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Ross Levine
Chen Lin
Mingzhu Tai
Wensi Xie

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ABSTRACT

Why did banks experience massive deposit inflows during the first months of the pandemic? Using weekly branch-level data on interest rates and county-level data on COVID-19 cases, we discover that interest rates at bank branches in counties with higher COVID-19 infection rates fell by more than rates at other branches—even branches of the same bank in different counties. When differentiating weeks by the degree of stock market distress and counties by the likely impact of COVID-19 cases on economic anxiety, the evidence suggests that the deposit inflows were triggered by a surge in the supply of precautionary savings.

Ross Levine
Haas School of Business
University of California at Berkeley
545 Student Services Building, #1900 (F685)
Berkeley, CA 94720-1900
and NBER
Ross_levine@haas.berkeley.edu

Chen Lin
Faculty of Business and Economics
The University of Hong Kong
Hong Kong
chenlin1@hku.hk

Mingzhu Tai
Faculty of Business and Economics
The University of Hong Kong
Hong Kong
taimzh@hku.hk

Wensi Xie
Department of Finance
Chinese University of Hong Kong
Hong Kong
wensixie@cuhk.edu.hk

1. Introduction

U.S. banks experienced massive deposit inflows during the first months of the COVID-19 pandemic. At a national level, total deposits increased from $13 trillion in January to $15 trillion in April of 2020 (see Figure 1). At a local level, banks branches in counties with higher COVID-19 infection rates, as measured by cases per capita, experienced more rapid deposit growth rates (see Figure 2). Furthermore, average saving rates surged over this period, with monthly personal savings as a percentage of personal income rising from about eight percent in January and February to over 30% in April (Figure 3). While it is clear that deposits and savings increased, it is unclear what drove these developments.

There are at least four distinct, though not mutually exclusive, views of why deposits surged during the first months of the COVID-19 pandemic. First, the precautionary savings view suggests that as the pandemic deepened concerns about economic disruptions and layoffs (e.g., Acharya and Steffen 2020), households boosted savings as a precaution against declines in future income, and some of those additional savings flowed into bank deposits (e.g., Browning and Lusardi 1996). This view also offers cross-county predictions about the relation between COVID-19 and both bank deposits and deposit interest rates. Given well-documented differences in COVID-19 infection rates across U.S. counties and assuming that these differences translate into cross-county differences in concerns about future income, the precautionary savings view suggests a positive relation between COVID-19 cases and bank deposits at the county level. Furthermore, the COVID-19 driven increase in local deposits will reduce local deposit interest rates, as long as there is some segmentation of banking markets. Although past research provides mixed evidence on the importance of precautionary savings (e.g., Dynan 1993; Starr-McCluer 1996; Carroll and Samwick 1998; Engen and Gruber 2001, Agarwal and Qian 2014; D'Acunto et al. 2020), we make an initial effort to evaluate the precautionary savings view in the context of a pandemic such as the COVID-19 using granular and high frequency data.

Second, the "flight-to-safety" view stresses that adverse financial market shocks induce people to flee from risky investments and into the safety of bank deposits (e.g., Bernanke Gertler, and Gilchrist 1996; Kashyap, Rajan, and Stein 2002; Gatev and Strahan

2006; Cornett et al. 2011), while stock market booms are associated with a reduction in households' demand for deposits (Lin 2019). When applied to the COVID-19 pandemic, this flight-to-safety view suggests that COVID-19 triggered financial market panic that prompted investors to allocate more of their savings to deposits. The COVID-19 crisis, however, is qualitatively different from the crises underlying past flight-to-safety studies, because the COVID-19 crisis did not originate as a shock to the financial sector. Thus, past research on the flight-to-safety view may not apply to the COVID-19 crisis. It is also valuable to note that the flight-to-safety view does not offer clear predictions about the cross-county intensity with which individuals reallocate their savings out of risky financial markets and into the safety of bank deposits. Specifically, although the view asserts that increases in the riskiness of national capital markets induce a generalized flight into deposits, the flight-to-safety view does not necessarily predict that this flow out of capital markets and into deposits will be greater in counties with higher COVID-19 infection rates.

A third view stresses that COVID-19 may have induced an increase in the demand for deposits. If businesses drawdown their lines of credit with banks in response to the economic disruptions triggered by the pandemic, then banks may increase rates to attract deposits in order to satisfy those drawdowns. Consistent with this demand-side effect, Acharya and Mora (2015) find that banks facing greater liquidity risks during the 2007-2009 financial crisis offered higher deposit interest rates. From this perspective, the pandemic-induced surge in bank deposits is driven by a demand shock, not a shock to the supply of deposits. One strategy for evaluating the comparative roles of demand and supply shocks is to examine prices, i.e., to examine how the pandemic influenced deposit interest rates.

A fourth explanation notes that expansionary monetary and fiscal policies could have triggered the flow into deposits (e.g. Agarwal et al., 2020). From this perspective, the Federal Reserve's asset purchases and lending programs and the Federal government's spending programs may have induced deposits to swell. The massive increase in deposits, therefore, might have more to do with national policies than with actions driven by a flight-to-safety, precautionary savings, or banks' demand-for-deposits.

In this paper, we primarily use weekly branch-level data on deposit interest rates and county-level data on COVID-19 cases to evaluate why deposits surged during the first months of the COVID-19 pandemic. For each bank branch, we use weekly data on interest rates on CDs (certificates of deposit). For each county, we use the logarithm of the number of confirmed COVID-19 cases per one million people on the Friday of each week. Our primary sample includes 287,262 branch-week observations over the period from January through April of 2019 and 2020, involving 9,847 branches.

We examine deposit interest rates to help distinguish between views stressing supply- or demand-side shocks. The flight-to-safety, precautionary savings, and expansionary policy views stress that COVID-19 triggered a surge in the supply of deposits, implying a drop in deposit interest rates. In contrast, the demand-for-deposits view predicts that rates will rise as banks seek to attract funds to satisfy borrowers drawing down their credit lines. By examining deposit rates, we provide evidence on which effect dominates.

In our baseline analyses, we regress deposit interest rates at the branch-county-week level on the county's COVID-19 infection rate in the previous week. The analyses include (1) branch fixed effects to help account for any time-invariant, branch-specific factors, (2) state-by-week fixed effects to control for all time-varying national and state-specific considerations, such national financial market fluctuations, national policies, as well as state-level economic conditions, policies, and demographics, and (3) bank-by-week fixed effects to control for time-varying bank characteristics that might be simultaneously correlated with COVID-19 infection and deposit interest rates, so that we can focus on differences in interest rates across a bank's branches in different counties.

We discover that deposit rates at bank branches in counties with higher COVID-19 infection rates fall by more than branches—even branches of the same bank—in otherwise similar counties. The drop in deposit rates following increases in county-level COVID-19 infection rates suggests that shocks to the supply of deposits dominate any increase in banks' demands for deposits, which is consistent with the three supply side views of how the pandemic influenced bank deposits. With respect to the economize size of the impact, the coefficient estimates suggest that a one standard deviation increase in *Ln(Cases per capita)* is associated with an average decline in deposit rates equal to 3.5% of the standard deviation of deposit interest rates when conducting the estimation over the full sample period and 13.6% of the standard deviation of deposit interest rates when focusing on the early weeks of the pandemic, which is before implementation of policies that muted the impact of local COVID-19 cases on deposit interest rates.

The baseline analyses also suggest that an increase in precautionary savings plays a material, independent role in driving the surge in deposits and the drop in deposits rates. In particular, the granular, high-frequency nature of the data and the extensive array of fixed effects mean that our analyses largely control for a flight-to-safety and national policies do not fully account for these developments. First, while the precautionary saving view suggests that local COVID-19 conditions will affect local anxiety about the economy and hence influence local savings and deposits, the flight-to-safety view does not necessarily suggest that the flight out of national capital markets and into banks deposits will be greater in counties with higher COVID-19 infection rates. Thus, by examining how weekly deposit rates at local branches change with local COVID-19 cases while including state-week and bank-week fixed effects, we largely abstract from the flight-to-safety effect. Second, our empirical strategy also controls for national policies by including state-time and bank-time fixed effects. Third, to assess whether the relation between deposit rates and local COVID-19 cases varies across different policy regimes, we show that the results are robust across different sample periods, including (a) before major policy reactions to the crisis, such as the CARES Act and the large payments associated with the Paycheck Protection Program (PPP) and (b) during different periods of the Federal Reserve response. In these ways, we abstract from the impact of national policies on deposits and focus on how a county's exposure to COVID-19 cases shapes deposit interest rates.

We next conduct a series of tests of whether deposit interest rates fall by more in response to increases in COVID-19 infection rates in weeks and counties in which people are likely to be more sensitive to adverse news concerning their economic futures. One factor that could increase people's sensitivity to news about local COVID-19 cases is the overall degree of financial system fragility. In particular, stock market volatility or declining values could create a situation in which an increase in local COVID-19 cases makes people more concerned about the local economy and their economic futures than the same news in better-performing markets. In this way, the anxiety-enhancing effects of national capital market fragility could influence the precautionary savings response to local COVID-19 cases. To evaluate this possibility, we assess whether the relation between deposit interest rates and COVID-19 cases is greater when (a) the stock market is more volatile and (b) the market is performing poorly. This is what we find. The rate-reducing effects are stronger when the stock market is more volatile and when market returns are lower. The results on volatility and stock returns are consistent with the view that (a) local COVID-19 cases create concerns about future income and (b) national financial market fragility magnifies the impact of those COVID-19 cases on the fears that residents have about the economy, generating a bigger surge in precautionary savings.

We then explore three additional implications of the precautionary savings view of how COVID-19 influences deposit interest rates by testing whether deposit interest rates fall by more in response to increases in COVID-19 infection rates in counties likely to be more sensitive to such news. First, news stories and academic research suggests that people aligned with the Democrat Party have responded with greater concern to the COVID-19 pandemic than those aligned with Republican Party. For example, according to an Axios poll in early March, 62% of Republicans believe that the COVID-19 threat is exaggerated, whereas just 31% of Democrats responded similarly. [1] Several recent studies (e.g., Allcott et al 2020; Grossman et al 2020) show significant differences in attitudes and responses towards COVID-19 between residents in Republican leaning counties and those of Democratic counties. Although researchers and commentators provide different explanations for these cross-party differences, we exploit these observations to evaluate an implication for our study: If local COVID-19 cases trigger more concern about future economic conditions in democratic-leaning counties, then the impact of local COVID-19 cases on deposits should be greater in more democratic-leaning counties. Consistent with this view, we discover that the

[1]See, https://www.marketwatch.com/story/republicans-are-far-more-likely-than-democrats-to-think-the-coronavirus-threat-is-exaggerated-new-survey-finds-2020-03-10.

rate-reducing effects of COVID-19 are stronger in counties that align more with the Democratic Party. In particular, the deposit interest rates drops more (a) among counties with a comparatively lower share of votes for Donald Trump in the 2016 election, and (b) among counties in states with a Democratic governor.

