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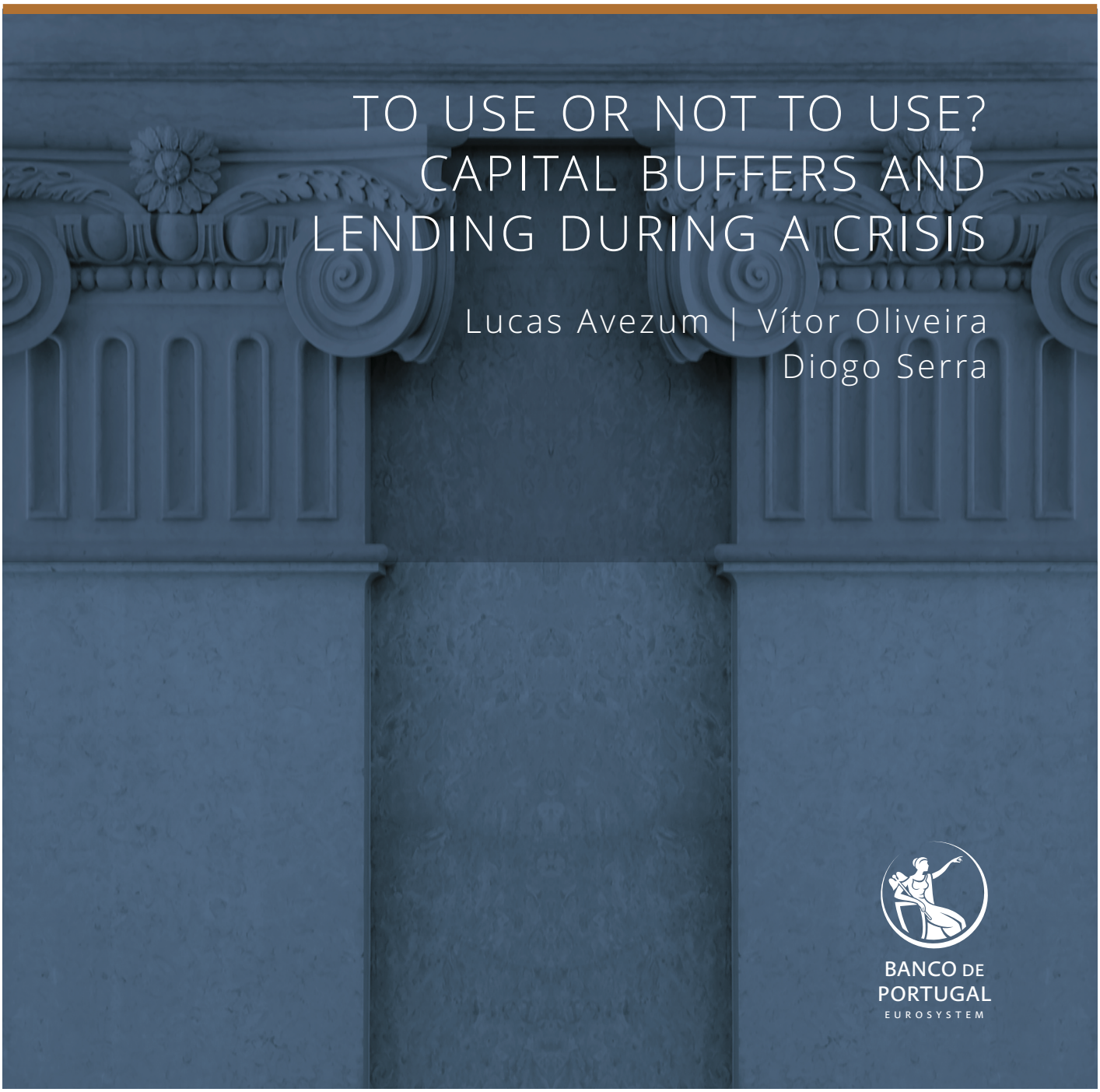

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To use or not to use? Capital buffers and lending during a crisis

