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Un-used Bank Capital Buffers and Credit Supply Shocks at SMEs during the Pandemic

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Abstract

Did banks curb lending to creditworthy small and mid-sized enterprises (SME) during the COVID-19 pandemic? Sitting on top of minimum capital requirements, regulatory capital buffers introduced after the 2008 global financial crisis (GFC) are *costly* regions of "rainy day" equity capital designed to absorb losses and provide lending capacity in a downturn. Using a novel set of confidential loan level data that includes private SME firms, we show that "buffer-constrained" banks (those entering the pandemic with capital ratios close to this regulatory buffer region) reduced loan commitments to SME firms by an average of 1.4 percent more (quarterly) and were 4 percent more likely to end pre-existing lending relationships during the pandemic as compared to "buffer-unconstrained" banks (those entering the pandemic with capital ratios far from the regulatory capital buffer region). We further find heterogenous effects across firms, as buffer-constrained banks disproportionately curtailed credit to three types of borrowers: (1) private, bank-dependent SME firms, (2) firms whose lending relationships were relatively young, and (3) firms whose pre-pandemic credit lines contractually matured at the start of the pandemic (and thus were up for renegotiation). While the post-2008 period saw the rise of banking system capital to historically high levels, these capital buffers went effectively unused during the pandemic. To the best of our knowledge, our study is the first to: (1) empirically test the *usability* of these Basel III regulatory buffers *in a downturn*, and (2) contribute a bank capital-based transmission channel to the literature studying how the pandemic transmitted shocks to SME firms.

Keywords: Financial institutions, Capital Regulation, Procyclicality, COVID-19

JEL classification: G20, G21, G28

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1. Introduction

> *"Since the onset of the pandemic, however, questions have arisen over banks' ability and willingness to use the regulatory buffers available to them… in a period of stress, banks might react with many of the same procyclical behaviors that we've seen in the past, such as reigning back new business activity."* – S&P Global, June 11, 2020

> *"There has been a concern that the buffers were not being used and there was a reluctance to use them."* - Andrea Enria, chair of the European Central Bank's Single Supervisory Mechanism, Financial Times, January 28, 2021

Regulatory reforms implemented after the 2008 global financial crisis (GFC) played a central role in re-building banking system capital to the highest level in decades (nearly double that of 2008). Despite increased capital in the banking system and significant government support measures such as the Paycheck Protection Program (PPP), business lending during the pandemic has remained weak. Much of the decline in business lending is attributable to loan demand and credit quality concerns. Beyond these factors, however, a key question remains as to whether banks used their large capital cushions built post-GFC to support lending to creditworthy SME firms during the pandemic.

More specifically, our paper investigates a novel supply-side propagation channel related to the "usability of regulatory capital buffers" and whether banks closer to their regulatory capital buffers constrained credit on the margin to creditworthy SME firms during the COVID-19 pandemic. Introduced as part of the Basel III capital reforms, regulatory capital buffers are costly regions of "rainy day" equity capital that sit on top of minimum capital requirements, and are designed by regulation to help absorb losses and support lending in a downturn.[2] In contrast to minimum capital requirements, which are "hard" mandates that send a bank into resolution when breached, regulatory capital buffers represent a "soft" mandate that limits the bank's ability to pay dividends and bonuses until its capital stock is rebuilt – these penalties act like a warning signal that disincentivize the unnecessary use of buffers in normal times and allow banks time to try to recover from unforeseen shocks.

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[2] As part of the Basel III capital reforms, the Basel Committee on Banking Supervision (BCBS) introduced a series of measures to promote the buildup of regulatory capital buffers (i.e., the capital conservation buffer, the countercyclical capital buffer, and the capital surcharge for global systemically important banks) in good times that can be drawn upon in periods of stress to support new lending activity. See, "Consultative document: Strengthening the resilience of the banking sector," BCBS, BIS, December 2009. In the US implementation, the Federal Reserve introduced the stress capital buffer as a replacement for the capital conservation buffer. Institutional details on the implementation of regulatory capital buffers in the U.S. are described in Section 2.

At the onset of the pandemic, the Federal Reserve publicly encouraged banks to use these buffers to support the economy during the downturn.[3] However, the prospect of large pandemic-related losses during 2020 appear to have caused banks to take steps to reduce the likelihood that they would have to operate near their regulatory buffers in an attempt to avoid incurring costs associated with dipping into their regulatory buffers, despite elevated capital levels.[4] Revealed preference appears to suggest that banks found these buffers as too costly to use. How close a bank was to the regulatory buffer region prior to the unanticipated arrival of the pandemic can be seen as a bank-specific measure of how binding the costs of the regulatory buffers were. Banks that started the pandemic with a capital ratio relatively close to the regulatory buffer region are referred to as "buffer-constrained" for ease of exposition. Consistent with the notion that banks demonstrated a reluctance to use these buffers to absorb pandemic losses, we show that "buffer-constrained" banks reduced loan commitments to SME firms by an average of 1.4 percent more (quarterly) and were 4 percent more likely to end pre-existing lending relationships during the pandemic than "buffer-unconstrained" banks.

[FIGURE 1]

As an illustrative preview, Figure 1 shows that a significant number of lending relationships between buffer-constrained banks and private bank-dependent SME firms ended during the pandemic (at least 2,500 relationships) as compared to that of buffer-unconstrained banks, whose lending relationships remained relatively stable.[5] While part of these firms may have exited due to pandemic-related bankruptcies or intentional deleveraging, the relative difference between the two lines provides suggestive evidence that a sizeable number of SME firms that originally banked with well-capitalized, albeit buffer-constrained, lenders may have lost access to credit during the pandemic due to the potential un-usability of regulatory capital buffers.[6]

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[3] See https://www.federalreserve.gov/newsevents/pressreleases/monetary20200315b.htm for the official press release.
[4] This regulatory issue expands beyond the case of the United States. In response to the concern that buffers were not be used, the ECB even went as far as to provide pandemic capital relief by temporarily eliminating a significant portion of regulatory capital buffers.
[5] As described in Section 3, we define a firm to be SME if the firm size is less than the median firm size as of 2019:Q4, private if it is privately-owned, and bank-dependent if it banks with a single lender.
[6] This is covered more formally in our relationship exit specifications.

More formally, we utilize a novel set of confidential, supervisory loan-level data (FR Y-14Q) between the largest U.S. banks and their corporate borrowers.[7] This granular data provides us with a unique advantage to observe the lending outcomes at an important, yet under-studied segment of the economy, namely, private bank-dependent SME firms. To overcome the identification challenge for single-bank SME firms, we extend the Khwaja and Mian (2008) approach and compare the lending of buffer-constrained versus buffer-unconstrained banks to *groups of similar borrower firms*. Specifically, these borrowers are grouped by size-x-date, geography-x-date, and industry-x-date.[8] Additionally, we utilize the granularity of this data to explore a second question: did buffer-constrained banks curtail lending to certain *types* of firms more than others during the pandemic (in other words, which firms were impacted most by the banks' procyclical response to regulatory capital buffers?) Firstly, we find that buffer-constrained banks disproportionately curtail lending to private bank-dependent SME firms while leaving their valuable relationships with large public ("core") clients untouched. Secondly, buffer-constrained lenders curb lending to firms with whom its lending relationship is relatively young (less than the median relationship age of 6 years of less). This would be consistent with the literature on relationship lending (Bharath et al. (2011)), which attributes a larger termination cost associated with older relationships. Finally, we also find that buffer-constrained banks contract credit to firms whose pre-pandemic credit lines contractually matured at the start of the pandemic. It is less costly to cut lending to these firms from a legal and contractual standpoint since the lender does not need to break any contractual terms of a pre-existing commitment to do so, but rather can simply decline to fund a credit line that is up for renegotiation. This third finding also provides additional robustness for the purpose of identifying credit supply shocks, as the selection rule for these treatment firms comes from a pre-determined variable (i.e. the maturity of a previous contract), which was made prior to the unanticipated arrival of the pandemic.

New to the COVID-19 literature, our paper uncovers the presence of a *transmission channel emanating from regulatory capital buffer constraints* that significantly affected SME

[7] This data has a minimum loan reporting threshold of $1 million USD, which excludes small business loans (according to the thresholds defined in Call Reports). Y-14 data excludes PPP loan balances.

[8] More specifically, we follow Degryse, De Jonge, Jakovlievic, Mulier and Schepens (2019) and instead of the Firm*Time fixed effects (which would absorb single-bank firms) in the Khwaja and Mian approach, we use Firm type*Time fixed effects. Firm-type includes firms grouped by industry, location (e.g., zip code) and size.

firms during the pandemic. Complementing studies that document the performance of SMEs during the pandemic, our paper establishes a supply-side (feedback) transmission channel that likely contributed to these conditions. In this way, our study contributes a new bank capital angle to an expanding literature that studies the various effects of the COVID-19 pandemic shock on the condition of private SME firms. For example, Bloom et al. (2021) use survey data on an opt-in panel of around 2,500 US small businesses to assess the impact of COVID-19 and find a significant negative sales impact that peaked with an average loss of 29 percent in sales. Of these, almost a quarter reported losses of more than 50 percent. In addition, they find these impacts to be persistent, as firms reporting the largest sales drops in mid-2020 were still forecasting large sales losses a year later in mid-2021. Bloom et al. (2020) estimates that COVID-19 would reduce Total Factor Productivity (TFP) in the private sector by up to 5 percent in 2020Q4, falling back to a 1 percent reduction in the medium term. Gourinchas et al. (2020) estimate the impact of the COVID-19 crisis on business failures among SMEs in seventeen countries using a large representative firm-level database. They estimate a large increase in the failure rate of SMEs under COVID-19 of nearly 9 percentage points, absent government support. Alekseev et al. (2020) use survey data collected via Facebook and find that about a quarter of small businesses had access to financing from financial institutions, and most small businesses were reliant on personal savings and informal sources of financing during the pandemic. Kapan and Minoiu (2021) find that despite the unexpected surge in credit line drawdowns at the onset of the COVID-19 pandemic, banks with significant exposures to credit lines tightened their lending standards and cut their C&I loan supply to small businesses. The authors interpret this response as the result of a reduction in banks' risk tolerance rather than balance sheet (liquidity and capital) constraints. Using loan-level data from FR Y-14 as we do, Chodorow-Reich et al (2020) document that, unlike large firms, SMEs take loans of shorter maturity, have less active maturity management, post more collateral, pay higher spreads, and have higher utilization rates. These facts, in their view, explain why during the pandemic SMEs did not draw down their credit lines as much as large firms did, though PPP loans helped alleviate their curtailed access to bank credit. Along these lines, Strahan and Li (2021) analyze the bank supply of credit under the emergency PPP lending program and conclude that PPP loans reflect a benefit of bank relationships as they facilitate firms' access to government-subsidized lending that help alleviate the rise in unemployment. Our results are consistent and complementary to the findings in these

papers, and cover a broader class of firms (those with young lending relationships as well as credit lines maturing at the start of the pandemic). In addition, our paper contributes a novel bank capital-based *transmission channel* that affected firms during the pandemic due to the procyclical lending response of buffer-constrained banks, enabling the discussion of policy remedies.