Second, if pandemic-generated fear helps drive the reduction in deposit rates, then this effect should be larger in counties with more “COVID-19 sensitive” demographic groups, i.e., where people become more fearful in response to local COVID-19 cases. For example, since older individuals are more susceptible to the disease, we would expect a larger precautionary-induced rush into deposits in counties with a larger proportion of older residents. Furthermore, more educated populations might be more aware of news and analyses discussing potential economic fragilities created by the disease. Under these conditions, COVID-19 will tend to generate stronger effects among more educated people, so that the response to COVID-19 is stronger in counties with more educated residents. Consistent with these views, we find that counties in which a larger proportion of the population is elderly or well-educated experienced sharper declines in deposit interest rates at local banks than other counties.

Third, a large literature on social capital stresses that communities with strong bonds and engagement with each other are more effective at addressing an array of challenges than those with less social connections. When applied to the COVID-19 pandemic, this suggests local COVID-19 cases are likely to induce less panic about future income in communities in which there are stronger social connections that provide emotional support and insurance during times of duress. From this perspective, the increase in deposits associated with precautionary savings is likely to be muted in counties with greater social capital. This is what we find: counties with higher values of *Community Health* experience less of a drop in deposit rates for branches in response to local COVID-19 cases. The results on social capital provide further support for the precautionary savings view of how COVID-19 influences deposit interest rates.

We also examine the quantity of deposits and consumption spending at the bank-county and the county level, respectively. In terms of the quantity of deposits, there are material data limitations. Namely, data on the quantity of deposits in 2020 are only available at the bank-by-county level (not the branch level) and at an annual frequency (not weekly). When conducting the analyses on these available data, we find that deposits increase by more among banks in counties more exposed to COVID-19. There are also data limitations on savings, as we do not have weekly data on savings at the county level. Instead, we examine the degree to which consumption varies with COVID-19 infection by using data on consumer spending at the county-level. We find that consumer spending drops more in counties with a higher COVID-19 infection rate. Though subject to limitations, these analyses of deposits and consumption are consistent with the precautionary savings view of how local COVID-19 infection rates changes in deposits among branches in the county.

Our results suggest that an increase in precautionary savings helps account for the surge in bank deposits in response to the pandemic. Without ruling out that people flee from risky assets into bank deposits, banks increase their demand for deposits, or that national policies contribute to the flow of funds into bank deposits, our branch-county-week analyses suggest that local exposure to COVID-19 cases triggered concerns about the economy that induced a sharp increase in precautionary savings.

Our research is related to but different from Li, Strahan, and Zhang (2020). They investigate how COVID-19 as a nationwide shock affects bank lending during the crisis, and discover that bank C&I lending differs across banks with different pre-pandemic conditions. They also explain the potential funding sources for large vs. small banks. We instead examine the effects of branch exposure to time-varying, local COVID-19 cases on depositor behavior. The weekly, branch-level deposit rates data enable us to control for any time-varying nationwide and statewide factors, so that we can exploit cross-county variations in local exposure to COVID-19 and evaluate its association with deposit rates. To our knowledge, ours is the first study of why deposits surged during the COVID-19 crisis.

2. Data

2.1 COVID-19

The Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU) provides daily data on the number of confirmed COVID-19 cases for each U.S. county, starting in January 22, 2020. To measure county-specific exposure to the pandemic, we compute *Ln(Cases per capita)* as the logarithm of one plus the cumulative number of confirmed cases divided by population (in millions) in a county on each day. County-level total population data comes from the Census. To generate weekly COVID-19 exposure data from daily observations, we use the value of *Ln(Cases per capita)* on Friday. As shown in Table 1, the average number of cases per capita in a county equals 94 (across all counties and weeks), and equals 720 when eliminating county-weeks where *Cases per capita* equals zero.

2.2 Deposit data

To evaluate the impact of COVID-19-exposure on deposit rates, we obtain data from RateWatch, which provides weekly interest rate data at the branch level for each type of deposit product. Our analyses focus on the most commonly tracked deposit product among U.S. branches, 12-month certificates of deposits (CDs) with an account size of $10,000. The key results hold when using CDs with different features, such as 24-month and 36-month CDs with an account size of $10,000, as well as 12-month CDs with an account size of $100,000. Our primary sample includes 287,262 branch-week observations over the period from January through April of 2019 and 2020, involving 9,847 branches.

2.3 Stock market data and county characteristics

To examine the heterogeneous effects of the COVID-19 pandemic on deposit rates by stock market conditions and county traits, we use data on (a) stock market returns and volatility and (b) county-specific characteristics. First, we retrieve daily U.S. market return data on the S&P500 index from Datastream provided by Thomson Reuters and compute the weekly stock returns, *Ret*, which equals the closing price on the last trading day of week t (P_t)

minus that of week *t*-1 (P_{t-1}) divided by P_{t-1}. To measure weekly market volatility, we use *Vol*, which equals the standard deviation of daily S&P 500 returns during each week.

Second, to measure the degree to which a county leans toward the Republican or Democrat Party, we collect data on (a) each county's voting results in the 2016 presidential election from the MIT Election Data and Science Lab (MIT 2018), and (b) whether a state's governor is a member of the Democratic or Republican Party from the National Governors Association's Rosters of Governors. In particular, we compute the vote share won by Donald Trump in the 2016 presidential election and set *LoTrump* equal to one if a county's vote share for Trump is below the sample median of county vote shares, and zero otherwise. *DemGov* is a dummy variable that equals one if a county is in a state with a governor who is a member of the Democratic Party, and zero otherwise.

Third, we collect county-level data on population age and education from the Census. *Hi%Age* is an indicator that equals one if the proportion of the population in a county over the age of 70 is above the sample median across counties, and zero otherwise. *Hi%College or above* is an indicator that equals one if the proportion of the population in a county with a college degree is above the sample median, and zero otherwise.

Fourth, to measure the degree of community cohesion and engagement, we use the index of *Community health* from the U.S. Congress (Joint Economic Committee) and the index of *Associations* collected by Penn State's Northeast Regional Center for Rural Development. *Community health* index captures the degree to which individuals engage in community activities, which includes membership organizations, non-religious non-profits organizations, and congregations, serving on a committee or as an officer, and the degree of community involvement in informal social activities such as attending public meetings, volunteering, helping neighbors, and taking part in political meetings or demonstration. Similarly, *Associations* equals the number of establishments related to community activities divided by population (in thousand), such as sports teams, clubs, and bowling teams, as well as religious, civic, business, professional, labor, and political establishments. Thus, both *Community health* and *Associations* indicators measure the degree of community engagement. We also use the average of these two measures as an alternative measure in robustness analyses.

3. Empirical Strategy

3.1 Baseline specification

We begin our evaluation of the relation between COVID-19 and deposit rates using the following baseline regression model.

$$Deposit\ Rate_{br,c,t} = \alpha_0 + \beta Ln(Cases\ per\ capita)_{c,t-1} + \alpha_{br} + \alpha_{s,t} + (\alpha_{day} + \alpha_{b,t}) + \varepsilon_{br,c,t}, \qquad (1)$$

where *br*, *c*, and *t* index branch, county, and week, respectively. The dependent variable, $Deposit\ Rate_{br,c,t}$, represents the deposit rate on 12-month CDs offered by branch *br* located in county *c* during week *t*. $Ln(Cases\ per\ capita)_{c,t-1}$ denotes the logarithm of one plus the cumulative number of confirmed cases per capita in county *c* on Friday of week *t*-1. We estimate the model using OLS and report standard errors clustered at the county levels.

As an initial strategy for isolating the relation between COVID-19 and deposit rates, we include an array of fixed effects. First, we include branch (α_{br}) fixed effects to account for time-invariant influences at the branch level. These fixed effects condition out branch and local community traits shaping the cross-sectional distribution of deposit rates. For example, to the extent that market structure does not change much over these weeks, these fixed effects account for the differences of a branch's market power (Berger and Hannan 1989; 1991). Second, we control for state-by-week fixed effects ($\alpha_{s,t}$) to account for all time-varying factors at the state-level. Thus, to the extent that states respond differently to the pandemic, or differences in demographics across states influence responses to COVID-19, or the evolution of other state-level (or national) economic conditions shape the evolution of the pandemic or the population's dynamic response to the pandemic, these fixed effects control for those influences and help in isolating the relation between $Ln(Cases\ per\ capita)_{c,t-1}$ and local deposit rates. Third, time-varying bank characteristics might be simultaneously correlated with COVID-19 infection rates and deposit rates across the bank's branches. For example, the pandemic and the policy response to the crisis could differentially shape the evolution of bank actions and bank risk, potentially altering deposits and the rates offered on those deposits. To address this concern, we control for bank-by-week fixed effects ($\alpha_{b,t}$). In this way, we focus on the differential response of local bank branches within the same bank to differential exposures to local COVID-19 cases. Finally, in some analyses, we include survey day fixed effects. Specifically, all branches are not surveyed on the same day of the week about their deposit rates. To address the concern that common shocks on particular survey days affect deposit rates across all branches, we therefore include survey date fixed effects (α_{day}).[2]

In conducting the baseline analyses, we also consider the possibility that expansionary monetary and fiscal policies triggered the surge in bank deposits, which we call the national policy view. Our empirical strategy of combining branch-level data on interest rates, county-level data on COVID-19 cases, and weekly observations directly addresses the possibility that national monetary and fiscal policies—and even state-level policies—account for our examination of the relation between deposit rates and COVID-19 cases. Specifically, by including state-time, and even bank-time fixed effects, it is unlikely that aggregate policies account for the time-varying relation between branch interest rates and county-level COVID-19 exposure. We also go farther in assessing the national policy view. We test whether the relation between branch deposit rates and local COVID-19 cases varies across periods of different monetary and fiscal policies.