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Abstract
In this paper, we study the effect of having a greater management capital buffer on banks' lending during a crisis. Using loan-level data merged with detailed supervisory data on banks' balance sheets and regulatory requirements, we find that Portuguese banks with greater headroom above the overall capital requirement lent more to firms after the Covid-19 shock than banks with lower headroom, i.e., banks used, at least to some extent, their management buffers. The introduction of public-guarantee schemes in this period mitigated this effect as banks with lower capital headroom had the incentive to lend under these schemes. Moreover, we find that the effect of management buffer on lending is stronger for banks with lower market funding and more vulnerable firms, highlighting the importance of market pressure and risk aversion, respectively.

JEL: E51, G28, H12

Keywords: macroprudential policy, capital buffer, Covid-19.

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1. Introduction

In the aftermath of the Global Financial Crisis, bank regulators introduced several capital buffers above the required minimum level of risk-weighted capital ratio. The distinction between a buffer requirement and the minimum requirement is that a breach of the former imposes less severe penalties and restrictions than a breach of the latter. In other words, buffer requirements are less binding than minimum requirements. Hence, buffer requirements provide banks with room to absorb losses during an economic downturn without breaching their minimum requirements. Otherwise, in troubled times, banks are forced to either raise equity or cut down lending to be able to absorb losses and not breach the minimum requirements. Theory and empirical evidence suggest that banks opt for the latter as raising equity is costly, even more so during recessions (Adrian and Shin 2014; Behn *et al.* 2016, 2020; Repullo and Suarez 2013). With this design, one of the objectives of capital buffers is to reduce the procyclicality of lending which is a result of imposing binding capital requirements (BCBS 2010, 2020b).

In response to the Covid-19 shock, several prudential authorities reduced capital buffer requirements or relaxed restrictions related to breaching them (BCBS 2020a). The rationale of these measures relates to the intended objective of capital buffers: the further a bank's capital ratio is from its required minimum capital ratio, the more the bank could use its buffer to keep providing credit, especially in a crisis. However, despite the accumulated buffers, both required and voluntary, banks' capital ratios did not decrease following the Covid-19 shock. Although several other factors could help explain it, such as fiscal measures, moratoria, as well as developments in credit demand, this observation raised the question of whether capital buffers have the expected positive effect on credit supply during a crisis (Duncan *et al.* 2022; Andreeva *et al.* 2020). In this paper, we answer this question by studying whether banks with greater headroom above capital requirements lent more than banks with lower headroom in Portugal during the Covid-19 shock.

To provide causal estimates to our research question, we face several challenges. First, we have to properly define and calculate capital buffers to avoid measurement errors and correctly measure what is available to banks. We rely on supervisory data on banks' balance sheets and regulatory requirements. This dataset allows us to precisely calculate the required capital ratio and actual capital ratio for each bank in Portugal on a quarterly basis. Moreover, during the Covid-19 shock, Portuguese banks were allowed to operate temporarily below the level of regulatory capital buffers, although noncompliance with part of them was still subject to restrictions on distributions (ECB 2020b; Banco de Portugal 2022a).[1] Hence, to have a clear-cut definition of the available capital buffer not subjected to regulatory penalties that banks could use for lending, we use the Management Buffer, which is the

1. As indicated in the notes to the press release of 12 March 2020, in the case of breaching the combined buffer requirement, banks could make distributions only within the limits of the maximum distributable amount as defined by EU law.

capital headroom above the regulatory requirements, i.e., the sum of the minimum and the combined buffer requirements.[2] Second, the Covid-19 shock impacted considerably credit demand. Many firms were forced to borrow to withstand the impact of several months with very low economic activity. To control for credit demand, we rely on loan-level information from the Portuguese Central Credit Register. This level of granularity allows us to use the estimator proposed by Khwaja and Mian (2008) to control for credit demand. Finally, we need the treatment variable, Management Buffer, to be exogenous. Although banks' capitalization and buffers are likely not exogenous to their credit policies, we exploit the timing and nature of the Covid-19 pandemic as the source of exogeneity. We assume that the deep economic recession, uncertainty, and the expectation of a deterioration in bank asset quality and profitability caused by the pandemic affect banks' credit supply. The extent to which the credit supply of each bank changes depends on its Management Buffer. However, the level of the Management Buffer of each bank before the shock does not depend on the change in credit supply due to the Covid-19 shock. Putting all together, our estimations reflect the difference in lending between banks with *different management buffers* to the *same borrower* around an *exogenous shock* to credit supply.