In relation to the literature studying the credit impacts of *"hard-mandate"* capital requirements (Kashyap, Stein, and Hanson, 2010; Basel Committee on Banking Supervision, 2010; Acharya, Engle, Richardson, 2012; Admati, et al., 2013; Baker and Wurgler, 2015; Sarin and Summers, 2016; Aiyar et al., 2014; Hanson, Kashyap and Stein, 2011; Greenwood et al., 2017; Financial Stability Board, 2020), relatively little is known about the effects of new Basel III "soft mandate" policy tools, such as regulatory capital buffers, *particularly during downturns like the pandemic*.[9] This literature can be categorized into two sets. The first set of papers present evidence on pre-Basel III changes in capital regulation and unequivocally finds that higher regulatory requirements reduce bank lending. Jiménez et al. (2017) studies bank lending responses to dynamic provisioning experiments in Spain and find that countercyclical regulatory capital buffers help to smooth credit cycles. Gropp et al. (2018) provide evidence for a similar lending response in European banking data to the 2011 EBA capital exercise, showing that large European banks required to maintain a higher capital ratio in the 2011 capital exercise responded by reducing total asset size, while keeping equity capital and asset risk constant. Behn, Haselmann and Wachtel (2016) and Fraisse, Lé, and Thesmar (2020) use German and French loan-level data, respectively, to show that banks are more likely to cut lending when capital charges on loans, under Basel II rules, increase. Meanwhile, the second set of papers based on US loan-level data explore the impact of Basel III regulatory capital buffers on lending outcomes *during normal times*. Specifically, Berrospide and Edge (2019) find that the introduction of regulatory capital buffers emanating from stress test disclosures led to a lower growth in C&I loan commitments, while Favara, Rezende, and Ivanov (2021) find that time variation in GSIB surcharge regulatory buffers result in significant declines in C&I loan commitments by GSIBs as well as broken lending relationships. As both of these papers concentrate on pre-pandemic boom periods, they both contribute the important finding that soft mandate Basel III regulatory capital

[9] Minimum requirements are "hard" mandates that send a bank into resolution when breached. Regulatory capital buffers, on the other hand, are "soft" requirements that allow banks time to try to recover. If the buffer is breached, the bank's ability to pay dividends and bonuses is restricted until its capital stock is rebuilt.

buffers did in fact play a key role in getting bank system capital to the historically high levels prior to the arrival of the pandemic. Our paper can be seen as a combination of both categories, as it is the first to empirically test whether the *Basel III* regulatory buffers were in fact usable *during a (pandemic) downturn*. We find evidence pointing to procyclical impacts of regulatory capital buffers during the pandemic downturn, particularly on private bank-dependent SMEs and other non-core firms for which it was relatively cheap to cut lending to.

Finally, our results also point to a different interpretation of the Basel III regulatory capital buffers. Rather than seeing the buffers as a cushion to be drawn upon during a downturn, as originally intended by Basel III, banks seem to be treating the regulatory buffers as additional minimum requirements. Relatedly, and in a complementary fashion, the IMF's Global Financial Stability Report (GFSR), in April 2021, addresses the usability of capital buffers and documents that, despite the vital role of capital buffers to ensure continued supply of credit to the real economy, banks remain reluctant to drawn down their buffers.[10] Using a sample of 72 large global banks, representing 60 percent of the global banking system's aggregate market capitalization, the report finds that only banks accounting for 5 percent of market capitalization clear the hurdles to use their buffers. Thus, banks seem to lack the economic incentives to dip into their capital buffers as regulation will require them to rebuild their buffers later. Low returns could make the usability of buffers a costly option if the additional value generated by the new lending does not offset the negative impact from the capital shortfall resulting from using the buffers in the first place. Using banks' balance sheet data and a different methodology, our paper provides evidence of additional reasons for the reluctance of banks to use their capital buffers. Beyond the costs associated with the need to rebuild their buffers in the GFSR, we estimate that the costs of using the buffers associated with credit downgrades and dividend cuts are relatively large (approximately 300 basis points in a 3-day window during stressful times) and thus may have prevented banks to use their regulatory capital buffers at the onset of the COVID-19 crisis.

The paper is organized as follows. Section 2 provides institutional background on regulatory capital buffers. Section 3 describes the data, empirical strategy, and summary statistics. Section 4 presents the results. Finally, Section 5 concludes.

[10] See, Chapter 1, "An Asynchronous and Divergent Recovery may put Financial Stability at Risk," pages 22-25.

2. Capital Ratios and Basel III Regulatory Capital Buffers

This section outlines some background on the Common Equity Tier 1 (CET1) capital ratio and the regulatory capital buffers, as implemented in the U.S. via Basel III. Bank CET1 capital ratios can be split into three parts:

CET1 Capital Ratio = Minimum Requirement + Regulatory Capital Buffers + Excess Cushion

- A regulatory minimum requirement to prevent undercapitalization. Following the Basel III capital rules, this is 4.5 percent for all banks and marks the ("hard" mandate) threshold below which a bank would be deemed insolvent by regulators. If a bank enters this regime, solvency procedures would be set in motion.[11]
- Basel III regulatory capital buffers, such as the Global Systemically Important Bank (GSIB) surcharge and the stress capital buffer. These are costly regions of "rainy day" capital that come with payout and bonus restrictions ("soft" mandate), apply only to the largest (GSIB) banks, and typically range from 2.5 – 7.0 percent, depending on the bank's risk profile. These buffers are designed to provide added resilience to absorb bank losses in the event of a stress scenario.
- Excess cushions, which reflect the CET1 capital ratio level of bank capital in excess of regulatory minimums plus regulatory buffers. For most large firms, this cushion is typically 3 percent or less. This excess cushion approximates the amount of capital that banks could lose without facing potential payout restrictions or shrinking their balance sheet in order to become compliant.

For illustrative purposes, Figure 2 depicts a hypothetical bank with a starting CET1 capital ratio of 12 percent. The bank's capital ratio is decomposed into a 4.5 percent Basel III minimum

[11] Several papers provide theoretical rationale for why banks find it optimal to maintain an equilibrium level of capital in excess of regulatory minimum requirements. Using a dynamic equilibrium model of relationship lending in which banks are unable to access the equity markets every period and the business cycle determines loans' probabilities of default, Repullo and Suarez (2013) show that banks hold endogenous capital buffers as a precaution against shocks that impair their future lending capacity. Koch et al. (2016) compare optimal capital structure prior to the Great Depression, when no government guarantees existed, versus that of the Great Recession, and suggest that market discipline would have induced the largest US banks to maintain higher capital buffers prior to the 2008 crisis. Baron (2020) further provides support for the case of strengthening countercyclical capital buffers since government guarantees can distort the incentives of banks to raise new equity and affect the dynamics of bank capital structure over the credit cycle. Milne and Whalley (2001) suggests that banks like to keep a capital buffer above minimum requirements, since they fear regulatory discipline from breaching such requirements. This means that changes in capital that occur well above the requirement should trigger less of a procyclical cutback in the provision of credit to the economy than changes that bring the level of capital close to the minimum. In line with these findings, Nier and Zicchino (2008) provide evidence that losses lead to greater pull-back in lending for banks at a lower initial level of capital.

requirement, a 5.5 percent regulatory buffer representing the combination of the stress capital buffer and GSIB surcharge, and an additional 2 percent cushion. As the bank's CET1 capital ratio declines due to the arrival of pandemic losses (downward sloping blue line), the right panel of Figure 2 (in red) highlights an important choice the bank has to make on their lending decisions. Specifically, the bank has two options:

- Option A: Shrink (e.g., by constraining credit) in order to remain above the regulatory buffer. This saves the bank all costs associated with entering this buffer (payout restrictions, bonus restrictions, etc.).
- Option B: Utilize the regulatory buffers to absorb pandemic losses and continue supporting creditworthy firms through the provision of credit.

[FIGURE 2]

3. Empirical Approach

a. Data Description and Summary Statistics

To perform our regression analysis, we access novel loan-level information on C&I credit lines (at the bank-firm-quarter level) sourced from the H1 Corporate Schedule of the confidential regulatory filing FR-Y14Q, and combine this with quarterly consolidated bank balance sheet level information at the BHC level from the regulatory filings FR Y-9C. The main balance sheet variable of interest that separates the set of treatment and control firms in our baseline specification is the lender's pre-pandemic distance to the regulatory buffer (as of 2019Q4). This is equivalent to the size of the green excess capital cushion from Figure 2. As will be elaborated in the next section, we define a bank as being constrained by the regulatory buffer ("buffer-constrained") if the distance between its CET1 capital ratio and its regulatory buffer threshold is equal to or less than that of the median bank (2.13 percent). In other words, we posit that if a bank enters the pandemic with a relatively small cushion to absorb pandemic losses before having to dip into its regulatory buffers (and thereby incur a variety of regulatory costs), that bank may choose to curtail credit in order to avoid incurring any costs from regulatory buffer usage – a less-than-desirable outcome given that the absolute level of CET1 is at historical highs, and yet would go un-used.

The FR Y-14 Corporate Schedule is collected for the very large BHCs that participate in the CCAR stress tests. While there are over 30 such BHCs that file, we exclude the filings of foreign bank intermediate holding companies (IHCs), since the capital of the IHCs are internal to the organization and thus driven by different incentives. In addition, we drop any BHCs that do not report the FR Y-14 data during the pandemic, or those that have too little C&I loan exposure (i.e. custodian banks). Additionally, to keep the focus on lending outcomes at nonfinancial corporations, we exclude C&I loans to U.S. and foreign banks, other depository financial institutions, non-depository financial institutions, and loans to financial agricultural production and other loans to farmers. This leaves us with quarterly loan information for 16 domestic U.S. BHCs and about 54 thousand firms between 2018Q1 and 2020Q3. The data in the FR Y-14 Corporate Schedule includes loan information at the credit facility level for loan committed balances greater than or equal to $1 million.[12] The advantage of using loan commitments is that they include both undrawn and drawn portions of credit facilities. This measure of commitments (rather than on-balance sheet outstanding loan amounts) is immune to demand-driven swings in credit line drawdowns and repayments and is thus closer to the idea of bank credit supply decisions, compared to other studies that use outstanding loan amounts.

Table 1 provides summary statistics at the bank-firm-time level for the control variables in our analysis. C&I commitments have grown on average at a quarterly rate of 1.36 percent at the bank-firm level. The average CET1 capital ratio is 11.12 percent, which is nearly double the average level of bank capital during the 2008 financial crisis. The average reporting bank primarily funds its assets through deposit funding (65 percent), holds a sizeable amount of illiquid assets on its books (31 percent), and has maintained a quarterly return on assets of about 28 basis points.

One appeal of the FR-Y14 data set is that it includes a wide range of firms; that is, small and large firms and publicly traded and private firms. Our use of the FR Y-14 C&I loan level data is quite novel as this is the closest data that we have in the United States to credit registry data used in the prior literature – see, for example, Jimenez, *et al*. (2017) for banks in Spain.