3.2 Additional implications

After reporting the results using this initial baseline regression model, we then extend the analyses to test whether deposit interest rates fall by more in response to increases in COVID-19 cases in weeks and counties in which people are likely to be more sensitive to adverse news about future economic uncertainties. By testing these additional implications,

[2] Thus, for each branch-week observations, the vector of fixed effects, α_{day}, includes five dummy variables, one for each day of that week, where the actual survey day is set equal to one and all of the other dummy variables are set equal to zero.

we both enrich the examination of the mechanisms linking local differences in exposure to COVID-19 and changes in deposit interest rates and reduce concerns that other factors shape the negative relationship between deposit interest rates and local COVID-19 cases.

The additional implications that we evaluate build from the precautionary savings view's core insight: increasing fears about disruptions to future income induce people to save more. First, the precautionary savings view suggests that the same news about local COVID-19 cases will induce a bigger increase in precautionary savings when people are more sensitive to such adverse news about their economic futures, such as when financial markets are in turmoil. Thus, we evaluate whether the relation between deposit interest rates and COVID-19 cases is greater when (a) the stock market is more volatile and (b) the market is performing poorly. Second, the precautionary savings view suggests that the impact of the same information about COVID-19 cases will have bigger effects on precautionary savings among individuals in which that information triggers greater fears about future income. We examine three county characteristics likely to influence the impact of COVID-19 exposure on fear and hence on precautionary savings and deposit interest rates. Specifically, we expect that the impact of COVID-19 cases will be greater (1) in counties with stronger leanings toward the Democratic rather than the Republican Party, as a growing body of evidence suggests that people aligned with the Democratic Party have been more concerned by COVID-19 than those aligned with the Republican Party (e.g., Allcott et al 2020; Grossman et al 2020), (2) in counties with older and more educated populations, older people are more susceptible to COVID-19 and have shorter investment horizons in terms of recouping loses and more educated individuals are likely to be more attuned to the economic risks triggered by the pandemic, and (3) among communities with less social capital, which might act as an economic and emotion buffer to the adverse repercussion of COVID-19 exposure.

4. Baseline Results

Results in Table 2 show that deposit rates drop more in counties exposed to a larger number of COVID-19 cases. As shown in columns 1 and 3, *Ln(Cases per capita)* enters negatively and significantly in all specifications, suggesting that interest rates on deposits fall more among branches in counties more heavily exposed to the disease. The results hold when conditioning on a full set of branch and state-by-week fixed effects. In terms of the magnitude of the estimated impact, the coefficients in column 3 indicate that a one standard deviation increase in *Ln(Cases per capita)* (1.65) is associated with 2.2 basis point decline in deposit rates, which is equivalent to 3.5% of the standard deviation of *Deposit Rate*. As shown, the finding that exposure to COVID-19 puts downward pressure on deposit rates is robust to including both bank-by-time and survey day fixed effects.

Figure 4 plots the relation between branch-level deposit rates and local COVID-19 cases. The vertical axis represents the residual deposit rate after conditioning out branch, state-week, and survey date fixed effects (*Deposit rate*). The horizontal axis is based on the residual values of *Ln(Cases per capita),* where the residuals are computed after conditioning out state-week fixed effects. We divide residual *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit rate across branches located in counties with residual *Ln(Cases per capita)* falling into the corresponding percentile. As shown, there is a strong negative relation between deposit rates and COVID-19 exposure.

We next turn to the national policy view. This view stresses that expansionary monetary and fiscal policies in response to the pandemic could have triggered the surge in deposits and the drop in deposit interest rates. Our empirical design, however, reduces the possibility that national, or even state, policies account for our findings. By examining the relation between branch-level deposit rates and county-level COVID-19 cases, while including branch, and state-time, it is unlikely that monetary and fiscal policies account for the results.

To go further in reducing concerns that macro policies confound our inferences, we extend the results in the following three ways. First, we distinguish among three sub-periods during the January through April of 2020. In particular, we first define the one-zero indicator variable *Before RateCut* as equal to one during the weeks before March 3rd of 2020, which is the period before the Federal Reserve first intervened by cutting the federal funds rate on March 3rd. We next similarly define the one-zero indicator variable *1st RateCut* and *2nd RateCut*. *1st RateCut* equals one during the weeks between March 3rd and March 15th, which is after the first cut in the federal funds rate and before the Fed further lowered the federal funds rate and announced its intention to purchase Treasury securities and agency mortgage-backed securities on March 15th. *2nd RateCut* equals one after March 15th.[3] We then examine whether the relationship between deposit interest rates and exposure to COVID-19 changes across these sub-periods.

In particular, we add to equation (1) the interactions between county exposure to the coronavirus (*Ln(Cases per capita)*) and each of the three sub-period indicators: *Before RateCut*, *1st RateCut*, and *2nd RateCut*. If conventional monetary policy is driving the results, then we should observe a stronger relation between COVID-19 and deposit rates when monetary policy is more expansive. As shown in Table 2, in the even numbered columns, we do not find this. Indeed, the coefficient estimates on the interaction between *Ln(Cases per capita)* and *Before RateCut*, *1st RateCut*, and *2nd RateCut* drop monotonically over time. This finding suggests that the rate-reducing effects of COVID-19 exposure are strongest before any monetary policy reactions. The estimated coefficients from column 4 indicate that a one standard deviation increase in *Ln(Cases per capita)* (1.65) is associated with a drop in deposit rates of 8.6 basis points during the first weeks of the virus outbreak, equivalent to 13.6% of the standard deviation of *Deposit Rate*.

Second, to mitigate the concern that results are driven by Federal Reserve and government lending, we repeat the analyses in Panel A of Table 2 while (a) restricting the analyses to the period from January through March 27, 2020, on which the CARES Act is passed, or (b) controlling for the amount of SBA Paycheck Protection Program (PPP) loans received by small businesses in each county and each week. We obtain data on PPP from the U.S. Department of the Treasury, which provides loan-level information on size[4], origination date, geographic location, borrower characteristics, etc. Accordingly, we compute *LnPPP* as the log cumulative amount of PPP loans originated in a county, up to the Friday of the previous week. In this way, we omit the impact of the CARES Act (The Coronavirus Aid,

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[3] Regarding fiscal policy, the U.S. Government passed the CARES (Coronavirus Aid, Relief, and Economic Security) Act on March 27th, and the U.S. Treasury mailed coronavirus economic assistance checks on April 29th).
[4] For loans larger than $150k, the exact loan size is not provided. Instead, only a size range is specified. In our analysis, we use the mid-point of each size category as a proxy for the loan size.

Relief, and Economic Security Act) and control for payments associated with the Paycheck Protection Program (PPP). As shown in Panel B of Table 2, all of the results hold over this period (columns 1 – 3) and when conditioning on the amount of PPP loans received by small businesses in each county-week (columns 4 – 6), suggesting that the rate-reducing effects of local infection rates are not a simple manifestation of government liquidity injections.

5. Results on Additional Implications

In this section, we conduct four tests of whether deposit interest rates fall by more in response to increases in COVID-19 infection rates in weeks and counties in which people are likely to be more sensitive to adverse news concerning their economic futures. To examine this, we identify (a) periods when people are likely to be more concerned about their economic futures and (b) counties where people likely to be more sensitive to COVID-19 cases and test whether the interest rate reducing effects of COVID-19 are greater in those periods and counties.[5]

5.1 Stock markets

One factor likely to intensify the impact of news about local COVID-19 cases on anxiety about the local economy is the overall degree of financial system fragility. From this perspective, the same information about COVID-19 exposure is likely to trigger precautionary savings more when people are more worried about the financial markets. To evaluate this implication, we assess whether the relation between deposit interest rates and COVID-19 cases is greater when (a) the stock market is more volatile and (b) the market is performing poorly.

Consistent with the precautionary savings view, we find that local deposit interest rates fall by more in response to local COVID-19 cases when stock market volatility is relatively high. Specifically, to equation (1), we add an interaction term, the interaction

[5] In moving from the baseline analyses to these additional studies in which we explore the heterogenous response of deposit rates in differing periods and counties, we no longer present the findings while including and excluding bank-week fixed effects. Since the vast majority of banks in RateWatch have only one branch, including branch and bank-week fixed effects eliminates most (more than 75%) of the full sample. Since in this section we are also differentiating by period and country traits, we include branch, state-week, and survey date fixed effects.

between the county's exposure to COVID-19 as of week *t-1* ($Ln(Cases\ per\ capita)_{c,t-1}$) and the volatility of daily stock market returns during week *t-1* (Vol_{t-1}). Since Vol_{t-1} is computed at the national level, state-year fixed effects eliminate the linear Vol_{t-1} term. As shown in Table 3, both $Ln(Cases\ per\ capita)_{c,t-1}$ and $Ln(Cases\ per\ capita)_{c,t-1} * Vol_{t-1}$, enter negatively and significantly, suggesting that the rate-reducing effects of COVID-19 exposure are more pronounced when financial markets are more volatile. The coefficient estimates from column 1 suggest that a one standard deviation increase in the stock market volatility (0.019) would increase the sensitivity of deposit rates to local COVID-19 exposure by 0.0036 (=0.187 * 0.019). This is not small given that the average sensitivity of deposit rates to local COVID-19 exposure is 0.0121 (Table 2).

Also we find that the rate-reducing effects of exposure to COVID-19 are greater when stock returns are lower. In particular, we include the interaction between *Ln(Cases per Capita)* and *Ret*, where *Ret* denotes the weekly return on the S&P 500. As reported in Table 3, while *Ln(Cases per Capita)* enters negatively and significantly, *Ln(Cases per Capita) * Ret* enters positively and significantly. This indicates that COVID-19 exposure has a larger rate-reducing effect when stock returns are lower. Furthermore, we distinguish weeks in which the market has positive or negative returns. Ret^{+} equals *Ret* if *Ret* is positive, and zero otherwise. Ret^{-} equals *Ret* if *Ret* is negative, and zero otherwise. When simultaneously including *Ln(Cases per Capita)* * Ret^{+} and *Ln(Cases per Capita)* * Ret^{-} in the model, we find that the coefficient estimates on *Ln(Cases per Capita)* * Ret^{-} are positive and statistically significant. These findings further confirm that the rate-reducing effects of exposure to COVID-19 are larger when stock returns are lower. Taken together, the results on volatility and stock returns are consistent with the view that local exposure to COVID-19 cases trigger more precautionary savings when market volatility is higher and stock price performance is worse.

