
Housing Price Index	0.338	0.648	0.025
	(0.101)	(0.148)	(0.005)
Unemployment	0.440	0.445	0.648
	(0.128)	(0.099)	(0.119)
Constant	Yes	Yes	Yes
State FE	Yes	Yes	Yes
Day FE	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes
Observations	206,348	206,348	206,348
Adj. R-squared	0.128	0.131	0.142

Table 3. The table presents the results for the impact of COVID-19 on abnormal returns. Variable descriptions are as in Table 1. Heteroskedasticity-robust standard errors are reported in parentheses. Significance is indicated as follows: * p<0.1; ** p<0.05; *** p<0.01.

COVID-19 Impacts on Bank Stability and Performance by Credit Line Expansion

VARIABLES	(1) Z-Score	(2) ROA	(3) NPL	(4) Equity Volatility
	Panel A. Above-Median Credit Expansion			
COVID-19 Exposure	-0.001	-0.010**	0.005*	3.647
	(-0.702)	(-2.573)	(1.646)	(1.602)
Constant	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	13,856	13,856	13,856	3,104
Adjusted R-squared	0.616	0.255	0.737	0.463
	Panel B. Below-Median Credit Expansion			
Weighted Covid	-0.007***	-0.004*	0.007**	7.747***
	(-3.864)	(-1.742)	(2.083)	(2.707)
Constant	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	13,769	13,769	13,769	1,553
Adjusted R-squared	0.659	0.791	0.810	0.512

Table 4. The table presents the results for the impact of COVID-19 on bank stability and financial performance based on its loan growth. Variable descriptions are as in Table 1. The regressions include state, year-quarter, and bank fixed effects. Heteroskedasticity-robust standard errors are reported in parentheses. Significance is indicated as follows: * p<0.1; ** p<0.05; *** p<0.01.

COVID-19 Impacts on Bank Stability and Performance by Credit Line Expansion

VARIABLES	(1) Z-Score	(2) ROA	(3) NPL	(4) Equity Volatility
	Panel A. Above-Median Credit Expansion & Equity Capital Capacity			
COVID-19 Exposure	-0.005	-0.009	0.000	26.017
	(-1.160)	(-1.410)	(0.003)	(1.605)
Constant	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	5,714	5,714	5,714	509
Adjusted R-squared	0.652	0.425	0.691	0.124
	Panel B. Below-Median Credit Expansion & Equity Capital Capacity			
COVID-19 Exposure	-0.006***	-0.005**	0.006*	4.740*
	(-2.744)	(-2.116)	(1.951)	(1.922)
Constant	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	5,604	5,604	5,604	1,155
Adjusted R-squared	0.610	0.511	0.790	0.642

Table 5. The table presents the results for the impact of COVID-19 on bank stability and financial performance based on loan growth and equity capital capacity. Variable descriptions are as in Table 1. The regressions include state, year-quarter, and bank fixed effects. Heteroskedasticity-robust standard errors are reported in parentheses. Significance is indicated as follows: * p<0.1; ** p<0.05; *** p<0.01.

COVID-19 Impacts on NPLs by Loan Type

VARIABLES	(1) Consumer	(2) Residential Mortgage	(3) Commercial	(4) Commercial Mortgage
COVID-19 Exposure	0.027***	0.011**	-0.004	0.009
	(3.359)	(1.997)	(-0.376)	(1.472)
Equity Capital	0.015	0.024	-0.096**	0.025
	(0.490)	(1.057)	(-2.038)	(1.003)
Loans	-0.021***	-0.042***	-0.013	-0.004
	(-2.968)	(-8.063)	(-1.229)	(-0.756)
Assets	-0.043	-0.641**	-1.196**	0.270
	(-0.125)	(-2.552)	(-2.279)	(0.953)
GDP Growth	-0.017	-0.041***	0.011	-0.035**
	(-0.976)	(-3.254)	(0.403)	(-2.474)
Home Ownership	0.012	-0.006	-0.021	0.003
	(0.850)	(-0.556)	(-1.021)	(0.264)
Housing Price Index	0.094	0.011	0.121	0.030
	(1.522)	(0.242)	(1.305)	(0.599)
Unemployment	-0.005	0.040	-0.046	0.122*
	(-0.060)	(0.717)	(-0.393)	(1.918)
Constant	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	26,698	26,698	26,698	26,698
Adjusted R-squared	0.373	0.644	0.393	0.569

Table 6. The table presents the results for the impact of COVID-19 on the categories of NPL, that are NPLs of consumer loans, residential mortgages, commercial loans, and commercial mortgages. Variable descriptions are as in Table 1. The regressions include state, year-quarter, and bank fixed effects. Heteroskedasticity-robust standard errors are reported in parentheses. Significance is indicated as follows: * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Bank Stability and Performance by Weighted Average Share of Black Population

VARIABLES	(1) Z-Score	(2) ROA	(3) NPL	(4) Equity Volatility
	Panel A. Above-Median Black Population			
Weighted Covid	-0.003**	-0.006**	0.006***	3.952**
	(-2.036)	(-2.231)	(2.776)	(2.310)
Constant	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	13,694	13,694	13,694	3,103
Adjusted R-squared	0.638	0.637	0.793	0.523
	Panel B. Below-Median Black Population			
Weighted Covid	-0.002	0.002	-0.003	6.233
	(-0.526)	(0.238)	(-0.327)	(0.592)
Constant	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes
Year-Quarter FE	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Observations	13,886	13,886	13,886	1,536
Adjusted R-squared	0.645	0.407	0.796	0.398

Table 7. The table presents the results for the impact of COVID-19 on bank stability and financial performance based on the share of black population. Variable descriptions are as in Table 1. The regressions include state, year-quarter, and bank fixed effects. Heteroskedasticity-robust standard errors are reported in parentheses. Significance is indicated as follows: * p<0.1; ** p<0.05; *** p<0.01.