We find that banks with greater headroom above the overall capital requirement lent more than banks with lower headroom after the Covid-19 shock, i.e., banks used, at least to some extent, their management buffers. Our estimates indicate that a one standard deviation increase in the management buffer leads to an increase in lending growth to firms from 1.5 to 4.2 percentage points.

We further investigate the impact of capital headroom on the different margins of lending and find conflicting effects. On the one hand, the results for the extensive margin suggest that having a higher management buffer allows banks to increase the number of firms to which they lend. On the other hand, conditional on maintaining the lending relationship i.e., the intensive margin, having lower capital headroom seems to encourage banks to increase lending to pre-existing relationships. Hence, during the Covid-19 shock among Portuguese banks, the overall effect of having greater management buffers on credit supply was driven by the extensive margin.

The puzzling result for the intensive margin is explained once we account for the use of public guarantees in the period. In the context of the Covid-19 shock, the Portuguese government made available to firms public guarantee schemes with the intention to ensure that the financial system could provide the necessary flow of credit to firms. The uptake was high: 40% of new loans granted between March and September of 2020 had a public guarantee associated (Banco de Portugal 2022b). Given the importance of public guarantees to explain the credit developments in the

2. In other words, the management buffer corresponds to a distance to the maximum distributable amount (MDA) trigger point, since automatic restrictions on distributions are imposed on banks depending on the severity of the failure to meet the combined buffer requirement. Section 2 provides the regulatory insights of the European capital framework.

period, we expand our analysis to study the effect of the use of public guarantees and its interaction with management buffers on credit supply. The results suggest that while the public guarantees reinforced the positive effect of the management buffer on lending at the extensive margin, public guarantees mitigated the effect at the intensive margin.

We investigate this interaction further and find that banks with less capital headroom were more likely to lend under a public guarantee scheme. Together our results suggest that, on the one hand, banks with a lower management buffer might have resorted to public guarantees to keep credit relationships and their market share at the cost of the lower expected profitability associated with public-guaranteed loans considering the low risk associated with this type of loans (Mateus and Neugebauer 2022). On the other hand, banks with a higher capital headroom could afford to maintain their level of risk-taking and rely less on public-guaranteed loans. Mateus and Neugebauer (2022) also show that banks were more likely to extend credit under public guarantees for firms they were already lending to, which helps explain why the mitigating role of public guarantees on the effect of management buffer on lending exists only at the intensive margin.

We extend our analysis in several ways. First, our evidence is consistent with the hampering effect of market discipline on the use of capital buffers. Behn *et al.* (2020), Schmitz *et al.* (2021), and Carvalho *et al.* (2022) note that market pressure to maintain or even increase capital ratios can constrain banks from using their buffers during economic downturns. The mechanism is that banks' funding costs could increase if the market perceives a decline in the capital ratio during a crisis as an increase in default risk. Hence, to avoid market stigma, banks might be reluctant to increase lending and reduce their management buffers. Second, we find that banks with larger management buffers lent more to riskier or vulnerable firms. These findings are consistent with the hypothesis that increased risk aversion is an impediment for banks to use their management buffers during a crisis. We also find that having a greater management buffer is associated with loans with lower interest rates and maturity, and more collateral. Finally, we examine whether the management buffers affect the aggregate availability of bank credit to firms. Our results suggest that firms cannot completely offset the impact of lower credit supply from banks with lower capital headroom by borrowing from banks with greater capital buffers.