5.2 Political affiliation

We next evaluate whether deposit interest rates fall by more in response to increases in COVID-19 infection rates in counties likely to be more sensitive to such news, where we first focus on political affiliation. Research suggests that people aligned with the Democrat Party have responded with greater concern to the COVID-19 pandemic than those aligned with the Republican Party. Although researchers and commentators provide different explanations for these cross-party differences, we exploit past research to evaluate an implication for our study: If more local COVID-19 cases trigger greater uncertainty about income and precautionary savings, this response should be greater in counties where COVID-19 induces greater concerns, i.e., in more democratic-leaning counties. As defined above, we use two measures of the degree to which a county is more democratic or republican leaning: *LoTrump* equals one if a county's vote share for Trump is below the sample median of county vote shares, and zero otherwise; and *DemGov* equals one if a county is in a state with a governor who is a member of the Democratic Party, and zero otherwise.

Consistent with the precautionary savings view of how COVID-19 shapes deposits—and past results that Democrats are more sensitive to the pandemic, we find that the rate-reducing effects of COVID-19 are stronger in counties more closely aligned with the Democratic Party. To test this, we add to equation (1) either the interaction between *Ln(Cases per Capita)* and *LoTrump* or its interaction with *DemGov*. As shown in Table 4, both the *Ln(Cases per Capita) * LoTrump* interaction term and the linear term, *Ln(Cases per Capita)*, enter negatively and insignificantly, suggesting that deposit rates drop by more in counties with lower vote shares for Donald Trump in the 2016 election. Table 4 also shows that the *Ln(Cases per Capita) * DemGov* interaction term enters negatively and significantly, suggesting that deposit rates fall by more in states with a Democratic governor. To illustrate the economic magnitudes, the estimates from column 2 indicate that a one-standard-deviation increase in county-level Covid-19 exposure is associated with a 1.8 basis point (= -0.0108 *1.65) large reduction in deposit rates in Democratic counties than in Republican counties.

5.3 Demographics

Different demographic groups may also have different sensitivities to COVID-19 exposure, leading to different rate-reducing effects of COVID-19 across counties. That is, if COVID-19 generated fears about the economy and financial markets help drive the surge in deposits and the reduction in deposit rates, then this effect should be larger in counties with more "COVID-19 sensitive" demographic groups, i.e., where people become more fearful in response to local COVID-19 cases. Since older individuals are more susceptible to the disease and have shorter invest horizons to recoup losses, we expect a larger rush into deposits in counties with a larger proportion of older residents. Furthermore, more educated populations might (a) be more aware of news and analyses discussing potential economic fragilities created by the disease and (b) be more forward-looking about future cash flow risks. Under these conditions, COVID-19 will tend to generate stronger effects among more educated people, so that the precautionary response to COVID-19 is stronger in counties with more educated residents. To measure these cross-county differences, we use (1) *Hi%Age*, which equals one if the proportion of the population in a county over the age of 70 is above the sample median, and zero otherwise, and (2) *Hi%College or above*, which equals one if the proportion of the population in a county with a college degree is above the sample median, and zero otherwise.

On the age and education of counties, the results are also consistent with the precautionary savings view of how COVID-19 influences deposit interest rates. Specifically, we find that counties in which a larger proportion of the population is elderly or well-educated experienced sharper declines in deposit interest rates at local banks than other counties. As shown in Table 5, *Ln(Cases per Capita) * Hi%Age* enters negatively and significantly, indicating that deposit prices of branches with an older customer base fell more in response to COVID-19 than branches with a younger customer base. These results are consistent with the view that older individuals are more susceptible to the disease, and therefore react more strongly. Furthermore, we also find that deposit rates fall more in counties with more well-educated people. As shown, *Ln(Cases per Capita) * Hi%College or above* enters negatively and significantly. This is consistent with the view more educated people become more informed about the economic risks associated with the pandemic and save more to protect themselves against future income shocks.

5.4 Social capital

Social capital is also apt to shape the degree to which local COVID-19 cases generate anxiety about future income and hence a surge in precautionary savings. In particular, while social capital in general refers to the shared values, accepted norms, reciprocal bonds, and trust among individuals in a community, social capital has distinct features, reflecting community engagement, social commitment, and family structure and stability. The "community engagement" feature of social capital stresses that communities which people residents have stronger bonds and engagement with each other are more effective at addressing an array of challenges than those with less social connections. When applied to the COVID-19 pandemic, this suggests local COVID-19 cases are likely to induce less fears in communities in which there are strong social connections that provide support and insurance during times of duress. From this perspective, community engagement will tend to reduce the rate-reducing effects of local COVID-19 cases. To test the prediction, we use the index of *Community health*, which measures the degree of cohesion and engagement across U.S. counties. Thus, to the equation (1) regression, we include the interaction between *Ln(Cases per Capita* and *High Community Health*, which is a dummy that equals to one in a county if *Community health* is above sample median and zero otherwise.

The results on social capital provide further support for the precautionary savings view of how COVID-19 influences deposit interest rates. In particular, consistent with the views that (a) local exposure to COVID-19 cases generates economic uncertainty that triggers precautionary savings and (b) social capital is a form of community insurance that reduces COVID-19 generated uncertainties, we find that county COVID-19 cases are associated with smaller reduction in local deposit rates in counties with greater social capital. As reported in Table 6, while the linear term, *Ln(Cases per Capita)*, enters negatively and significantly, the interaction term, *Ln(Cases per Capita)* High Community Engagement*, enters positively and significantly in all columns, suggesting that counties with higher values of *Community Engagement* experience less of a surge in precautionary savings at local branches in response to Covid-19 cases, where community engagement is measured by the indicators of *Community Health* (column 1), *Associations* (column 2), or the average of the two (column 3).

Figure 5 – 8 illustrates the heterogeneity of results across counties with different characteristics. We plot the sensitivity of branch-level deposit rates to local COVID-19 cases, while differentiating counties by (a) the degree to which a county is more democratic or republican leaning, (b) population age, (c) the degree of education, and (d) the extent to which residents in local communities have strong bonds and engagement with each other. The vertical axis represents the residual deposit rate in each bank branch in each week, after conditioning out branch, state-week, and survey date fixed effects. *Ln(Cases per capita)* is measured at the county-week level and equals the residual log number of cases per 1 million population, after conditioning out state-week fixed effects. We divide residual *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit rates across branches located in counties with residual *Ln(Cases per capita)* falling into the corresponding percentile. As shown, the relation between branch deposit rates and local COVID-19 infection rates is stronger in counties where people are likely to become more anxious about the local economy's future in response to any given value of *Ln(Cases per capita)*.

Finally, Table 7 reports regression results in which we simultaneously include the array of interactions associated with financial market fragility, political affiliations, demographics, and social capital. Specifically, we estimate a model that includes *Ln(Cases per Capita)*Vol*, *Ln(Cases per Capita)*Ret*, *Ln(Cases per Capita)*LoTrump*, *Ln(Cases per Capita)*Hi%Age*, *Ln(Cases per Capita)*Hi%College or above*, and *Ln(Cases per Capita)*High Community Health*. As shown, each of the interaction terms enters statistically significantly, with the same sign as when they were examined separately. These results suggest that these conditioning variables capture different aspects of heterogeneity, rather than the same factor being proxied by different variables. These results also confirm the implications of the precautionary savings view of how COVID-19 influences deposit interest rates, reducing concerns that omitted variables drive the findings.

6. The Quantity of Deposits and Consumer Spending

A key feature of the precautionary savings view is that more funds flow into deposits and this drives down deposit rates. As emphasized above, we do not focus on examining the flow of funds into bank branches because (1) we aim to distinguish the supply-side effects from the demand side by examining the price and (2) there are data limitations on deposits in 2020, i.e., data on the quantity of deposits are only available at the bank-by-county level (not the branch level) and at an annual frequency (not weekly). While recognizing these limitations, we provide evidence on the response of bank deposits to COVID-19 using available data. We examine changes in bank deposits from June 30, 2019 to June 30, 2020 using data from the Summary of Deposits, and relate these changes to banks' exposure to COVID-19.

We use the following regression specification:

$$Deposit\ Growth_{b,c} = \alpha_0 + \beta Ln(Cases\ per\ Capita)_c + X_b + (\alpha_s + \alpha_a) + \varepsilon_b, \qquad (2)$$

where there is one observation per bank-county, data permitting. $Deposit\ Growth_{b,c}$ is the growth in deposits held at bank b's branches in county c and is computed over the period from June 30, 2019 to June 30, 2020. $Ln(Cases\ per\ Capita)_c$ is the county exposure to COVID-19 cases as of June 2020. X_b is a vector of bank characteristics including lagged growth in deposits, size, equity-asset ratio, profitability, and Tier-1 capital ratio. Lagged growth in deposits is the growth in deposits held at bank b's branches in county c and is computed over the period from June 2018 through June 2019. We include lagged growth in deposits to control for potential trends in deposit growth. Size equals the log of book value of total assets. Equity-asset ratio equals total equity divided by total assets. Profitability equals operating income divided by total assets. Tier-1 capital ratio equals Tier 1 capital divided by risk-weighted assets. α_s is the fixed effect for the bank's headquarter state, and α_a is the fixed effect for the bank's regulatory agency.

Consistent with the precautionary savings view, Table 8 shows a larger increase in deposits among bank-branches in counties more exposed to COVID-19. The results hold when conditioning on (a) an array of bank traits, namely lagged deposit growth rate, size, equity-asset ratio, profitability, and Tier1 capital ratio, and (b) bank, headquarter state, and regulatory agency fixed effects.

Another key feature of the precautionary savings view is that an increase in anxiety about future income triggers a reduction in consumption and an increase in savings. We cannot evaluate the impact of local COVID-19 infection rates on local saving rates because we lack weekly data on savings at the county level. However, we can shed additional light on the precautionary savings mechanism by examining seasonally-adjusted consumer spending data at the county-level. These data are provided by Economic Tracker, which is based on Chetty et al. (2020).

As shown in Table 9, consumer spending drops more in counties with a higher COVID-19 infection rate. The coefficient estimates on *Ln(Cases per Capita)* are negative and statistically significant in all specification. In particular, the results hold when including or excluding (a) county, time, and/or state-by-time fixed effects, and (b) local employment, which helps account for economic conditions in the county. The results are also consistent with recent studies showing an aggregate reduction in consumer spending during the COVID-19 pandemic (e.g., Chen, Qian, and Wen 2020).