[TABLE 1]

[12] For this reason, FR Y-14 does not capture very small business lending (<$1 million USD), and instead captures SME as well as large public firms.

Figure 3 plots the relationship between the size of pre-pandemic distance to the regulatory buffer, measured as of 2019Q4, versus the subsequent growth in C&I loan commitments during the pandemic period. The figure shows that ex-post commitment growth during the pandemic was weaker among banks that were ex-ante buffer-constrained, a.k.a. those that entered the pandemic with CET1 capital ratios closer to the regulatory buffer.[13]

[FIGURE 3]

Next, we plot time trends by comparing C&I commitment growth rates across buffer-constrained and -unconstrained banks. Suggestive of parallel trends, Figure 4 shows the average commitment growth rates before and after the pandemic for firms that borrow from buffer-constrained lenders (red) versus buffer-unconstrained lenders (blue). As shown in the picture, overall C&I commitment growth rates declined significantly after the pandemic, that is, from 2019Q4 to 2020Q3. The contraction was more severe for buffer-constrained banks (-3 percentage points) than for buffer-unconstrained banks (-1.86 percentage points).

[FIGURE 4]

b. Regression specifications

While using consolidated bank balance sheet data is less suitable for disentangling credit supply from credit demand, to overcome this issue, we use loan-level data on C&I credit lines. Considering that the bulk of firms in FR Y-14 data borrow from a single bank, we extend the Khwaja and Mian (2008) approach to compare the lending of buffer-constrained versus buffer-unconstrained banks to *groups of similar borrowing firms* that are likely to experience common demand shocks (Figure 5). Specifically, our identification strategy follows Degryse, De Jonge, Jakovlievic, Mulier and Schepens (2019) and replaces the firm*time fixed effects with firm type*time fixed effects. Firm type includes firms grouped by industry, location (e.g., zip code) and 10 size bins. These firm type*time fixed effects allow us to control for demand shocks that are common to firms in the same group. Moreover, we add firm*bank fixed effects to control for any unobserved characteristics within that specific bank-firm lending relationship. As additional

[13] Please refer to Appendix for further analysis showing that this relation cannot be explained by plotting the pre-pandemic level of the CET1 ratio versus the pandemic commitment growth. Counter to intuition, excess capital cushions are not positively correlated with CET1 ratios.

robustness for the purpose of identifying credit supply shocks, we perform a specification that compares lending outcomes of buffer-constrained banks for firms whose pre-pandemic credit lines contractually matured at the start of the pandemic – the selection rule for assigning treatment comes from a pre-determined variable (i.e. the maturity of a previous contract), which was made prior to the unexpected arrival of the pandemic and thus unlikely to be correlated with demand shocks in the pandemic.

[FIGURE 5]

i. Commitment Growth to Existing Borrowers

Our first set of specifications study bank response along the intensive margin. We categorize banks as either buffer-constrained and buffer-unconstrained using a dummy variable $BufferConstrainedBank$, which takes the value of 1 for banks that had CET1 capital ratios close to the regulatory buffer right before the onset of the pandemic and 0 for those that had CET1 capital ratios far from it. This threshold is based on whether this distance is above or below the median distance (2.13 percent) for CCAR banks as of 2019Q4. Equation (1) below presents our intensive margin specification:

$$(1)\quad \frac{\Delta Commitments_{bft}}{Commitments_{bf,t-1}} = \beta_0 POST_t + \beta_1 BufferConstrainedBank_{b,2019q4} + \beta_2\theta + \cdots + \beta_3 POST_t * BufferConstrainedBank_{b,2019q4} * \theta + \beta_B BankControls_{b,t-1} + \beta_F FirmControls_{f,t-1} + InternalRiskRating_{b,f,t-1} + \varepsilon_{bft}$$

where the "…" includes all pairwise interactions between the three interacting variables. $\frac{\Delta Commitments_{bft}}{Commitments_{bf,t-1}}$ is the quarterly growth rate in commitments from bank b to firm f at time t. POST is a dummy variable that equals 1 starting 2020Q1 or later (pandemic period). For regression tables 2-5, θ takes on each respective element of the following set: $\left\{\begin{matrix} SMEFirm_{f,2019q4}, PrivbankdepSMEFirm_{f,2019q4}, YoungRelationship_{b,f,2019q4}, \\ FirmCreditLineMaturinginPandemic_{b,f} \end{matrix}\right\}$, where

- $SMEFirm_{f,2019q4}$ is a dummy variable that equals 1 for all firms f smaller (in total assets) than the median firm size as of 2019Q4.

- $PrivBankdepSMEFirm_{f,2019q4}$ is a dummy variable that equals 1 for all firms f that are private, SME, and only banked with a single lender as of 2019Q4.

- $YoungRelationship_{b,f,2019q4}$ is a dummy variable that equals 1 for all firms f that have maintained a lending relationship with their bank b for less than or equal to the median relationship age (6 years), as of 2019Q4.

- $FirmCreditLineMaturinginPandemic_{b,f}$ is a dummy variable that equals 1 for all firms f whose prior credit line with bank b is set to contractually mature as of 2020Q2.

$BankControls_{b,t-1}$ include $CET1Ratio_{b,t-1}, MarketCapitalRatio_{b,t-1}$, $\Delta MarketCapitalRatio_{b,t-1}, BankSize_{b,t-1}, DepositRatio_{b,t-1}, NPLShare_{b,t-1}$, $LiquidAssetShare_{b,t-1}, ROA_{b,t-1}$, while $Firm\ Controls_{f,t-1}$ include $Ln(Firm\ Size)_{f,t-1}, Firm\ Leverage_{f,t-1}, Firm\ ROA_{f,t-1}, and\ Firm\ Sales\ Rate_{f,t-1}$. Note that $InternalRiskRating_{b,f,t-1}$ are the confidential internal ratings that bank b assigns to a particular loan between itself and firm f at time t-1. This variable provides a way to control for borrower risk.

According to our hypothesis, for the triple difference-in-differences specifications, we expect a negative coefficient on the triple interaction term $POST_t{*}BufferConstrainedBank_{b,2019q4} * \theta$. These signs would be consistent with our prediction that buffer-constrained banks curb commitments disproportionately to firms with particular characteristics: private bank-dependent SMEs, those with relatively young lending relationships, and those whose pre-existing credit lines are coming due at the start of the pandemic.

ii. Terminated Lending Relationships

Section 3.b.i captures any changes in commitment growth between a buffer-constrained bank b and firm f assuming the bank does not reduce commitments to 0 (e.g. relationship termination). On the other hand, our second set of specifications (equation 2) in this Section study the bank's decision to terminate pre-existing lending relationships. Our choice of a linear rather than nonlinear model is motivated by two factors. First, nonlinear models tend to produce biased estimates in panel data sets that have many fixed effects, leading to an incidental parameters problem and inconsistent estimates. Second, nonlinear fixed effects models generate biased estimates for interaction terms (Ai and Norton, 2003), the main coefficients of interest. Therefore, following the recommendation of the econometrics literature (Wooldridge, 2002), we estimate a linear model of relationship termination decisions.

$$
\begin{aligned}
(2)\ TerminateRelationship[0/1]_{b,f,t+1} \\
&= \beta_0 POST_t + \beta_1 BufferConstrainedBank_{b,2019q4} + \beta_2 \theta + \cdots + \beta_3 POST_t \\
&* BufferConstrainedBank_{b,2019q4} * \theta + \beta_F FirmControls_{f,t} \\
&+ \beta_X BankControls_{b,t} + InternalRiskRating_{b,f,t-1} + \varepsilon_{bft}
\end{aligned}
$$

where $TerminateRelationship[0/1]_{b,f,t+1}$ is a [0/1] dummy that indicates whether the bank ends its relationship with firm f in the following period. This is determined by observing if the bank reports an observation (in the FR Y-14Q) for this same bank b – firm f pair in the following quarter. Thus, the interpretation of any given coefficient would be the impact of that particular right-hand side variable on the probability that the bank ends this relationship in the following quarter. All other variable definitions are the same as in Section 3.b.i.

According to our hypothesis, we expect a positive coefficient on the double interaction term $POST_t$*$BufferConstrainedBank_{b,2019q4}$(column 1 of Table 5). This would be consistent with the idea that buffer-constrained banks are more likely to end pre-existing relationships during the pandemic. Furthermore, for the triple difference-in-differences specifications, we expect a positive coefficient on the triple interaction terms $POST_t$*$BufferConstrainedBank_{b,2019q4}$*$\theta$. These signs would be consistent with our prediction in terms of heterogeneous firm effects, i.e. the idea that buffer-constrained banks

disproportionately terminate pre-existing relationships with firms that have particular characteristics: private bank-dependent SMEs, those with relatively young lending relationships, and those whose pre-existing credit lines are maturing at the start of the pandemic.

4. Results

Tables 2-5 shows the regression estimates for the intensive margin specifications (equation 1), where each column gradually add on bank controls and firm controls. Column 1 of Table 2 has a baseline difference-in-differences estimate that shows a negative and significant impact of *BufferConstrainedBank* on the growth of committed amounts of C&I loans for all borrower firms. Columns 2 through 4 show economically and statistically significant heterogeneous effects across firm size. Specifically, banks that entered the pandemic as buffer-constrained disproportionately curtail lending to SME firms rather than large firms, i.e. roughly 1.4 percentage point quarterly reduction to SME firms during the pandemic. These magnitudes are economically meaningful, given that the average growth rate of a utilized loan is 1.3 percent per quarter as reported in Table 1. Note that these specifications control for the absolute level of CET1 capital.[14] This would be consistent with the notion that since bank insolvency was not a concern during the pandemic, banks were managing their capital ratios with respect to the regulatory buffer threshold (4.5 percent minimum requirement plus regulatory buffers, e.g. the orange plus blue regions in Figure 2), as opposed to the insolvency threshold (4.5 percent minimum requirement, e.g. orange region in Figure 2).

Table 3 explores the impact on all SME borrowers that are also private and bank-dependent (e.g. firms that bank with only one FR Y-14Q lender), and finds that the effect on the triple interaction POST*BufferConstrainedBank*PrivBankdepSMEFirm has similar magnitude of about -1.39 percentage point lower C&I commitment growth and is statistically significant. Thus, buffer-constrained banks appear to be curtailing credit more to firms that do not have the ability to easily substitute toward other forms of financing. Additionally, Table 6 shows evidence that buffer-constrained banks are 4.6 percent more likely to terminate relationships with private, bank-dependent SME firms during the pandemic.

[14] In appendix A we show plots with evidence that buffer-constrained banks tend to have higher CET1 capital ratios, implying that our regression results are not explained by the absolute level of capital.

Our results point to concerns about potential delays in the economic recovery following the peak of the pandemic, as bank-dependent firms incur higher costs when their lender relationship is terminated than do large firms. Notice that the double interaction coefficient is small and statistically insignificant. This result is equally informative as it indicates that buffer-constrained banks did not curb credit to large borrowers, which would be consistent with the notion that banks will protect relationships with large public borrowers as they are more valuable (e.g. multi-line products that the bank services for these firms). These findings are corroborated in Figure 6, which shows the number of firms entering new relationships and exiting old ones with each our two groups of banks, respectively. The top panel shows that, during the pandemic, buffer-constrained banks appear to end more pre-existing relationships and start fewer new relationships with private, bank-dependent SME firms than do buffer-unconstrained banks. The bottom panel of Figure 6 shows that neither bank type appears to be making net changes to their number of large borrowers, as would be expected.