This paper contributes to several strands of the empirical literature that studies the relationship between bank capital and bank lending. First, Bernanke *et al.* (1991) and Berrospide and Edge (2010) find a weak relationship between capital ratio and lending while Carlson *et al.* (2013) find that the relationship was significant during and shortly following the Global Financial Crisis but not at other times. Our approach and results are more closely related to Gambacorta and Mistrulli (2004) who find a positive impact on lending of excess capital-to-assets ratio, which is a measure of capital headroom above capital requirements. We contribute to their findings by studying a more robust set-up that allows us, for instance, to control for credit demand and explore the factors that could hamper

banks to use their buffers. Several papers find a substantial negative impact of capital requirements on bank lending (among others, Aiyar *et al.* 2014; Behn *et al.* 2016; Berrospide and Edge 2022; Cappelletti *et al.* 2019; De Jonghe *et al.* 2020; Fang *et al.* 2022; Fraisse *et al.* 2020; Gambacorta and Mistrulli 2004; Imbierowicz *et al.* 2018; Peek and Rosengren 1997). Our findings relate to Behn *et al.* (2016) who study changes in lending due to increases in risk-sensitive capital requirements. They find that the impact of increases in capital requirements on lending would be less pronounced if banks kept larger buffers over the regulatory minimum. We extend this finding by directly studying the impact of capital buffers on lending and possible impediments to the use of these buffers.

The pandemic crisis has motivated the upsurge of a number of studies regarding the effectiveness of the release of buffers and their potential use by banks. Abad and Pascual (2022) provide a framework to understand the incentives of buffer usability. Their results suggest that the cases in which the use of buffers makes economic sense are rare in practice. Avezum *et al.* (2021) use a synthetic control method at the country level and data from European countries to investigate the effect of the countercyclical capital buffer and systemic risk buffer release on aggregate credit supply to households. They conclude that the release of buffers contributed, on average, to mitigate the procyclicality of credit to households, specifically for house purchase and for small business purposes. Using a difference-in-difference estimation methodology applied to a sample of 302 European banks, Dursun-de Neef *et al.* (2022) find that the release of the countercyclical capital buffer led to an increase in the average bank's lending as a percentage of its total assets. This increase was observed mainly in mortgage loans and was independent of banks' capital ratios before the Covid-19 crisis. Using a sample of European banks, Couaillier *et al.* (2022b) observe that the type of relief measures matters: while the release of buffers worked as expected, capital requirement releases related to the possibility given to banks to operate below the Pillar 2 Guidance, the bank-specific microprudential buffer for the euro-area, had no significant impact on banks' lending behavior during the pandemic which they argue could be the result from the uncertainty surrounding that buffer.

Finally, this paper is closely related to Berrospide *et al.* (2021) and Couaillier *et al.* (2022a). Berrospide *et al.* (2021) show that banks with less capital headroom before the Covid-19 shock reduced loan commitments to SME firms and were more likely to end pre-existing lending relationships during the pandemic as compared to banks with more capital headroom. Similar to us, they also find heterogeneous effects across firms' characteristics. Our results are in line with their findings, but we contribute by providing evidence to the universe of firm borrowing from banks in Portugal and by studying the interaction between buffers and the use of public guarantees. Using a sample of around 300 banks in the Euro Area and a methodology similar to ours, Couaillier *et al.* (2022a) conclude that banks with little headroom above regulatory buffers reduced their lending relative to other banks. They also analyzed the role played by government guarantees but only from the firms' perspective, i.e., the dependent variable is the credit obtained by each

firm and not the credit granted by banks. Our loan-level information on public guarantee allows us to understand the incentives banks had to resort to these schemes and the relationship with capital buffers. Moreover, our detailed dataset on firms' and banks' characteristics allows us to extend the analysis and study the potential impediments of buffer usability. Hence, to the best of our knowledge, this paper is the first to investigate other factors that could impact the relationship between banks' capital position and buffers' usability such as market discipline, public guarantee schemes, and borrowers' riskiness.