7. Conclusion

In this study, we investigate deposits' behavior and explain why deposits surged during the first months of the COVID-19 pandemic. Using weekly data at the branch level on deposit interest rates and weekly data on COVID-19 cases at the county level, we assess the dynamic relation between deposit rates and COVID-19 cases. Consistent with the precautionary savings motive, our baseline analyses show that deposit rates at bank branch in counties with higher COVID-19 infection rates fall by more than branches in otherwise similar counties. Thus, the increase in deposits were driven by the supply of deposits, rather than the demand side. Moreover, the impact of exposure to COVID-19 on deposit rates is greater when (a) the stock market is more volatile and (b) the market is performing poorly, suggesting that the effects were exacerbated by a flight-to-safety, i.e., when people are more likely to be sensitive to financial system stability.

Several extensions further indicate that the negative relation between local COVID-19 infection rates and deposits rates reflects an increase in precautionary savings. The rate-reducing effects of COVID-19 are more pronounced (a) in more democratic-leaning counties, (b) in counties with a larger proportion of elderly or well-educated population, and (c) communities with weaker bonds and engagement. Overall, the evidence is consistent with the precautionary savings view that due to concerns about future income, depositors increase precautionary savings, pushing down deposit rates.

References

Acharya, V., Steffen, S., 2020. 'Stress tests' for banks as liquidity insurers in a time of COVID. Working Paper

Acharya, V.V., Mora, N., 2015. A Crisis of Banks as Liquidity Providers. *Journal of Finance* 70, 1-43.

Agarwal, S., Chomsisengphet, S., Yildirim, Y., and Zhang, J., 2020, Interest Rate Pass-Through and Consumption Response: the Deposit Channel. *Review of Economics and Statistics*, forthcoming.

Agarwal, S., Qian, W., 2014. Consumption and debt response to unanticipated income shocks: evidence from a natural experiment in Singapore. *American Economic Review* 104, 4205-4230

Allcott, H., Boxell, L., Conway, J., Gentzkow, M., Thaler, M. and Yang, D.Y., 2020. Polarization and public health: Partisan differences in social distancing during the Coronavirus pandemic. *Journal of Public Economics* 191, 104254.

Berger, A.N., Hannan, T.H., 1989. The Price-Concentration Relationship in Banking. The Review of Economics and Statistics 71, 291-299

Berger, A.N., Hannan, T.H., 1991. The rigidity of prices: Evidence from the banking industry. American Economic Review 81:938–45.

Bernanke, B., Gertler, M., Gilchrist, S., 1996. The Financial Accelerator and the Flight to Quality. The Review of Economics and Statistics 78, 1-15

Browning, M., Lusardi, A., 1996. Household Saving: Micro Theories and Micro Facts. Journal of Economic Literature 34, 1797-1855

Carroll, C.D., Samwick, A.A., 1998. How Important Is Precautionary Saving? The Review of Economics and Statistics 80, 410-419

Chen, H., Qian, W., Wen, Q., 2020. The Impact of the COVID-19 Pandemic on Consumption: Learning from High Frequency Transaction Data. Working paper.

Chetty, R., Friedman, J., Hendren, N., Stepner, M., the Opportunity Insights Team, 2020. The Economic Impacts of COVID-19: Evidence from a New Public Database Built from Private Sector Data. Working Paper.

Cornett, M.M., McNutt, J.J., Strahan, P.E. and Tehranian, H., 2011. Liquidity risk management and credit supply in the financial crisis. *Journal of Financial Economics*, *101*(2), pp.297-312.

D'Acunto, F., Rauter, T., Scheuch, C., and Weber, M., 2020. Perceived Precautionary Savings Motives: Evidence from FinTech. NBER Working Paper No. 26817.

Dynan, K.E., 1993. How prudent are consumers? Journal of Political Economy 101, 1104-1113

Engen, E.M., Gruber, J., 2001. Unemployment insurance and precautionary saving. Journal of Monetary Economics 47, 545-579

Gatev, E., Strahan, P.E., 2006. Banks' Advantage in Hedging Liquidity Risk: Theory and Evidence from the Commercial Paper Market. The Journal of Finance 61, 867-892

Grossman, G., Kim, S., Rexer, J. and Thirumurthy, H., 2020. Political partisanship influences behavioral responses to governors' recommendations for COVID-19 prevention in the United States. Proceedings of the National Academy of Sciences 117, 24144-24153.

Kashyap, A.K., Rajan, R., Stein, J.C., 2002. Banks as Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-taking. The Journal of Finance 57, 33-73

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, forthcoming.

Lin, L., 2019. Bank Deposits and the Stock Market. The Review of Financial Studies 33, 2622-2658

MIT, Election Data, Science Lab, 2018. County Presidential Election Returns 2000-2016.

Starr-McCluer, M., 1996. Health insurance and precautionary savings. American Economic Review 86, 285-295

Figure 1. Aggregate trend of deposit during the COVID-19 epidemic

This figure plots the time trend of total deposits in commercial banks during the COVID-19 epidemic. The line represents the weekly level of deposits in billion dollars since January 22, 2020, with the scale marked on the left vertical axis. The bars represent the log number of total COVID cases in each corresponding week in the U.S., with the scale marked on the right vertical axis. Source: Federal Reserve Bank of St. Louis.

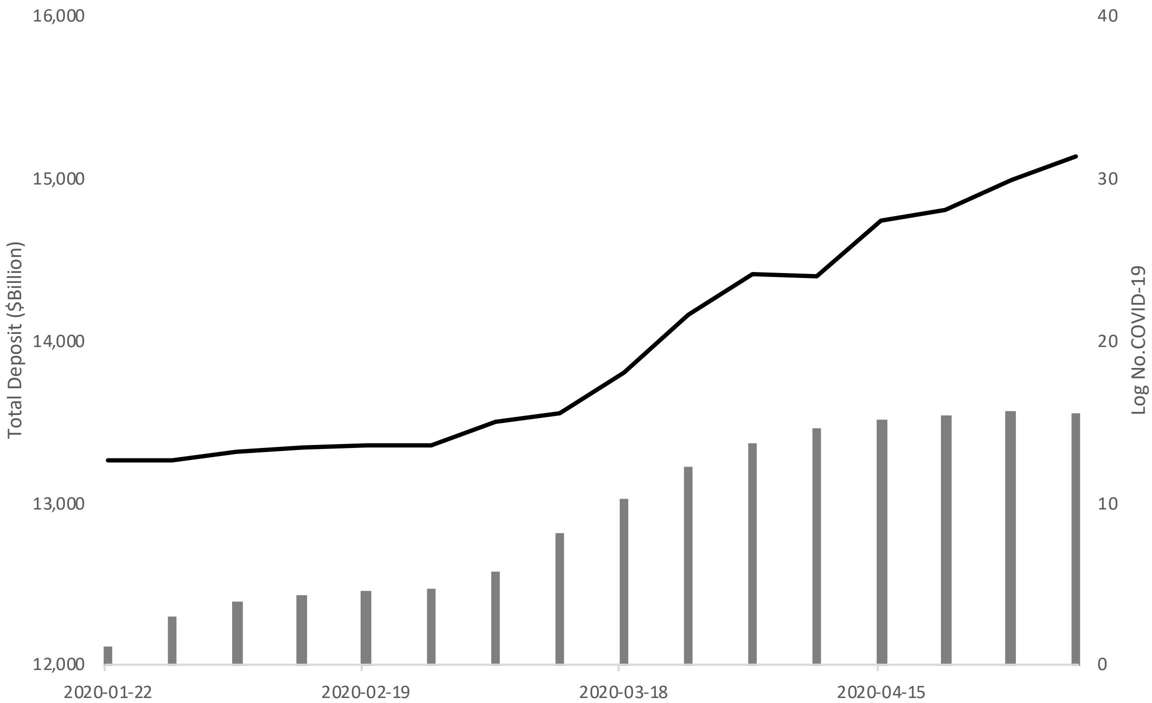

Figure 2. Deposit Quantity and COVID-19 Exposure

This figure plots the relationship between deposit quantity and a bank's exposure to COVID in a county. Deposit growth equals the log difference of total deposits held by bank *b* in county *c* between 2019 June 30 and 2020 June 30. The vertical axis is the residual deposit growth after conditioning out bank fixed effects. The horizontal axis is the county-level exposure to COVID-19, *Ln(Cases per capita)*.We divide *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit growth across bank-counties with *Ln(Cases per capita)* falling into the corresponding percentile. The line is the fitted linear line that relate deposit growth to exposure to COVID-19. Source: Summary of Deposits and John Hopkins University.

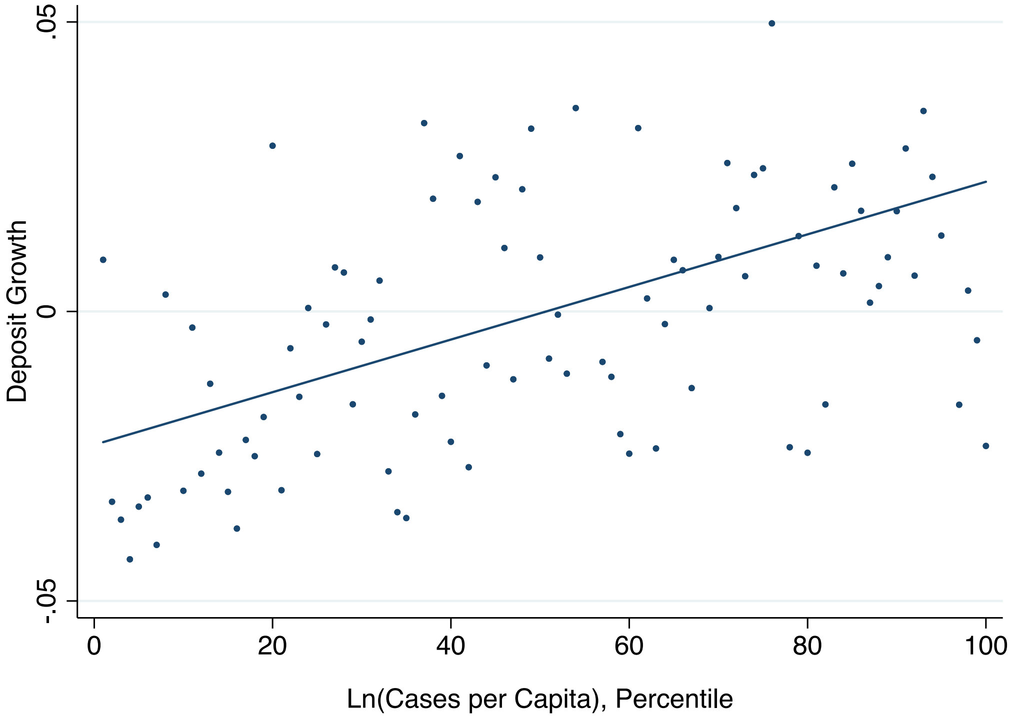

Figure 3. Aggregate trend of personal saving rate during the COVID-19 epidemic
This figure plots the monthly personal saving rate (measured as the personal savings as a percentage of disposable personal income) during the COVID-19 epidemic. Source: Federal Reserve Bank of St. Louis.