Tables 4 and 7 provide estimates for credit supply adjustments along the intensive and exit margins for borrowers whose lending relationships are relatively young. We define a lending relationship as relatively young if its age is below the median relationship age for all bank-firm pairs in the Y-14 sample (6 years or less). Along the intensive margin, Table 4 shows that buffer-constrained banks reduce C&I commitment growth to young relationship firms by roughly 1.2 percentage points quarterly during the pandemic. Meanwhile, Table 7 shows that buffer-constrained banks are 0.8 percent more likely to end a pre-existing lending relationship if that relationship qualifies as young. This result is consistent with the idea that ending younger relationships is less costly to banks as compared to older relationships.

Finally, Tables 5 and 8 explore the set of firms who have credit lines that was originated prior to the pandemic, namely, that contractually mature in the first major quarter of the pandemic, 2020Q2. These are the set of firms for which it is least costly (legally and contractually speaking) for a buffer-constrained bank to cut lending to, since the bank does not need to break any terms of the pre-existing contract or wait for any covenants to be violated. The bank can simply decline to renew during the contract renegotiation and allow the exposure to roll off its books. Table 5 shows that buffer-constrained banks reduced C&I commitment growth to these firms by 2.3 percentage points during the pandemic. Note that this effect is economically significant. In addition to this, buffer-constrained banks are 3 percent more likely

to end relationships with those firms. Note also that this finding provides additional robustness for the purpose of identifying credit supply shocks since the selection rule for this treatment group of firms comes from a pre-determined variable (e.g. the contractual maturity of a pre-pandemic credit line contract), which was determined prior to the unexpected arrival of the pandemic downturn. This finding strongly suggests the presence of credit supply effects, as it would be difficult to explain this result using a demand-side story. Our analysis shows that this supply side effect expands to firms *beyond just SMEs*. Specifically, *any* firm with a young lending relationship or loans maturing at the start of the pandemic qualify as less costly options for buffer-constrained banks to curtail lending to in order to preserve bank capital.

In summary, we find evidence that buffer-constrained banks cut lending (and terminate lending relationships) disproportionately with private bank-dependent SME firms, young relationship firms, and firms whose prior credit lines were set to mature at the start of the pandemic. Altogether, these findings are consistent with the idea that a buffer-constrained bank optimizes how best to curtail credit by choosing firms for which it is least costly to trim lending to or end relationships with.

iii. Why banks might find using regulatory buffers expensive?

As described in the introduction and Section 2, regulatory capital buffers are soft mandate requirements, where banks are allowed to dip into but will incur penalties for doing so – in particular, Basel III regulatory buffer usage means banks face market stigma when facing regulatory restrictions on payout restrictions as well as . None of the prior studies in the literature of regulatory buffers (Favara et al., 2021, Berrospide et al., 2019, Jimenez et al, 2017, Gropp et al., 2018, Behn et al., 2016, Fraisse et al., 2020) explores which costs associated with the use of the capital buffers is most binding for banks. While this task is also not empirically possible to pin down in the context of the pandemic either, below we provide some background on the historical costs of two possible causes for banks to avoid using their regulatory buffers, particularly during the 2008 financial crisis, namely, the possibility of a credit rating downgrade, and the associated limitations on capital distributions (e.g. dividend payments and share repurchases).

Banks that dip into their regulatory capital buffers may fear potential risks associated with credit ratings downgrades. For example, during April 2020, Moody's released a statement

that global investment banks are expected to maintain solid capital buffers at or above 2019 levels. To test the impact of a potential downgrade under stress, we use Moodys and S&P ratings downgrades data from 1990 – 2020 and daily stock price data, to conduct an event study using a Fama French 3 factor model. For each event i, we estimate coefficients for the Fama French 3 factor model in a 120-day estimation window (130 days before to 10 days before event).

$$R_{it} = \beta_i + \gamma_{it}(Mkt - Rf)_t + \alpha_2 HML_t + \tau_3 SMB_t + \varepsilon_{it}$$

We then use these coefficients to extract the abnormal stock return of bank i using a (-1,1) 3-day event window around the ratings downgrade. We find that credit rating downgrades are associated with negative abnormal stock returns for banks, and the magnitude of the decline is more severe during stress events such as the Global Financial Crisis.

	Ratings Downgrade Events	(-1,1) CAR percent
All	122	-1.29 percent***
Normal Times	73	-0.43 percent
GFC Crisis	48	-2.65 percent***

Firms that breach regulatory capital buffers may face limitations on capital distributions imposed by regulators.[15] We conduct a second event study, using dividend cuts from 1990-present, and employing a framework similar to that described in the previous section. Overall, we find that dividend cuts reduce cumulative abnormal returns about 2 percent during the 3-day event window. The effects are larger when firms are under stress.

	Events	(-1,1) CAR percent
ALL	42	-2.34 percent**
Normal Times	12	-1.07 percent
GFC Crisis	28	-2.88 percent**

[15] For example, Capital conservation buffer, countercyclical capital buffer amount, and GSIB surcharge, 12 C.F.R. § 217.11.

In both cases, the costs associated with credit downgrades and dividend cuts during the GFC are relatively similar and close to 300 basis points during the 3-day event window. Despite the potential caveats associated with the limited number of these events, our estimates seem statistically and economically significant and point to the magnitude of the costs banks may fear they could have faced had they used their regulatory capital buffers at the onset of the COVID-19 crisis. As discussed above, our cost estimates for potential market penalties associated with the use of capital buffers add to the costs estimates provided by the IMF's GFSR associated with the need to rebuild the buffers if they were to be used in the first place.

5. Conclusion

Sitting on top of minimum capital requirements, regulatory capital buffers introduced after the 2008 financial crisis are costly regions of "rainy day" equity capital designed to allow banks to absorb losses and support the economy through lending in a downturn. Although the implementation of these Basel III regulatory buffers played a key role in helping build banking system capital (nearly double that of 2008), it appears this stockpile of capital went effectively unused during the pandemic. Our results suggest that banks were reluctant to use their regulatory buffers to absorb pandemic losses, and instead curtailed lending to SME firms that were *deserving of credit* during the pandemic.

To explore this, we employ a novel set of confidential, supervisory loan-level data between the largest U.S. banks and their corporate borrowers during the pandemic. This comprehensive coverage of this data provides us with a unique advantage to observe the lending outcomes at an important, yet under-studied segment of the economy, namely, private SME firms, whose survival was particularly dependent on financing from their relationship lenders.

Controlling for borrower risk, we find that during the pandemic, "buffer-constrained banks" (e.g. lenders that entered the pandemic with a capital ratio relatively close to the regulatory buffer region) curtailed commitments and terminated lending relationships with private SME firms significantly more than "buffer-unconstrained" banks (e.g. lenders that entered the pandemic with a capital ratio relatively far to the regulatory buffer region). We further find heterogeneous effects across firm type. Specifically, our results show that buffer-constrained banks disproportionately curtailed lending to and ended lending relationships with:

(1) private bank-dependent SME firms (leaving their valuable relationships with large public clients untouched), (2) firms that had a relatively young lending relationship with their bank, and (3) firms whose pre-pandemic credit lines contractually matured at the start of the pandemic (and thus were up for renegotiation). These results are consistent with banks making cost-minimizing decisions on which firms would be least costly to curtail credit to.

Our study brings a new angle to the literature on how the pandemic transmitted shocks to SME firms – specifically, these findings uncover a novel transmission channel emanating from constraints related to bank capital which led to credit supply shocks, potentially delaying the economic recovery for private SME firms. Rather than seeing the buffers as a cushion to be drawn upon during a downturn, as intended by Basel III, banks seem to be treating the regulatory buffers as additional minimum requirements.

6. References

Acharya, V., Engle R., and Richardson M. 2012. Capital Shortfall: A New Approach to Ranking and Regulating Systemic Risks. American Economic Review: Papers and Proceedings 102, 59-64.

Admati A., DeMarzo P., Hellwig M. and Pfleiderer P., 2014. Fallacies and Irrelevant Facts in the

Debate on Capital Regulation in Central Banks at a Crossroads: Europe and Beyond. In: Goodhart C., Gabor D., Vestegaard J., and Erturk I. (Eds.), Anthem Press.

Ai, C., Norton, E., 2003. Interaction terms in logit and probit models. Economics Letters 80, 123–129.

Aiyar, S., Calomiris, C. Hooley, J. Korniyenko, Y. and Wieladek. T. 2014. The international transmission of bank capital requirements: Evidence from the UK. Journal of Financial Economics 113:368–82.

Alekseev, Georgij, et al. 2020. The Effects of COVID-19 on U.S. Small Businesses: Evidence from Owners, Managers, and Employees, National Bureau of Economic Research Working Paper Series

Arnold, Martin. January 28, 2021. "Nine banks ate into capital buffers under ECB's pandemic relief", Financial Times. https://www.ft.com/content/d18c91e4-9d78-4e94-bfdf-58da1aa75f01

Matthew Baron. 2020. Countercyclical Bank Equity Issuance, The Review of Financial Studies, Volume 33, Issue 9, Pages 4186–4230

Baker, M., and Wurgler J., 2015. Do Strict Capital Requirements Raise the Cost of Capital? Bank Regulation, Capital Structure and the Low Risk Anomaly. American Economic Review: Papers and Proceedings 105, 315-20.

Basel Committee on Banking Supervision (BCBS). 2009. Strengthening the resilience of the banking sector, Consultative Document, https://www.bis.org/publ/bcbs164.htm

Behn, M., Haselmann R., and Wachtel P., 2016. Procyclical Capital Regulation and Lending. Journal of Finance, 71(2), 919-956.

Berrospide, J., and Rochelle Edge. 2019. The Effects of Bank Capital Buffers on Bank Lending and Firm Activity: What Can We Learn from Five Years of Stress-Test Results? Finance and Economic Discussion Series 2019-050, Federal Reserve Board

Bharath, S., Dahiya, S., Saunders, A., and Srinivasan, A. 2011. Lending Relationships and Loan Contract Terms, The Review of Financial Studies, Volume 24, Issue 4, Pages 1141–1203

Bloom, N., Fletcher, R., Yeh, E. 2021. The Impact of COVID-19 on U.S. Firms, NBER Working Paper 28314

Bloom, N., Bunn, P., Mizen, P., Smietanka, P., Thwaites, G. 2020. The Impact of COVID-19 on Productivity. NBER Working Paper 28233.

Cappelletti, G., Marques, A., et al. 2019. Impact of Higher Capital Buffers on Banks' Lending and Risk-Taking: Evidence from the Euro Area Experiments, ECB Working Paper No. 2292.

Chodorow-Reich, G., Darmouni, O., Luck, S. and Plosser M. 2020. Bank Liquidity Provision Across the Firm Size Distribution. NBER Working Paper 27945.