Moreover, we differ from Berrospide *et al.* (2021) and Couaillier *et al.* (2022a) on how to interpret the coefficients. In their interpretation, the positive coefficient on the management buffer means that banks are not willing to use their regulatory buffers, despite these being designed to be used. In other words, if we see that banks with larger management buffers are lending more than banks with less management buffer, we could interpret as evidence that banks are not willing to use their regulatory buffers. Although we recognize this alternative interpretation, we prefer ours for two reasons. First it is not trivial that banks would always be willing to use their management buffers, and second, banks closer to the regulatory buffer threshold are also closer to the level of their minimum requirements. Hence, unless regulatory capital buffers are so high that banks are no longer sensitive to the minimum requirement, we cannot disentangle the sensitivity of banks to the regulatory buffer threshold and the minimum requirements using the management buffers.

The remainder of the paper is organized as follows: the next section presents some background information on capital regulation in Portugal. Section 3 describes the data and the methodology followed. Section 4 reports the main results of the analysis. Section 5 presents extensions of the analysis and robustness tests. Section 6 discusses our interpretation of the results in light of the interpretation in the literature and Section 7 concludes.

2. Institutional Background and Hypothesis

In the European Union, capital regulation is implemented through the CRR and CRD, which transposes the Basel III accords into EU law. The Common Equity Tier 1 capital requirements (CET1) applied to each institution may be split into two components: (i) minimum capital requirements (Pillar 1 Requirements – P1R) and Pillar 2 requirements (P2R), and (ii) the combined buffer requirement. Besides CET 1 capital requirements, banks should also hold the Pillar 2 Guidance (P2G), which corresponds to a supervisory expectation for additional own funds.

Regarding P1R requirements, which aim to address credit, counterparty, market, and operational risks, institutions shall meet, on an ongoing basis, the following capital ratios as a percentage of total risk-weighted exposure amount: (i) common equity tier 1 (CET1) of 4.5%; (ii) a Tier 1 capital (T1) ratio of 6%; and (iii) a total capital ratio of 8%. For the determination of P2R, microprudential authorities

shall assess the institution's specific risks and the corresponding control mechanisms implemented and based on this assessment may decide to impose specific measures on the institution, including additional capital requirements.

Capital buffers are intended to increase the financial system's capacity to absorb losses, with the aim of preserving financial stability. For the fulfillment of this purpose, the buffers may be used to absorb losses in adverse periods. There are five capital buffers foreseen in the European regulatory framework, which all together form the Combined Buffer Requirement: Capital Conservation Buffer (CCoB), Countercyclical Capital Buffer (CCyB), the maximum between the Global Systemically Important Institutions Buffer (G-SIIs), and the Other Systemically Important Institutions Buffer (O-SIIs), and the Systemic Risk Buffer (SyRB).

Institutions that fail to meet the CBR are subject to automatic restrictions on distributions until compliance is restored in accordance with a capital conservation plan duly authorized by the microprudential supervisory authority. Automatic restrictions on distributions are calculated based on the maximum distributable amount (MDA) which is a percentage of the profits proportional to the CBR breach.

In the context of the Covid-19 shock, several national and international authorities have adopted various measures to safeguard financial stability and ensure that the financial system can provide the necessary flow of credit to help households and firms overcome the economic effects of the Covid-19 pandemic crisis. Two of the main measures taken by the various bodies were the temporary flexibility in complying with part of the capital requirements, to encourage institutions to make use of their capital buffers, and the reduction in the level of some macroprudential buffers. In particular, on 12 March 2020, the ECB communicated that it would be flexible in approving capital conservation plans which significant institutions, subject to its supervision, are legally obliged to present if they decide to operate temporarily below the level set for the combined buffer requirement (ECB 2020b; Banco de Portugal 2022a). Moreover, the ECB has also allowed institutions to temporarily operate below the P2G. Regarding macroprudential buffers, authorities in the European Economic Area (EEA) countries decided to release three capital buffers: the CCyB, the SyRB, and the O-SII buffer.[3]

Moreover, on 27 March 2020, the ECB issued a Recommendation that no dividends, including irrevocable commitments, were paid out by the credit institutions for the financial year 2019 and 2020 (ECB 2020a). This Recommendation was addressed to significant institutions directly supervised by