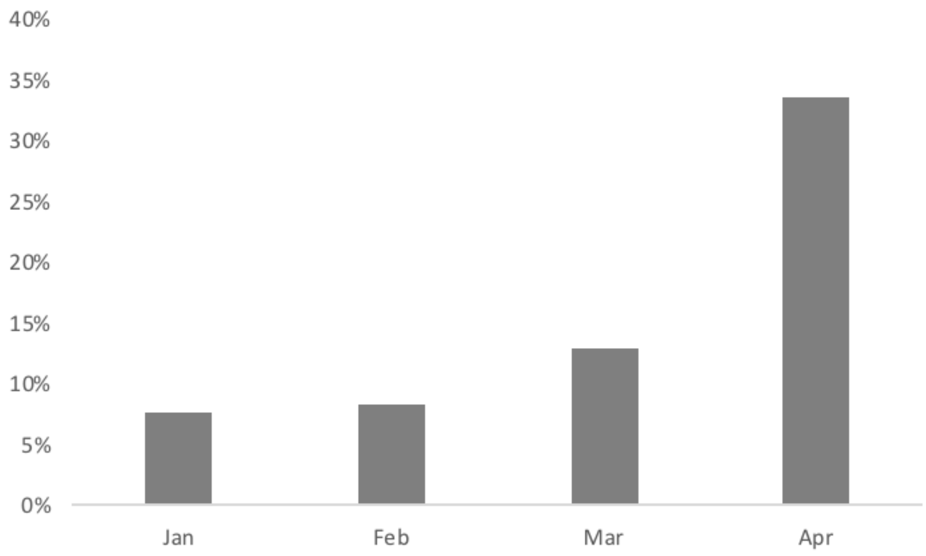

Figure 4. Deposit Rates and COVID-19 Exposure

This figure plots the sensitivity of branch-level deposit rates to COVID-19 exposure (i.e., *Ln(Cases per capita)*). Deposit rate is the residual deposit rate in each bank branch in each week, after conditioning out branch, state-week, and survey date fixed effects. *Ln(Cases per capita)* is measured at the county-level and equals the residual log number of cases per 1 million population, after conditioning out state-week fixed effects. We divide *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit rates across branches located in counties with residual *Ln(Cases per capita)* falling into the corresponding percentile. The line is the fitted linear line that relate bank deposit rates to exposure to COVID-19. Source: RateWatch and John Hopkins University.

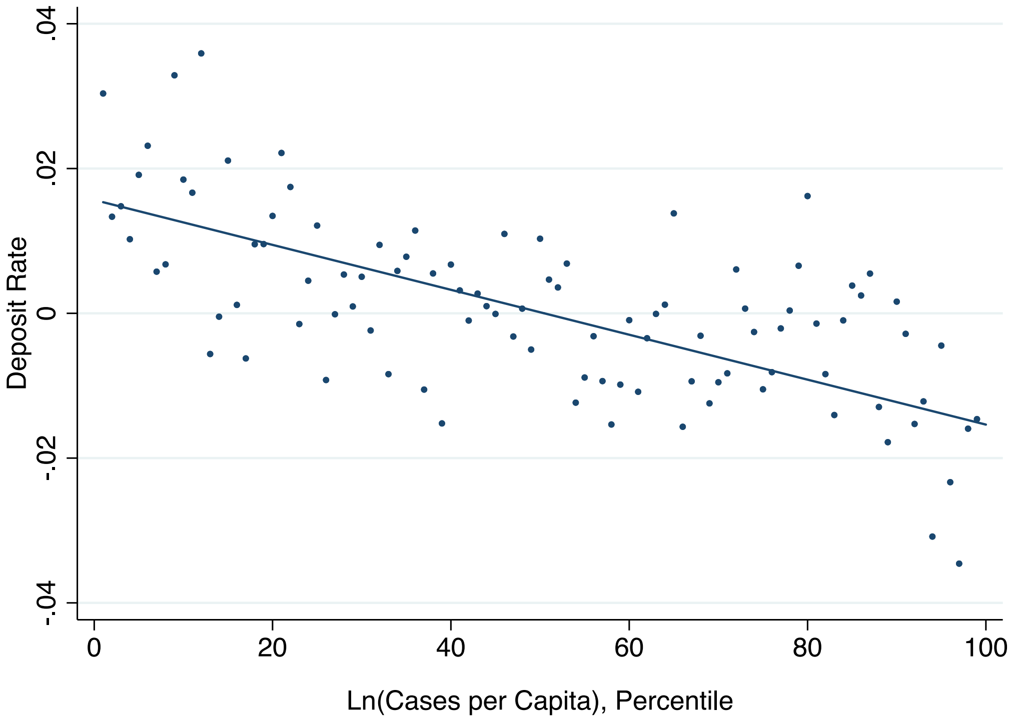

Figure 5. Deposit Rates and COVID-19 Exposure, by Partisanship

This figure plots the sensitivity of branch-level deposit rates to COVID-19 exposure (i.e., *Ln(Cases per capita)*), while differentiating counties by the degree to which a county is more democratic or republican leaning. Blue (Orange) represents counties in which the vote share for Trump is below (above) the sample median of county vote shares in the 2016 presidential election. Deposit rate is the residual deposit rate in each bank branch in each week, after conditioning out branch, state-week, and survey date fixed effects. *Ln(Cases per capita)* is measured at the county-level and equals the residual log number of cases per 1 million population, after conditioning out state-week fixed effects. We divide *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit rates across branches located in counties with residual *Ln(Cases per capita)* falling into the corresponding percentile. The line is the fitted linear line that relate bank deposit rates to exposure to COVID-19.

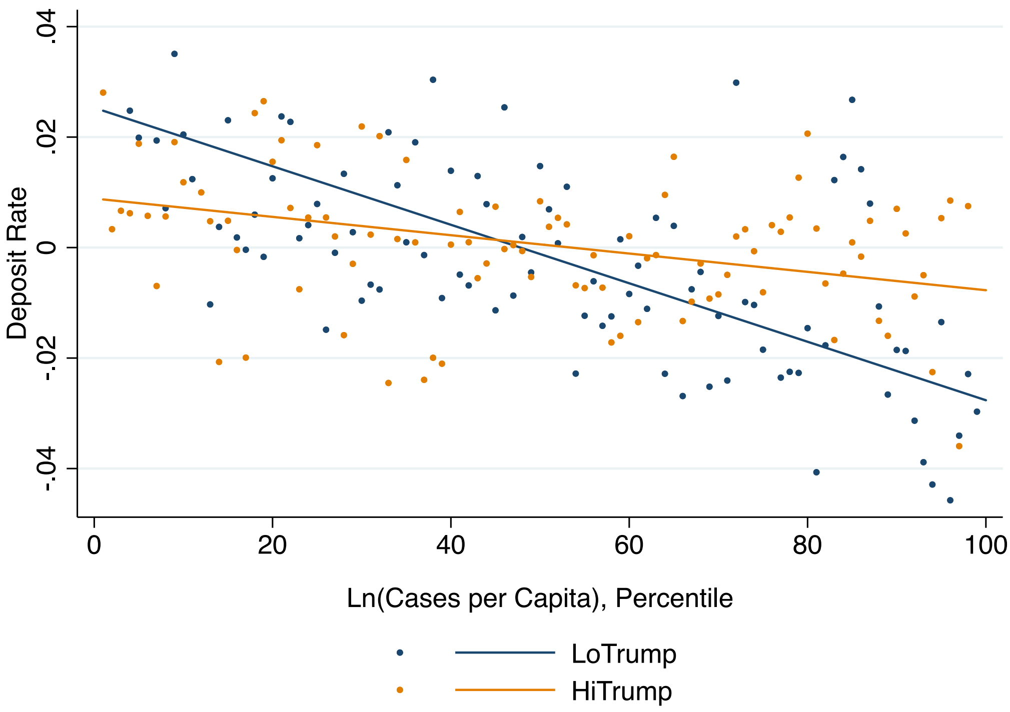

Figure 6. Deposit Rates and COVID-19 Exposure, by Population age

This figure plots the sensitivity of branch-level deposit rates to exposure to COVID-19 (i.e., *Ln(Cases per capita)*), while differentiating counties by population age. Blue (Orange) represents counties in which the proportion of the population in a county over the age of 70 is below (above) the sample median. Deposit rate is the residual deposit rate in each bank branch in each week, after conditioning out branch, state-week, and survey date fixed effects. *Ln(Cases per capita)* is measured at the county-level and equals the residual log number of cases per 1 million population, after conditioning out state-week fixed effects. We divide *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit rates across branches located in counties with residual *Ln(Cases per capita)* falling into the corresponding percentile. The line is the fitted linear line that relate bank deposit rates to exposure to COVID-19.