Correa, R., Du W., Liao G. 2020. U.S. Banks and Global Liquidity. Becker Friedman Institute for Economics Working Paper No. 2020-89.

Degryse, H., De Jonghe, O., Jakovljević, S., Mulier, K., Schepens, G. 2019. Identifying credit supply shocks with bank-firm data: Methods and applications, Journal of Financial Intermediation, Volume 40

Favara, G., Rezende, M., and Ivan Ivanov. 2021. GSIB Surcharges and Bank Lending: Evidence from U.S. Corporate Loan Data," Journal of Financial Economics, forthcoming.

Fraisse, H., Lé M., and Thesmar D., 2020. The Real Effects of Capital Requirements. Management Science 66, 5-23.

Global Financial Stability Report, 2021. Preempting a Legacy of Vulnerabilities, International Monetary Fund. April.

Greenwood, R., Hanson S., Stein J. C., and Sunderam A., 2017. Strengthening and Streamlining Bank Capital Regulation. Brookings Papers on Economic Activity 48, 479-544.

Gourinchas, P., Kalemli-Özcan, S., Penciakova, V., Sander, N. 2020. COVID-19 and SME Failures, NBER Working Paper 27877

Gropp, R., Mosk, T., Ongena, S., and Carlo Wix. 2018. Banks Response to Higher Capital Requirements: Evidence from a Quasi-Natural Experiment, Review of Financial Studies, Volume 32, Issue 1, January 2019, Pages 266-299.

Hanson, S., Kashyap A. K., and Stein J. C., 2011. A Macroprudential Approach to Financial Regulation. Journal of Economic Perspectives 25, 3-28.

Jiménez, G., Ongena, S., Peydró, J.S., and Saurina, J. Macroprudential Policy, Countercyclical Bank Capital Buffers, and Credit Supply: Evidence from the Spanish Dynamic Provisioning Experiments. Journal of Political Economy 2017 125:6, 2126-2177

Kapan, Tumer and Minoiu, Camelia. 2021. Liquidity Insurance vs. Credit Provision: Evidence from the COVID-19 Crisis. Working Paper, https://ssrn.com/abstract=3773328

Kashyap, A. K., Stein J. C., and Hanson S., 2010. An Analysis of the Impact of 'Substantially

Heightened' Capital Requirements on Large Financial Institutions. Unpublished working paper. Harvard University.

Khwaja, A., and Mian. A. 2008. Tracing the impact of bank liquidity shocks: Evidence from an emerging market. American Economic Review 98:1413–42.

Koch, Christoffer, Gary Richardson, and Patrick Van Horn. 2016. "Bank Leverage and Regulatory Regimes: Evidence from the Great Depression and Great Recession." American Economic Review, 106 (5): 538-42.

Milne, A., Whalley, A. 2001. Bank Capital and Incentives for Risk-Taking. Cass Business School Research Paper, WBS Finance Group Research Paper No. 15

Nier, E., Zicchino, L. 2008. Bank Losses, Monetary Policy and Financial Stability - Evidence on the Interplay from Panel Data. IMF Working Paper No. 08/232

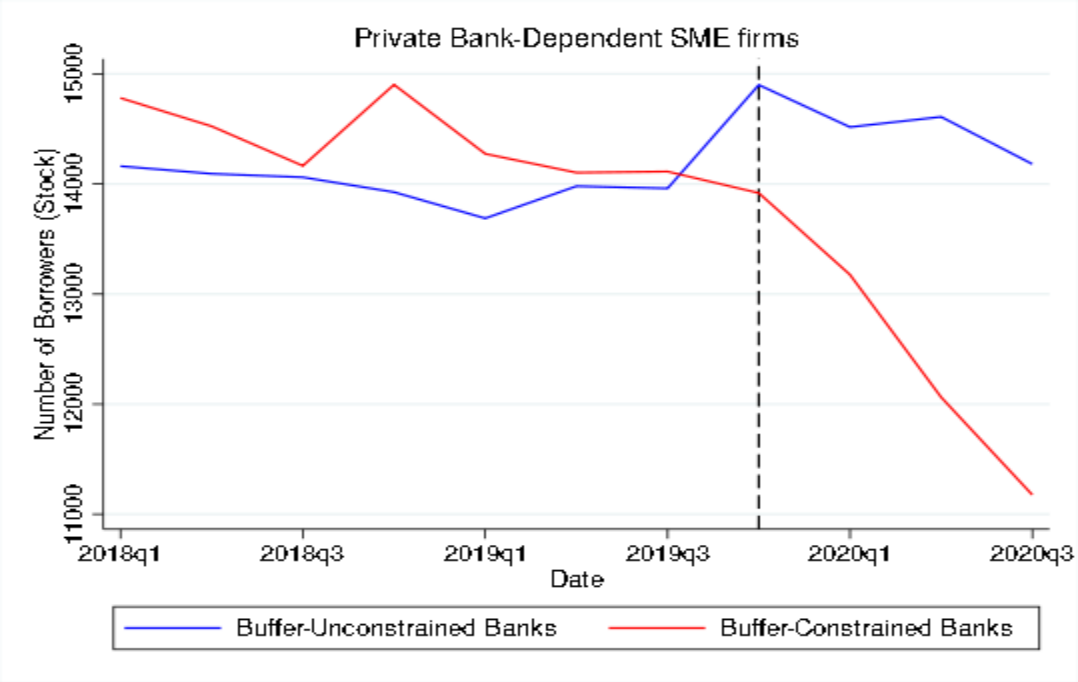
Repullo, R., and Suarez, J. 2013, The Procyclical Effects of Bank Capital Regulation, Review of Financial Studies, 26, issue 2, p. 452-490.

Standard & Poor's Financial Services LLC. June 11, 2020. Bank Regulatory Buffers Face Their First Usability Test. https://www.spglobal.com/ratings/en/research/articles/200611-bank-regulatory-buffers-face-their-first-usability-test-11527594#ContactInfo

Strahan, P., Li, L. 2021. Who Supplies PPP Loans (And Does it Matter)? Banks, Relationships and the COVID Crisis. NBER Working Paper 28286

Wooldridge, J., 2002. Econometric analysis of cross-section and panel data. MIT Press, Cambridge, MA.

Figure 1: Buffer-Constrained Banks vs. Number of Borrowers



Note: This plot shows the number of lending relationships between SME firms and buffer-constrained banks (those that start the pandemic with a capital ratio relatively close to the regulatory buffer region). Domestic BHCs, Source: Y-14Q H1 Schedule.

Figure 2: Visualizing the Bank's Decision Whether to Avoid or Use Regulatory Buffers

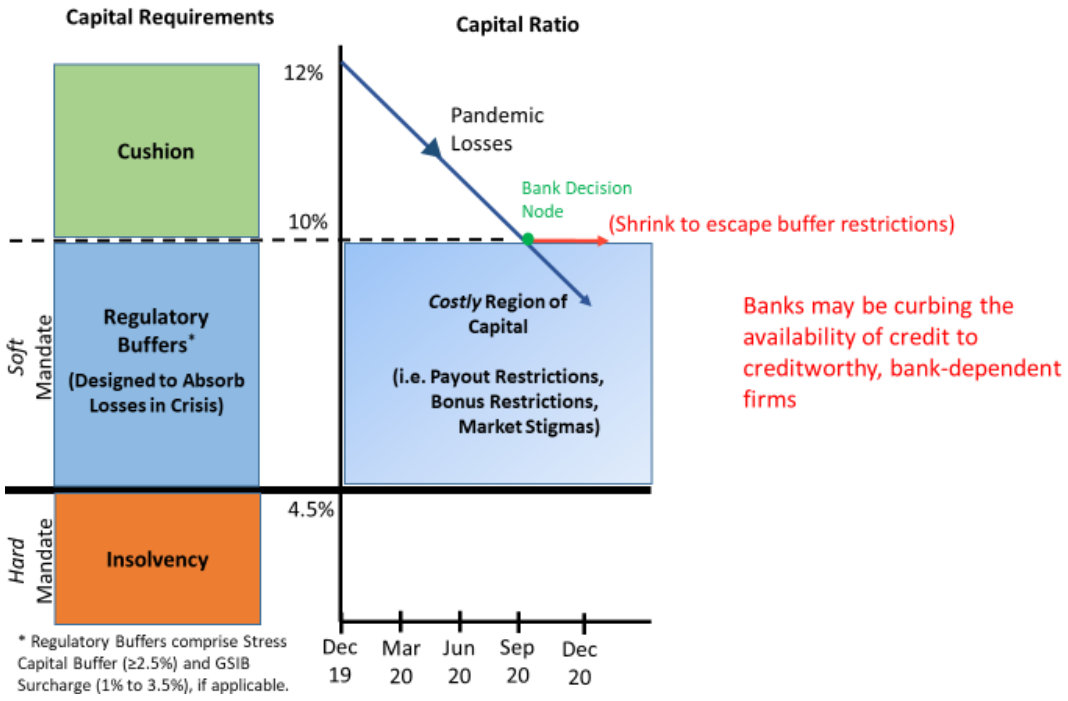
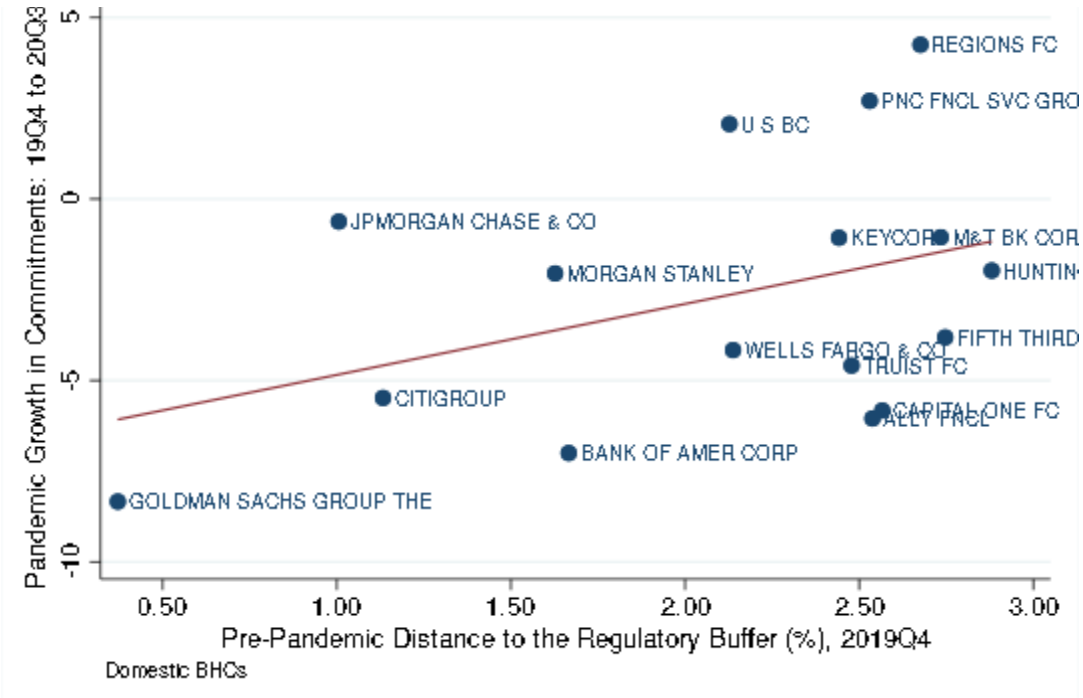
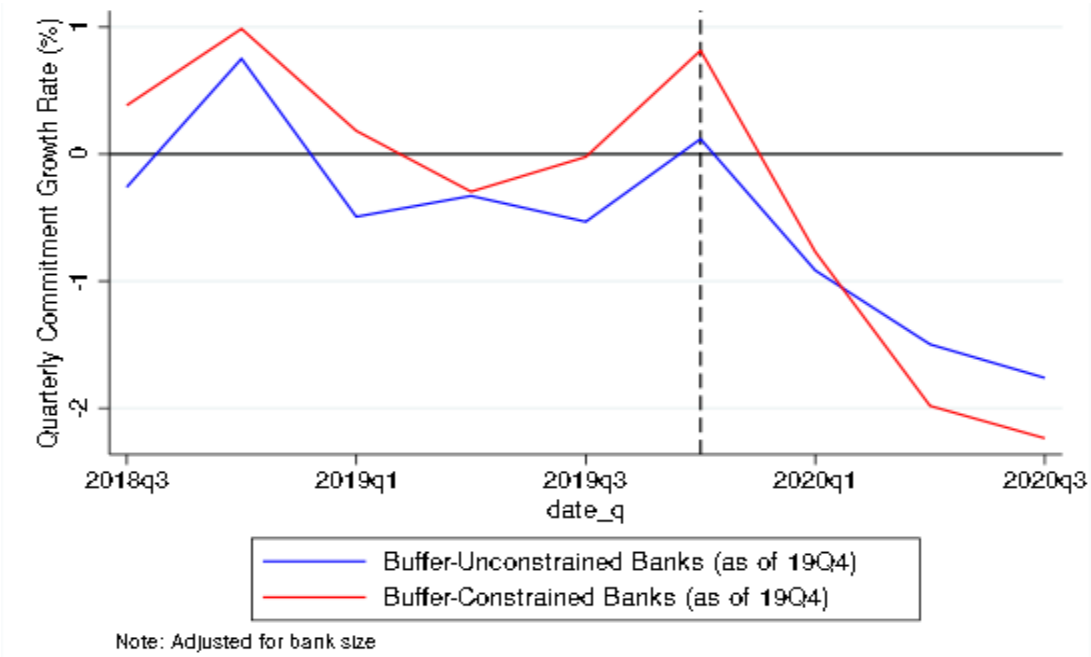