3. In March of 2020, macroprudential authorities in seven countries decided to fully release the CCyB (Denmark, France, Iceland, Ireland, Lithuania, Sweden, and United Kingdom), while three other macroprudential authorities decided to release this buffer only partially (Norway, Czech Republic, and Slovakia); the macroprudential authorities in Estonia, Finland and Poland have fully released the SyRB for all institutions, while the Dutch macroprudential authority has partially released this buffer; finally, the Finnish and the Dutch macroprudential authorities have also decided to lower the O-SII buffer rate applied to some institutions, due to the existing linkages between this buffer and the systemic risk buffer, thus ensuring an actual easing in capital requirements.

the ECB and to national competent authorities regarding smaller euro area banks (less significant institutions).

Despite all the measures and the accumulated buffers, both required and voluntary, banks' capital ratio did not decrease following the Covid-19 shock. During the same period, several other measures were taken to help firms and households to withstand the pandemic. These included public guarantee schemes and loan moratoria. Banks could have maintained lending without a decrease in their capital ratios due to the lower risk-weight associated with loans with public guarantees. Similarly, loan moratoria could have shielded banks from losses at the onset of the pandemic, allowing banks to keep providing credit to the economy without compromising their capital ratios. Moreover, credit demand could have decreased during the Covid-19 shock. Nevertheless, the fact that capital ratios did not decrease during a negative shock raised the question of whether capital buffers have the expected positive effect on credit supply during a crisis.

Hence, the main purpose of this paper is to test the hypothesis of whether banks with greater capital headroom above capital requirements lend more than banks with lower headroom during a crisis, i.e., whether they used their management capital buffers.

3. Data and Empirical Strategy

To test the hypothesis outlined in the previous section, we construct a sample of loans matched with firm and bank characteristics. Below, we start by describing the sample construction and the variables' summary statistics, followed by an explanation of our empirical strategy.

3.1. Sample Construction

We collect quarterly data on loans granted to firms from the CRC. This dataset includes all loans above 50 euros granted by banks operating in Portugal. The information available in the CRC was expanded in the third quarter of 2018, which is the initial date available to us. We use information up to the fourth quarter of 2020. We obtain quarterly supervisory data on banks' balance sheets and regulatory requirements from the FINREP-COREP reporting models. We consider banks on a consolidated basis where applicable, i.e., lending from affiliates operating in Portugal is assigned to the ultimate parent bank. We exclude from the analysis EU foreign branches for which we do not have information on the COREP reporting models.

Finally, data on firms' characteristics are obtained from the Simplified Business Information for Portugal. This dataset provides balance sheet information from the universe of Portuguese firms on a yearly basis at the unconsolidated level.

We collapse the quarterly data into a period before and one after the Covid-19 pandemic outbreak in Europe because serial correlation in panel data models leads

to inconsistent standard errors (Bertrand *et al.* 2004). Our pre- and post-Covid-19 shock periods comprise the average values between the second and fourth quarters of 2019 and 2020, respectively. Dependent variables are in terms of the change from the pre-period to the post-period, such as the growth rate, while control variables are the pre-period value. We end up with a cross-section sample of 492,615 loans, for 271,601 firms, from 20 banks. Table 1 reports the summary statistics for this sample.

We also collapse this bank-firm dataset to the firm level. Bank-level variables are averaged using, as weights, the share of each bank in the firm's total loan volume. Table 2 reports the summary statistics for this firm-level sample. Table A1 in Appendix A describes the variables used in this study

3.2. Empirical Strategy

Our objective is to find the causal effect of the available capital buffer on lending during a crisis. First, we have to properly define and calculate capital buffers to avoid measurement errors and correctly measure what is available to banks. Our supervisory data on banks' balance sheets and regulatory requirements allows us to precisely calculate the required capital ratio and actual capital ratio for each bank in Portugal on a quarterly basis. Moreover, during the Covid-19 shock, Portuguese banks were allowed to operate temporarily below the level of the P2G and regulatory capital buffers, although noncompliance with the latter was still subject to restrictions on distributions (ECB 2020b; Banco de Portugal 2022a). Hence, to have a clear-cut definition of the available capital buffer not subjected to regulatory penalties that banks could use for lending, we use the management buffer, which is the sum of the P2G and the voluntary capital buffer.