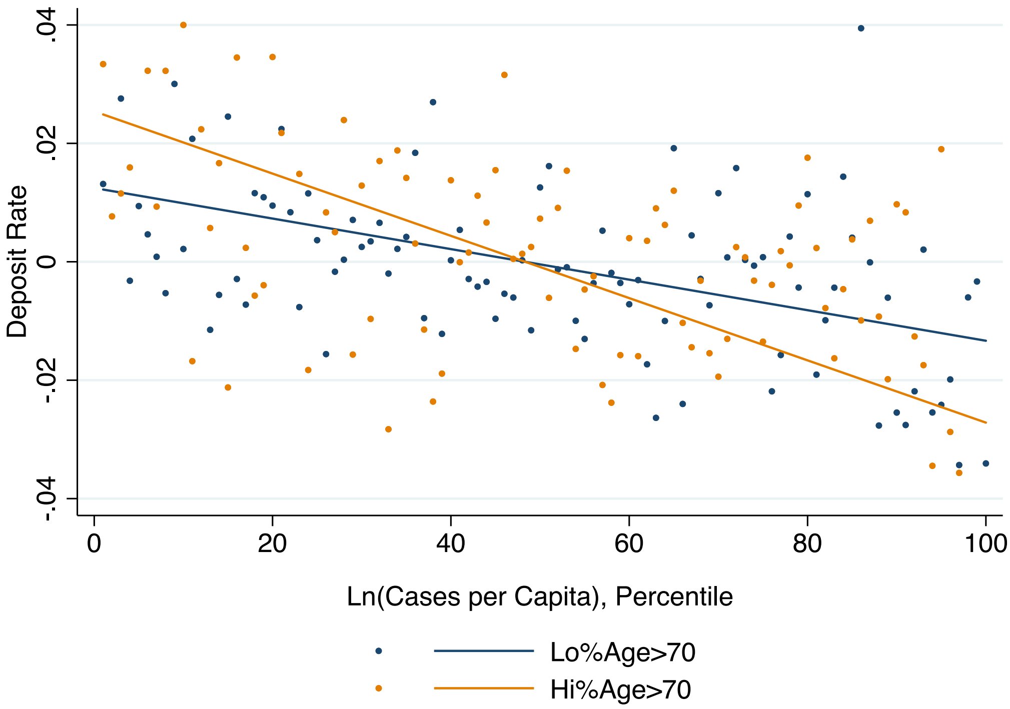

Figure 7. Deposit Rates and COVID-19 Exposure, by Education

This figure plots the sensitivity of branch-level deposit rates to exposure to COVID-19 (i.e., *Ln(Cases per capita)*), while differentiating counties by the degree of education. Blue (Orange) represents counties in which the proportion of the population with a college degree or above is below (above) the sample median. Deposit rate is the residual deposit rate in each bank branch in each week, after conditioning out branch, state-week, and survey date fixed effects. *Ln(Cases per capita)* is measured at the county-level and equals the residual log number of cases per 1 million population, after conditioning out state-week fixed effects. We divide *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit rates across branches located in counties with residual *Ln(Cases per capita)* falling into the corresponding percentile. The line is the fitted linear line that relate bank deposit rates to exposure to COVID-19.

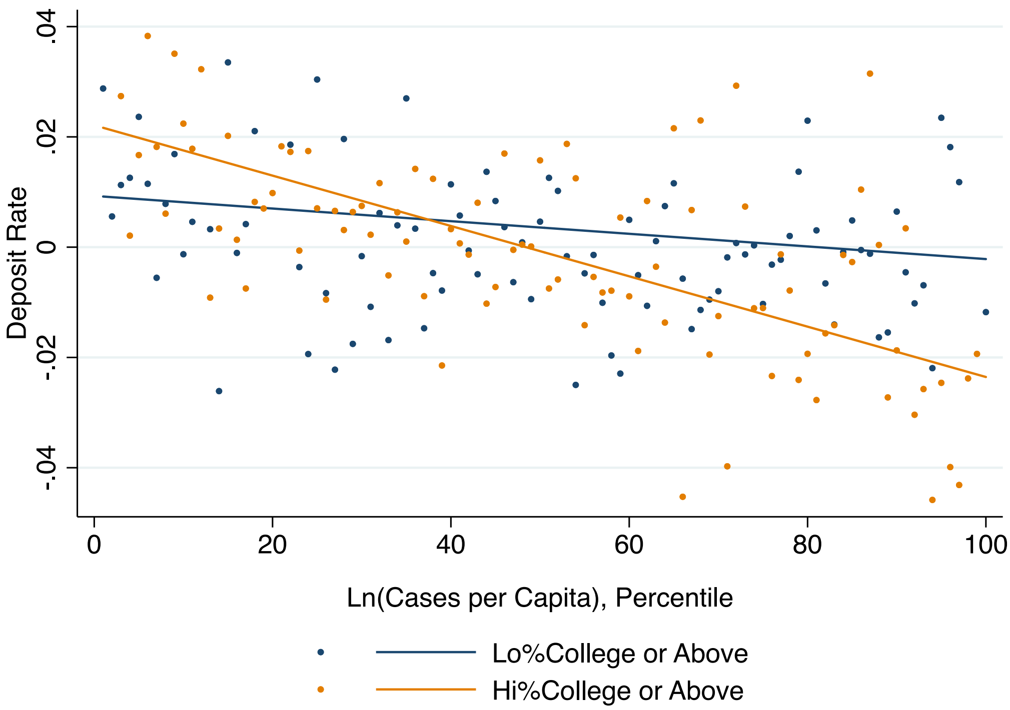

Figure 8. Deposit Rates and COVID-19 Exposure, by Community Health

This figure plots the sensitivity of branch-level deposit rates to exposure to COVID-19 (i.e., *Ln(Cases per capita)*), while differentiating counties by the extent to which residents in local communities have strong bonds and engagement with each other. Blue (Orange) represents counties in which the degree of cohesion and engagement (*Community health*) is below (above) the sample median. Deposit rate is the residual deposit rate in each bank branch in each week, after conditioning out branch, state-week, and survey date fixed effects. *Ln(Cases per capita)* is measured at the county-level and equals the residual log number of cases per 1 million population, after conditioning out state-week fixed effects. We divide *Ln(Cases per capita)* into 100 bins, so that each dot represents the average deposit rates across branches located in counties with residual *Ln(Cases per capita)* falling into the corresponding percentile. The line is the fitted linear line that relate bank deposit rates to exposure to COVID-19.

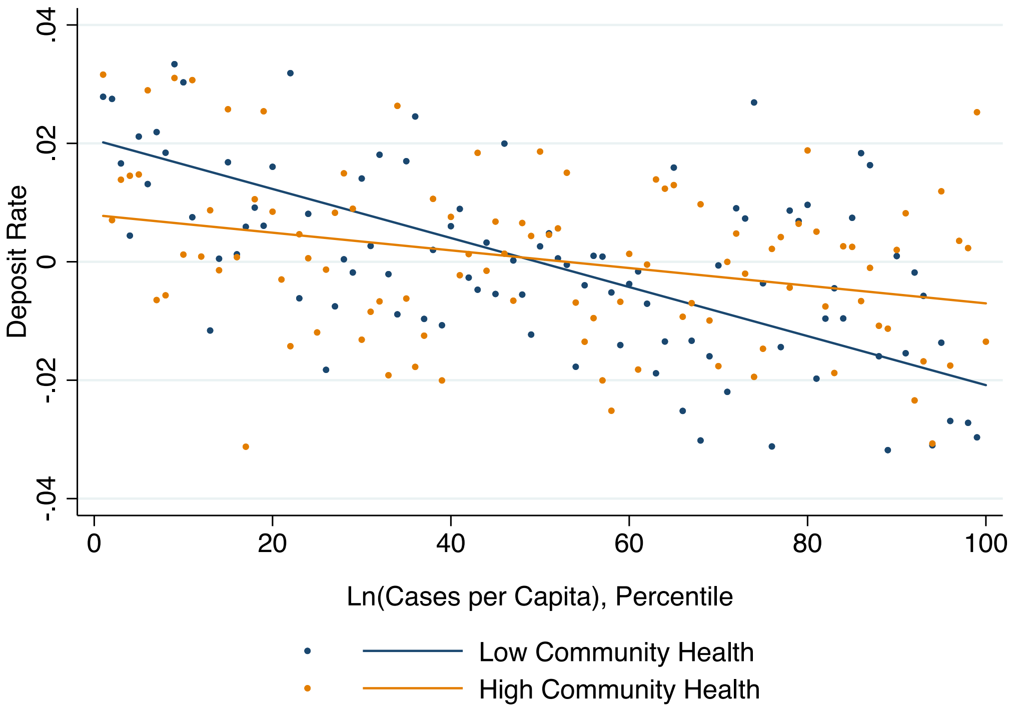

Table 1 Summary Statistics
This table reports summary statistics of the key variables used in the analysis.

	N	mean	sd	p25	p50	p75
	(1)	(2)	(3)	(4)	(5)	(6)
Branch-week level:						
Deposit Rate (%)	287,262	0.905	0.634	0.350	0.800	1.350
County-week level:						
Number of Cases per Capita	77,750	94	762	0	0	0
Number of Cases per Capita (>0)	10,183	720	1997	89	251	614
Ln(Cases per capita)	77,750	3.59	1.65	2.58	3.63	4.63
Ln(Cases per capita) (>0)	10,183	5.61	1.47	4.81	5.70	6.49
County level:						
%Trump	2,357	62.5	15.6	53.7	65.4	74.3
DemGov	2,361	0.432	0.496	0	0	0
%Age>70	2,362	13.2	3.3	11.1	13.0	15.0
%College or above	2,362	22.4	9.6	15.6	20.0	27.1
Community health	2,362	-0.078	0.898	-0.695	-0.261	0.343
Bank-county level:						
ΔLn Deposits	24,411	0.184	0.325	0.075	0.140	0.223
Bank level:						
LnAsset	5,288	12.51	1.47	11.56	12.32	13.20
Equity/Asset	5,288	0.122	0.041	0.098	0.112	0.132
ROA	5,288	0.282	0.464	0.171	0.262	0.355
Tier1	5,288	18.66	10.77	12.74	15.44	20.05
Weekly market data:						
Ret (SP500)	35	0.003	0.048	-0.010	0.006	0.025
Vol (SP500)	35	0.016	0.019	0.004	0.007	0.023

Table 2. Deposit rates and COVID-19 exposure

Panel A represents the baseline regression results that estimate the effect of COVID on deposit rate. Panel B repeats the baseline regressions in Panel A, while (a) restricting the analyses to the period from January through March 27, on which the CARES Act is passed, or (b) controlling for the amount of PPP loans received by small businesses in each county and each week. *LnPPP* is the log cumulative amount of PPP loans that are originated in the same county, up to the Friday of the previous week. The dependent variable is the percentage rate of 12-month certificate deposits of each branch in each week, reported by RateWatch. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county reported on the Friday of the previous week. *Before RateCut* indicates the period before March 03, 2020, when the first federal funds rate cut is announced; *1st RateCut* indicates the period between March 03 and March 15, 2020, when the second rate cut is announced; *2nd RateCut* indicates period after March 15, 2020. LnPPP is the log cumulative amount of PPP lending up to the Friday of the previous week. *Survey Date* is the calendar date when the branch is surveyed about its deposit rate in a week. Heteroskedasticity-robust standard errors are clustered by county, as reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