Figure 3. Buffer-Constrained Banks and C&I Commitment Growth in the Cross-Section



Source: Public FR Y-9C reports

Figure 4: Buffer-Constrained Banks and C&I Commitment Growth through Time



Domestic BHCs. Source: FR Y-14Q H1

Figure 5: Empirical Setup

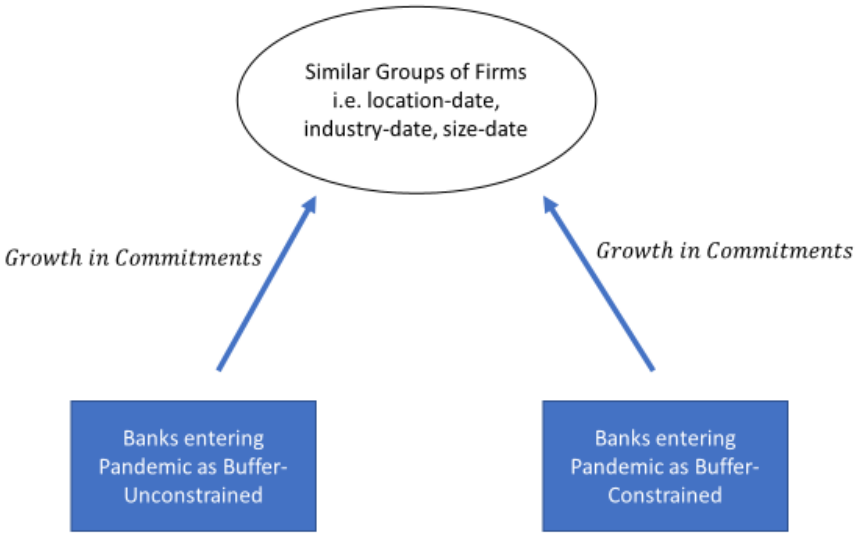
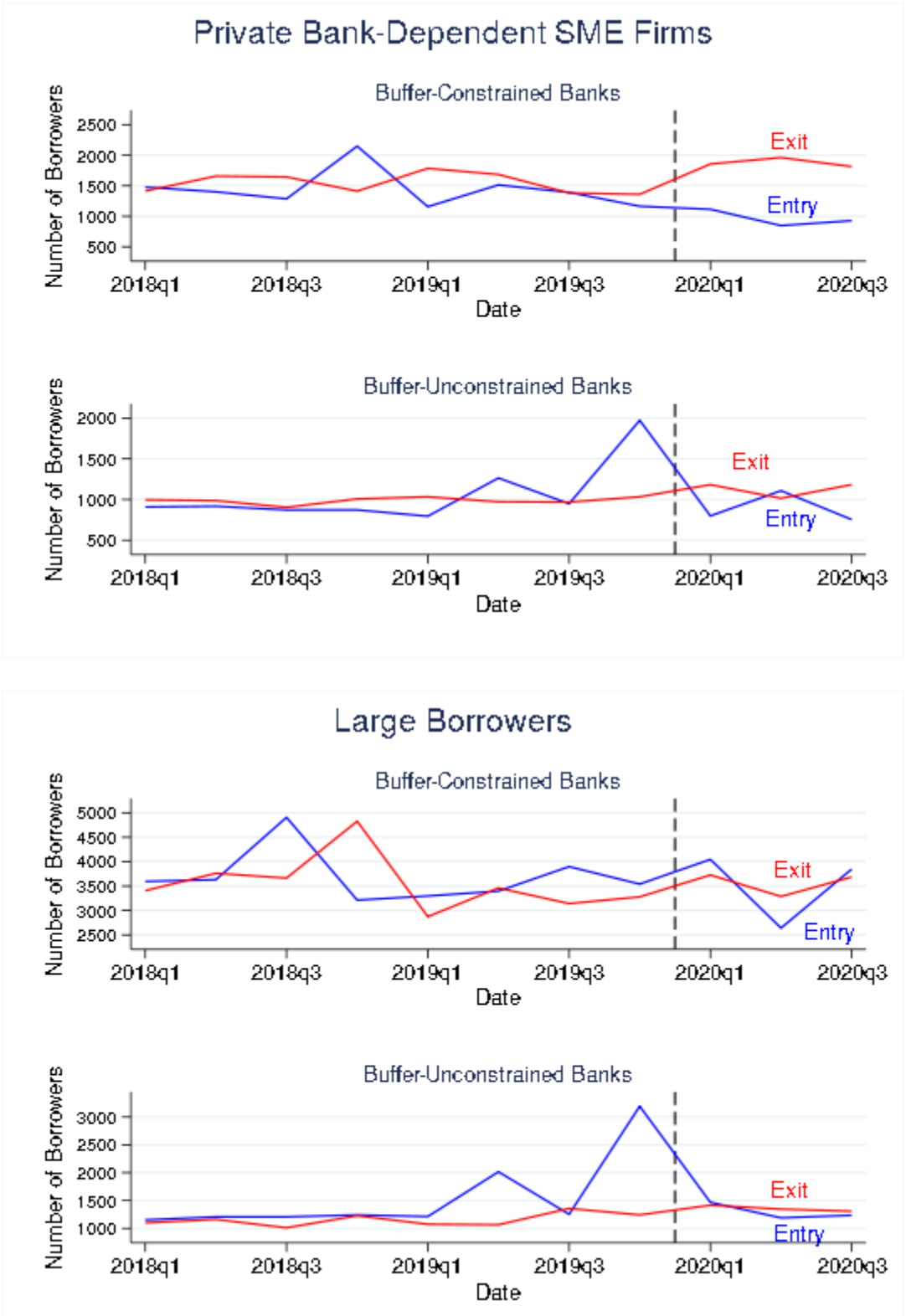

Similar Groups of Firms
i.e. location-date,
industry-date, size-date
Growth in Commitments
Growth in Commitments
Banks entering
Pandemic as Buffer-
Unconstrained
Banks entering
Pandemic as Buffer-
Constrained

Figure 6: Extensive Margin (Relationship Entry and Exit Flow



Note: Domestic BHCs. Source: FR Y-14Q H1

Table 1: Summary Statistics

This table provides summary statistics for all balance sheet variables in the regression analysis using bank-firm observations for the lending by the 16 BHCs in our sample to nonfinancial firms in the FR Y-14Q data. The table reports the number of observations (at the bank-firm-time level), 10th percentile, mean, 90th percentile, and standard deviation for both BHC variables and firm variables. There are 530,904 bank-firm-time observations, which are spread across 16 lenders and 11 quarters. Source: FR Y-9C, FR Y-14.

Variable	p10	Mean	p90	Std Dev
Growth in Commitments (perc)	-6.68	1.36	4.46	20.53
CET1 Ratio (perc)	9.35	11.12	12.87	1.49
Bank Undrawn CL Exposure (perc)	8.86	13.69	20.73	4.94
ln(Bank Assets)	18.76	20.44	21.69	1.17
Bank Deposit / Assets (perc)	56.07	65.61	75.70	10.36
Bank Liq Assets / Assets (perc)	22.31	31.53	39.10	7.03
Bank Provisions / Assets (perc)	-0.01	0.06	0.26	0.13
Bank ROA (perc)	0.13	0.28	0.38	0.12
Borrower Debt / Assets (perc)	0	34	72	28
Borrower ROA (perc)	-0.02	0.10	0.24	0.19
Borrower Net Sales / Assets (perc)	0.31	2.24	4.34	2.06
ln(Borrower Size)	15.31	18.35	22.42	2.73
Borrower Rating	B	BB	BBB	.

Table 2: Impact of Buffer-constrained Banks on Commitment Growth to SME Firms – Intensive margin

This table reports the regression results for equation (1) capturing the relative differences in quarterly loan commitment growth rates to SME firms from buffer-constrained banks after the 2020Q1 arrival of the pandemic. BufferConstrainedBank is a 0/1 variable denoting if the firm banks with a lender whose CET1 capital ratio was relatively close to the costly regulatory capital buffer region ex-ante to the pandemic (2019Q4). SMEFirm is a 0/1 variable denoting if the firm's size is less than the median. Controls include lagged firm and bank-level characteristics. All specifications are at the bank-firm-date level and include bank-firm, firmindustry-date, firmzip-date, and firmsize-date fixed effects. Standard errors are clustered at the firm level. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Source: Y-14Q H1

	C&I Loan Commitment Growth Rate percent (Quarterly)			
VARIABLES	(1)	(2)	(3)	(4)
POST * BufferConstrainedBank	**-0.397****	0.172	-0.0394	0.0192
POST * BufferConstrainedBank * SMEFirm		-1.215***	-1.304***	-1.400***
POST * SMEFirm		0.693	0.766*	0.530
Borrower Size	-0.385***			-0.315***
Borrower ROA	1.370***			1.727***
Borrower Leverage	-2.839***			-2.867***
Borrower Sales Ratio	0.0840			0.0734
Rating_BtoAAA	0.0712			0.0490
CET1 capital ratio	0.219**		0.248**	0.213**
Undrawn Credit Line Exposure	-0.170***		-0.167***	-0.196***
Bank Log Assets	-1.667***		-1.863***	-1.614***
Bank Deposit Ratio	-0.0536*		-0.0577*	-0.0495
Bank Provisions to RWA	-0.437		-0.523	-0.516
Bank Liquid Asset Ratio	0.0603**		0.0524*	0.0620**
Bank ROA	-0.952*		-0.790	-0.847
Constant	44.98***	1.534***	41.47***	42.88***
Observations	530,904	517,391	517,391	480,102
R-squared	0.272	0.260	0.260	0.268
Bank-Firm FE	Y	Y	Y	Y
Industry-Date FE	Y	Y	Y	Y
Zip-Date FE	Y	Y	Y	Y
Size-Date FE	Y	Y	Y	Y
No. of Banks	16	16	16	16
No. of Firms	54849	45209	45209	43023

Table 3: Impact of Buffer-constrained Banks on Commitment Growth to Private, Bank-Dependent SME Firms – Intensive margin

This table reports the regression results for equation (2) capturing the relative differences in quarterly loan commitment growth rates to private bank-dependent SME firms from buffer-constrained banks after the 2020Q1 arrival of the pandemic. BufferConstrainedBank is a 0/1 variable denoting if the firm banks with a lender whose CET1 capital ratio was relatively close to the costly regulatory capital buffer region ex-ante to the pandemic (2019Q4). PrivBankdepSMEFirm is a 0/1 variable denoting if the firm is an SMEFirm, private, and banks with only one Y-14 lender. Controls include lagged firm and bank-level characteristics. All specifications are at the bank-firm-date level and include bank-firm, firmindustry-date, firmzip-date, and firmsize-date fixed effects. Standard errors are clustered at the firm level. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Source: Y-14Q H1

	C&I Loan Commitment Growth Rate percent (Quarterly)		
VARIABLES	(1)	(2)	(3)
POST * BufferConstrainedBank	0.168	-0.0338	0.0131
POST * BufferConstrainedBank * PrivBankdepSMEFirm	-1.219***	-1.308***	-1.389***
POST * PrivBankdepSMEFirm	0.219	0.288	0.153
Borrower Size			-0.345***
Borrower ROA			1.731***
Borrower Leverage			-2.806***
Borrower Sales Ratio			0.0678
Rating_BtoAAA			0.0477
CET1 capital ratio		0.246**	0.215**
Undrawn Credit Line Exposure		-0.163***	-0.197***
Bank Log Assets		-1.827***	-1.565***
Bank Deposit Ratio		-0.0631**	-0.0524
Bank Provisions to RWA		-0.514	-0.502
Bank Liquid Asset Ratio		0.0477*	0.0581*
Bank ROA		-0.825	-0.845
Constant	1.576***	41.25***	42.74***
Observations	525,208	525,208	486,114
R-squared	0.261	0.261	0.268
Bank-Firm FE	Y	Y	Y
Industry-Date FE	Y	Y	Y
Zip-Date FE	Y	Y	Y
Size-Date FE	Y	Y	Y
No. of Banks	16	16	16
No. of Firms	46971	46971	44342

Table 4: Impact of Buffer-constrained Banks on Commitment Growth to Young Relationship Firms – Intensive margin

This table reports the regression results for equation (2) capturing the relative differences in quarterly loan commitment growth rates to SME firms from buffer-constrained banks after the 2020Q1 arrival of the pandemic. BufferConstrainedBank is a 0/1 variable denoting if the firm banks with a lender whose CET1 capital ratio was relatively close to the costly regulatory capital buffer region ex-ante to the pandemic (2019Q4). YoungLendingRelationship is a 0/1 variable denoting if the firm's relationship with its lender is less than the median age (6 years or less). Controls include lagged firm and bank-level characteristics. All specifications are at the bank-firm-date level and include bank-firm, firmindustry-date, firmzip-date, and firmsize-date fixed effects. Standard errors are clustered at the firm level. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Source: Y-14Q H1

	C&I Loan Commitment Growth Rate percent (Quarterly)		
VARIABLES	(1)	(2)	(3)
POST * BufferConstrainedBank	0.364*	0.133	0.212
POST * BufferConstrainedBank * YoungLendingRelationship	**-1.110*** **	**-1.083*** **	**-1.197*** **
POST * YoungLendingRelationship	-0.411**	-0.400**	-0.258
Borrower Size			-0.378***
Borrower ROA			1.359***
Borrower Leverage			-2.796***
Borrower Sales Ratio			0.0848
Rating_BtoAAA			0.0624
CET1 capital ratio		0.239**	0.213**
Undrawn Credit Line Exposure		-0.129***	-0.168***
Bank Log Assets		-1.939***	-1.635***
Bank Deposit Ratio		-0.0673**	-0.0503
Bank Provisions to RWA		-0.517	-0.460
Bank Liquid Asset Ratio		0.0440	0.0570*
Bank ROA		-0.875*	-0.928*
Constant	1.472***	43.46***	44.14***
Observations	574,053	574,053	530,904
R-squared	0.264	0.264	0.272
Bank-Firm FE	Y	Y	Y
Industry-Date FE	Y	Y	Y
Zip-Date FE	Y	Y	Y
Size-Date FE	Y	Y	Y
No. of Banks	16	16	16
No. of Firms	58466	58466	54849

Table 5: Impact of Buffer-constrained Banks on Commitment Growth to Firms with Prior Credit Lines Set to Mature at the Start of the Pandemic – Intensive margin

This table reports the regression results for equation (2) capturing the relative differences in quarterly loan commitment growth rates to SME firms from buffer-constrained banks after the 2020Q1 arrival of the pandemic. BufferConstrainedBank is a 0/1 variable denoting if the firm banks with a lender whose CET1 capital ratio was relatively close to the costly regulatory capital buffer region ex-ante to the pandemic (2019Q4). FirmCreditLineMaturinginPandemic is a 0/1 variable denoting if the firm has a previous credit line that is maturing in 2020Q2. Controls include lagged firm and bank-level characteristics. All specifications are at the bank-firm-date level and include bank-firm, firmindustry-date, firmzip-date, and firmsize-date fixed effects. Standard errors are clustered at the firm level. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Source: Y-14Q H1

	C&I Loan Commitment Growth Rate percent (Quarterly)		
VARIABLES	(1)	(2)	(3)
POST * BufferConstrainedBank	-0.0610	-0.299*	-0.290*
POST * BufferConstrainedBank * FirmCreditLineMaturinginPandemic	**-2.459*** **	**-2.454*** **	**-2.323*** **
POST * FirmCreditLineMaturinginPandemic	-0.280	-0.278	-0.266
Borrower Size			-0.305**
Borrower ROA			1.717***
Borrower Leverage			-2.896***
Borrower Sales Ratio			0.0732
Rating_BtoAAA			0.0270
CET1 capital ratio		0.243**	0.205*
Undrawn Credit Line Exposure		-0.152***	-0.187***
Bank Log Assets		-1.991***	-1.720***
Bank Deposit Ratio		-0.0583*	-0.0474
Bank Provisions to RWA		-0.623	-0.650
Bank Liquid Asset Ratio		0.0447	0.0552*
Bank ROA		-0.888*	-0.866
Constant	1.675***	44.39***	45.06***
Observations	511,393	511,393	473,170
R-squared	0.260	0.260	0.267
Bank-Firm FE	Y	Y	Y
Industry-Date FE	Y	Y	Y
Zip-Date FE	Y	Y	Y
Size-Date FE	Y	Y	Y
No. of Banks	16	16	16
No. of Firms	46719	46719	44038

Table 6: Impact of Buffer-constrained Banks on Commitment Growth to SME Firms – Lending Relationship Exit

This table reports the regression results for linear probability model in equation (2), capturing the change in the probability that a buffer-constrained banks will renew its relationship with a private, bank-dependent SME firm during the pandemic. BufferConstrainedBank is a 0/1 variable denoting if the firm banks with a lender whose CET1 capital ratio was relatively close to the costly regulatory capital buffer region ex-ante (2019Q4). PrivBankdepSMEFirm is a 0/1 variable denoting if the firm is an SMEFirm, private, and only banks with one Y-14 lender. Controls include lagged firm and bank-level characteristics. All specifications are at the bank-firm-date level and include bank-firm, firmindustry-date, firmzip-date, and firmsize-date fixed effects. Standard errors are clustered at the firm level. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Source: Y-14Q H1

	Pr (End Lending Relationship)			
VARIABLES	(1)	(2)	(3)	(4)
POST * BufferConstrainedBank	**0.00969*** **	-0.000267	-0.00216	-0.00332*
POST * BufferConstrainedBank *PrivBankdepSMEFirm		**0.0461*** **	**0.0460*** **	**0.0459*** **
POST * PrivBankdepSMEFirm		-0.0158***	-0.0158***	-0.0173***
Borrower Size	-0.000216			-0.000979
Borrower ROA	-0.0159***			-0.0108**
Borrower Leverage	-0.000145			0.000333
Borrower Sales Ratio	0.000497			-6.80e-05
Rating_BtoAAA	-0.00512***			-0.00353***
CET1 capital ratio	0.00237**		0.00180**	0.00190**
Undrawn Credit Line Exposure	-0.00189***		-0.000826**	-0.000674*
Bank Log Assets	-0.0107**		-0.0140***	-0.0158***
Bank Deposit Ratio	0.00173***		0.00133***	0.00124***
Bank Provisions to RWA	-0.00522		-0.00285	-0.00390
Bank Liquid Asset Ratio	-0.000348		-0.000169	-0.000110
Bank ROA	-0.0244***		-0.0182***	-0.0205***
Constant	0.177	0.0319***	0.232**	0.290***
Observations	570,369	547,962	547,962	516,982
R-squared	0.398	0.369	0.369	0.376
Bank-Firm FE	Y	Y	Y	Y
Industry-Date FE	Y	Y	Y	Y
Zip-Date FE	Y	Y	Y	Y
Size-Date FE	Y	Y	Y	Y
No. of Banks	16	16	16	16
No. of Firms	58222	47599	47599	45593

Table 7: Impact of Buffer-constrained Banks on Commitment Growth to Young Relationship Firms – Lending Relationship Exit

This table reports the regression results for linear probability model in equation (2), capturing the change in the probability that a buffer-constrained banks will renew its relationship with a young relationship firm during the pandemic. BufferConstrainedBank is a 0/1 variable denoting if the firm banks with a lender whose CET1 capital ratio was relatively close to the costly regulatory capital buffer region ex-ante to the pandemic (2019Q4). YoungRelationshipFirm is a 0/1 variable denoting if the firm's relationship with its lender is less than the median. Controls include lagged firm and bank-level characteristics. All specifications are at the bank-firm-date level and include bank-firm, firmindustry-date, firmzip-date, and firmsize-date fixed effects. Standard errors are clustered at the firm level. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Source Y-14Q H1