Panel A: Baseline

	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Cases per Capita)	-0.0121***		-0.0135***		-0.0075***	
	(0.0031)		(0.0031)		(0.0027)	
Ln(Cases per Capita)		-0.0512***		-0.0523***		-0.0379***
* Before RateCut		(0.0151)		(0.0156)		(0.0121)
Ln(Cases per Capita)		-0.0315***		-0.0328***		-0.0137**
* 1st RateCut		(0.0071)		(0.0071)		(0.0069)
Ln(Cases per Capita)		-0.0121***		-0.0135***		-0.0074***
* 2nd RateCut		(0.0031)		(0.0031)		(0.0027)
Branch FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Survey Date FE	No	No	Yes	Yes	Yes	Yes
Bank-Week FE	No	No	No	No	Yes	Yes
Obs.	287,138	287,138	287,131	287,131	63,094	63,094
R-Squared	0.8558	0.8559	0.8570	0.8570	0.9741	0.9741

Panel B: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)
Ln(Cases per Capita)	-0.0239***	-0.0246***	-0.0135***	-0.0117***	-0.0129***	-0.0069**
	(0.0042)	(0.0042)	(0.0038)	(0.0034)	(0.0034)	(0.0028)
LnPPP				-0.0007	-0.001	-0.0012
				(0.0018)	(0.0018)	(0.0013)
Branch FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Week FE	Yes	Yes	Yes	Yes	Yes	Yes
Survey Date FE	No	Yes	Yes	No	Yes	Yes
Bank-Week FE	No	No	Yes	No	No	Yes
Obs.	204,250	204,245	44,891	287,138	287,131	63,094
R-Squared	0.8898	0.8901	0.9777	0.8558	0.8570	0.9741

Table 3. Stock market and deposit rates during COVID-19

This table represents the regression results that estimate the effect of COVID on deposit rate, interacting with the effect from the stock market. The dependent variable is the percentage rate of 12-month certificate deposits of each branch in each week, reported by RateWatch. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county, reported on the Friday of the previous week. *Before RateCut* indicates the period before March 03, 2020, when the first federal funds rate cut is announced; *1st RateCut* indicates the period between March 03 and March 15, 2020, when the second rate cut is announced; *2nd RateCut* indicates period after March 15, 2020. *Vol* is the weekly volatility of SP500 index in the previous week. *Ret* is the weekly return of SP500 index in the previous week. *Ret+* equals to *R* when *R*>0 and equals to 0 otherwise. *Ret-* equals to *Ret* when *Ret*<0 and equals to 0 otherwise. *Survey Date* is the calendar date when the branch is surveyed about its deposit rate in a week. Heteroskedasticity-robust standard errors are clustered by county, as reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

	(1)	(2)	(3)
Ln(Cases per Capita) * Vol	-0.1873***		
	(0.0563)		
Ln(Cases per Capita) * Ret		0.0319***	
		(0.0068)	
Ln(Cases per Capita) * Ret+			-0.0018
			(0.0114)
Ln(Cases per Capita) * Ret-			0.0730***
			(0.0195)
Ln(Cases per Capita)	-0.0068**	-0.0142***	-0.0119***
	(0.0030)	(0.0031)	(0.0029)
Branch FE	Yes	Yes	Yes
State-Week FE	Yes	Yes	Yes
Survey Date FE	Yes	Yes	Yes
Obs.	287,131	287,131	287,131
R-Squared	0.8570	0.8570	0.8570

Table 4. COVID-19 exposure and deposit rates, differentiating by partisanship

This table represents the regression results that estimate the effect of COVID on deposit rate across areas with different partisan preferences. The dependent variable is the percentage rate of 12-month certificate deposits of each branch in each week, reported by RateWatch. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county, reported on the Friday of the previous week. *LoTrump* indicates the county's votes for Trump in the 2016 presidential election is below 50%. *DemGov* indicates that the county is in a state with a democratic governor. *Survey Date* is the calendar date when the branch is surveyed about its deposit rate in a week. Heteroskedasticity-robust standard errors are clustered by county and reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

	(1)	(2)
Ln(Cases per Capita) * LoTrump	-0.0098***	
	(0.0034)	
Ln(Cases per Capita) * DemGov		-0.0108*
		(0.0064)
Ln(Cases per Capita)	-0.0037	-0.0075
	(0.0042)	(0.0046)
Branch FE	Yes	Yes
State-Week FE	Yes	Yes
Survey Date FE	Yes	Yes
Obs.	286,804	286,119
R-Squared	0.8570	0.8570

Table 5. COVID-19 exposure and deposit rates, differentiating by age and education

This table represents the regression results that estimate the effect of COVID on deposit rate across areas with different partisan preferences. The dependent variable is the percentage rate of 12-month certificate deposits of each branch in each week, reported by RateWatch. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county, reported on the Friday of the previous week. *Hi%Age>70* indicates the county's percentage share of population with age>70 is above sample median. *Hi%College or above* indicates that the county's percentage share of population with college degree or above is above median. *Survey Date* is the calendar date when the branch is surveyed about its deposit rate in a week. Heteroskedasticity-robust standard errors are clustered by county, as reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

	(1)	(2)	(3)
Ln(Cases per Capita) * Hi%Age>70	-0.0066*		-0.0097***
	(0.0037)		(0.0036)
Ln(Cases per Capita) * Hi%College or above		-0.0135***	-0.0160***
		(0.003)	(0.0031)
Ln(Cases per Capita)	-0.0132***	0.0009	0.0042
	(0.0029)	(0.0040)	(0.0041)
Branch FE	Yes	Yes	Yes
State-Week FE	Yes	Yes	Yes
Survey Date FE	Yes	Yes	Yes
Obs.	287,131	287,131	287,131
R-Squared	0.8571	0.8571	0.8572

Table 6. COVID-19 exposure and deposit rates, differentiating by social capital

This table represents the regression results that estimate the effect of COVID on deposit rate across areas with different levels of social capital. The dependent variable is the percentage rate of 12-month certificate deposits of each branch in each week, reported by RateWatch. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county, reported on the Friday of the previous week. *High Community health* is a dummy that equals to one if the county-level community health index is above median. *Survey Date* is the calendar date when the branch is surveyed about its deposit rate in a week. Heteroskedasticity-robust standard errors are clustered by county, as reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

	Community Health	Associations	Average
	(1)	(2)	(3)
Ln(Cases per Capita) * High Community Engagement	0.0077**	0.0077**	0.0091***
	(0.0036)	(0.0036)	(0.0034)
Ln(Cases per Capita)	-0.0155***	-0.0145***	-0.0153***
	(0.0033)	(0.0032)	(0.0033)
Branch FE	Yes	Yes	Yes
State-Week FE	Yes	Yes	Yes
Survey Date FE	Yes	Yes	Yes
Obs.	287,131	287,131	287,131
R-Squared	0.8571	0.8571	0.8571

Table 7. Simultaneous analysis

This table represents the regression results that estimate the effect of COVID on deposit rate across areas with different partisan preferences. The dependent variable is the percentage rate of 12-month certificate deposits of each branch in each week, reported by RateWatch. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county, reported on the Friday of the previous week. *Vol* and *Ret* are the weekly volatility and return of SP500 index in the previous week. *LoTrump* indicates the county's votes for Trump in the 2016 presidential election is below sample median. *Hi%College or above* indicates that the county's percentage share of population with college degree or above is above median. *High Community health* is a dummy that equals to one if the county-level community health index is above median. Heteroskedasticity-robust standard errors are clustered by county, as reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

	(1)	(2)	(3)
Ln(Cases per Capita) * Vol	-0.1578***		-0.2074***
	(0.0550)		(0.0596)
Ln(Cases per Capita) * Ret	0.0222***		0.0242***
	(0.0056)		(0.0057)
Ln(Cases per Capita) * LoTrump		-0.0085**	-0.0087**
		(0.0036)	(0.0036)
Ln(Cases per Capita) * Hi%Age		-0.0110***	-0.0106***
		(0.0036)	(0.0036)
Ln(Cases per Capita) * Hi%College or above		-0.0134***	-0.0138***
		(0.0033)	(0.0034)
Ln(Cases per Capita) * High Community Health		0.0087**	0.0090***
		(0.0034)	(0.0034)
Ln(Cases per Capita)	-0.0083***	0.0077*	0.0153***
	(0.0029)	(0.0046)	(0.0050)
Branch FE	Yes	Yes	Yes
State-Week FE	Yes	Yes	Yes
Survey Date FE	Yes	Yes	Yes
Obs.	287,131	286,804	286,804
R-Squared	0.8570	0.8573	0.8573

Table 8. Deposit growth and COVID-19 exposure, bank-by-county

This table represents the regression results that estimate the effect of COVID on the growth of deposit amount at the bank-county level. The dependent variable is the deposit growth between June 2019 and June 2020 in each bank-county. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county. *Lagged ΔLn Deposits* is the log change of deposit amount between 2018 and 2019. Bank Char. include size, capital-asset ratio, profitability, and Tier 1 capital. Heteroskedasticity-robust standard errors clustered by county (in columns 1 and 2) or bootstrapped standard errors (in columns 3 and 4) are reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

	(1)	(2)	(3)	(4)
Ln(Cases per Capita)	0.0132***	0.0111***	0.0081***	0.0081***
	(0.0021)	(0.0032)	(0.0015)	(0.0015)
Lagged ΔLn Deposits			0.0265	0.0265
			(0.0172)	(0.0172)
Bank Char.	Yes	No	No	No
Bank FE	No	Yes	Yes	Yes
HQ State FE	No	No	No	Yes
Regulatory Agency FE	No	No	No	Yes
N	24,411	22,416	21,531	21,531
r2	0.0075	0.2186	0.2192	0.2192

Table 9. COVID-19 exposure and spending

This tables represents the regression results of consumer spending on local COVID-19 exposure at the county-week level. The dependent variable is the seasonally adjusted credit/debit card spending relative to January 4-31, 2020. *Ln(Cases per Capita)* is the log number of total COVID cases per 1 million population in each county, reported on the Friday of the previous week. *Employment* is the employment level for all workers in a county relative to January 4 - 31, 2020. Heteroskedasticity-robust standard errors are clustered by county and reported in the parenthesis. "*" indicates statistical significance at 10% level, "**" at 5% level, and "***" at 1% level.

	(1)	(2)	(3)	(4)	(5)
Ln(Cases per Capita)	-0.0519***	-0.0193***	-0.0163***	-0.0158***	-0.0124***
	(0.0007)	(0.0011)	(0.0011)	(0.0012)	(0.0017)
Employment					0.0873**
					(0.0376)
County FE	No	No	Yes	Yes	Yes
Week FE	No	Yes	Yes	No	No
State-Week FE	No	No	No	Yes	Yes
Obs.	24,840	24,840	24,840	24,825	10,290
R-Squared	0.2709	0.5792	0.6865	0.7236	0.8312