	Pr (End Lending Relationship)		
VARIABLES	(1)	(2)	(3)
POST * BufferConstrainedBank	0.0134***	0.0104***	0.0102***
POST * BufferConstrainedBank * YoungRelationshipFirm	**0.00980*** **	**0.0109*** **	**0.00846** **
POST * YoungRelationshipFirm	0.0250***	0.0242***	0.0263***
Borrower Size			-0.000808
Borrower ROA			-0.0145***
Borrower Leverage			-0.00202
Borrower Sales Ratio			0.000380
Rating_BtoAAA			-0.00510***
		0.00226**	0.00244**
CET1 capital ratio		-0.00191***	-0.00154***
Undrawn Credit Line Exposure		-0.00982*	-0.0128**
Bank Log Assets		0.00198***	0.00173***
Bank Deposit Ratio		-0.00396	-0.00481
Bank Provisions to RWA		-0.000415	-0.000361
Bank Liquid Asset Ratio		-0.0223***	-0.0239***
Bank ROA	0.0455***	0.136	0.223*
Constant			
	604,770	604,770	570,369
Observations	0.394	0.394	0.399
R-squared	Y	Y	Y
Bank-Firm FE	Y	Y	Y
Industry-Date FE	Y	Y	Y
Zip-Date FE	Y	Y	Y
Size-Date FE	16	16	16
No. of Banks	61021	61021	58222
No. of Firms	0.0134***	0.0104***	0.0102***

Table 8: Impact of Buffer-constrained Banks on Commitment Growth to Firms with Prior Credit Lines Set to Mature at the Start of the Pandemic – Lending Relationship Exit

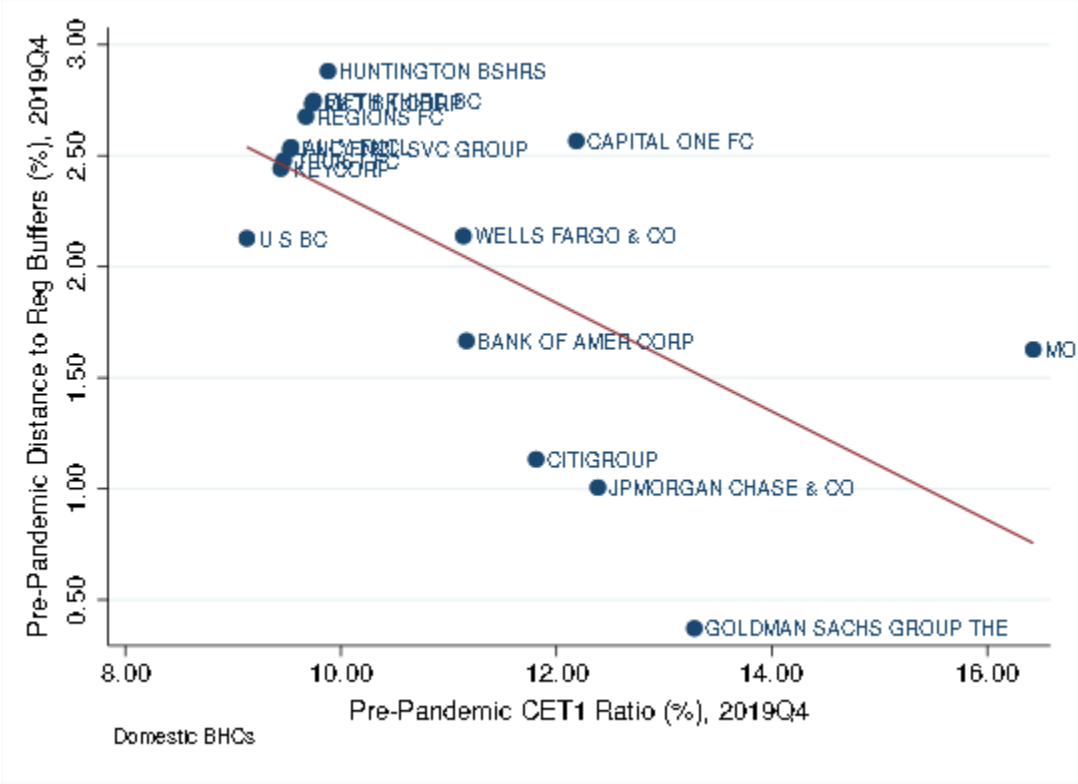
This table reports the regression results for linear probability model in equation (2), capturing the change in the probability that a buffer-constrained banks will renew its relationship with a firm whose prior credit line is contractually set to mature in 2020Q2. BufferConstrainedBank is a 0/1 variable denoting if the firm banks with a lender whose CET1 capital ratio was relatively close to the costly regulatory capital buffer region ex-ante (2019Q4). FirmCreditLineMaturinginPandemic is a 0/1 variable denoting if the firm has a pre-pandemic credit line that is set to mature in 2020Q2. Controls include lagged firm and bank-level characteristics. All specifications are at the bank-firm-date level and include bank-firm, firmindustry-date, firmzip-date, and firmsize-date fixed effects. Standard errors are clustered at the firm level. *, **, and *** denote statistical significance at 10 percent, 5 percent, and 1 percent, respectively. Source: Y-14Q H1

	Pr (End Lending Relationship)		
VARIABLES	(1)	(2)	(3)
POST * BufferConstrainedBank	0.0122***	0.0107***	0.00959***
POST * BufferConstrainedBank * FirmCreditLineMaturinginPandemic	**0.0359*** **	**0.0355*** **	**0.0331*** **
POST * FirmCreditLineMaturinginPandemic	0.0155***	0.0158***	0.0156***
Borrower Size			-0.00171
Borrower ROA			-0.0113**
Borrower Leverage			0.00417
Borrower Sales Ratio			7.13e-05
Rating_BtoAAA			-0.00345***
CET1 capital ratio		0.0023***	0.00236***
Undrawn Credit Line Exposure		-0.0011***	-0.000947**
Bank Log Assets		-0.00991**	-0.0121**
Bank Deposit Ratio		0.0013***	0.00130***
Bank Provisions to RWA		-0.00342	-0.00418
Bank Liquid Asset Ratio		-0.000104	-5.82e-05
Bank ROA		-0.0175***	-0.0195***
Constant	0.0247***	0.139	0.213*
Observations	532,424	532,424	502,187
R-squared	0.367	0.368	0.374
Bank-Firm FE	Y	Y	Y
Industry-Date FE	Y	Y	Y
Zip-Date FE	Y	Y	Y
Size-Date FE	Y	Y	Y
No. of Banks	16	16	16
No. of Firms	47336	47336	45285

Appendix A: Distance to the Regulatory Buffer and CET1 capital ratios

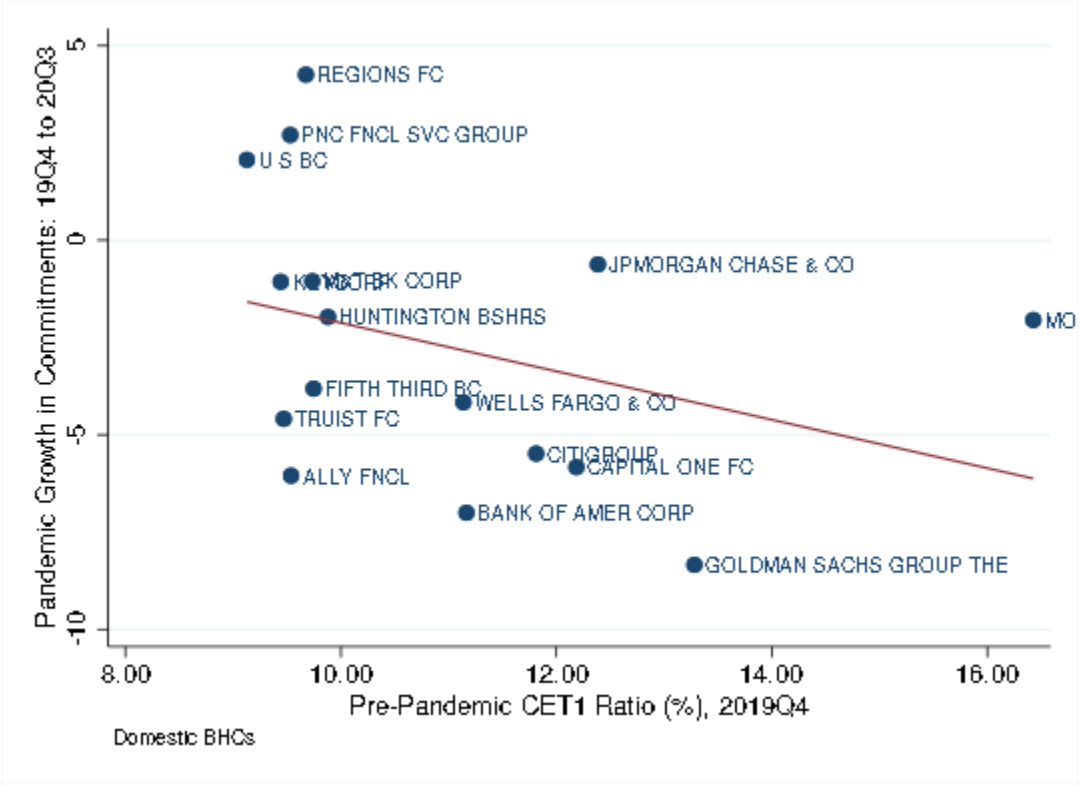
The literature on bank capital typically uses the *level of CET1 capital ratios* when analyzing credit effects. Thus, a natural question is whether banks with high excess capital cushions also tend to have high CET1 capital ratios. Figure 7 demonstrates this is not the case, as there appears to be a negative relation during the pandemic episode. If one were to evaluate solely the relationship between pre-pandemic CET1 capital ratios and pandemic credit growth, a negative relation appears (Figure 8), where higher capitalized banks appear to have weaker commitment growth during the pandemic. This is counterintuitive to what the traditional bank capital literature would predict. This picture is resolved once the excess capital cushion portion is broken out separately, as in Figure 3. Comparing Figures 3 and 8, the key question is: what threshold are banks responding to when managing capital ratios? Given that bank CET1 capital ratios are so high (and thus the 4.5 percent minimum capital requirements are nowhere close to binding), insolvency concerns are unlikely to be driving bank capital management decisions. However, the costs associated with utilizing regulatory buffers are closer to binding during the pandemic. As evidenced in section 3, banks are managing capital ratios with regards the regulatory buffer threshold, i.e. to avoid costs incurred by utilizing the GSIB surcharge and stress capital buffers.

Figure 7: CET1 capital ratios and Distance to the Regulatory Buffer



Source: Public Y-9C reports

Figure 8: Pre-Pandemic CET1 capital ratios vs. Pandemic Growth in C&I Commitments



Source: Public Y-9C reports