Second, the Covid-19 shock impacted considerably credit demand. Many firms were forced to borrow to withstand the impact of several months with very low economic activity. To control for credit demand, we take advantage of the granularity of our dataset to use the estimator proposed by Khwaja and Mian (2008) to control for credit demand. The identifying assumption is that a firm's credit demand is homogeneous across banks. Finally, we need the treatment variable, Management Buffer, to be exogenous. Although banks' capitalization and buffers are likely not exogenous to their credit policies, we exploit the timing and nature of the Covid-19 pandemic as the source of exogeneity. We assume that the deep economic recession, uncertainty, and the expectation of a deterioration in bank asset quality and profitability caused by the pandemic affect banks' credit supply. The extent to which the credit supply of each bank changes depends on its Management Buffer. However, the level of the Management Buffer of each bank before the shock does not depend on the change in credit supply due to the Covid-19 shock. The underlining assumption is that we observe different levels of Management Buffer not because banks have different expectations of unanticipated shocks but mostly due to other factors such as their capacity and willingness to retain earnings and issue equity. For instance, some banks could still be struggling with NPL portfolios

from the previous crisis and hence not capable to reach their target capital ratios at the time of the Covid-19 shock.

Figure 1 allows us to have a first contact with the difference in lending between banks with different levels of capitalization. Under this descriptive approach, it is reasonable to consider only bank-firm relationships that did not benefit from public guarantees, given the key role of this governmental scheme on credit developments in response to the pandemic. That said, in 2019, before the Covid-19 shock, the group of banks with lower management buffers show a parallel lending trend as that with a higher capital headroom above capital requirements. As of the second quarter of 2020, the Covid-19 shock appears to have had a stronger impact on the group of less capitalized banks, which exhibited a higher drop in lending than banks with greater capital headroom. Given the above considerations, the next section estimates empirically the difference in lending between banks with *different management buffers* to the *same borrower* around an *exogenous shock* to credit supply

4. Management Buffer and Banks' Lending

This section presents the results of the bank-firm analysis. First, we investigate whether banks with greater capital headroom at the onset of a crisis lend more. Next, we show that the use of public guarantees alleviates the constraint on lending due to a lower management buffer. We proceed by interacting the management buffer with the share of non-deposits liabilities to total liabilities and with firm-level riskiness indicators to understand, respectively, the impact of market discipline and risk aversion on the use of the management buffer. Finally, we study the effect of greater capital headroom on interest rates, maturity, and collateral.

4.1. Main Results

As our baseline analysis, we estimate the following model:

$$\mathrm{Y}_{b,f} = \beta \text{Management Buffer}_b + \gamma \mathrm{X}_b + \alpha_f + \varepsilon_{b,f} \tag{1}$$

where $\mathrm{Y} \in \{\Delta\text{Credit, Exit, Enter}\}$. Our main dependent variable, ΔCredit, is the percentage change in loans from bank b to firm f around the Covid-19 shock.[4] We also use two other dependent variables to study the extensive margin. Exit is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. Enter is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In all regressions, we include firm-level fixed effects to control for credit demand. Since

4. The change in variables is standardized as follows: $\Delta\text{Credit}_{b,f} = \frac{\text{Credit}_{b,f,post} - \text{Credit}_{b,f,pre}}{0.5 \times (\text{Credit}_{b,f,post} + \text{Credit}_{b,f,pre})}$.

observations of firms with a single lending relationship are absorbed by firm fixed effects, we restrict the sample to firms that have at least two loans from different banks. Due to a small number of banks, we choose to cluster standard errors at the borrower's industry-location-size-bank level.

Table 3 reports the main results. Column 1 shows that the management buffer has a positive impact on the change of bank lending to firms. Adding bank-level control variables (market discipline, average risk-weight, overall capital requirement ratio, bank size, and provisions-to-assets ratio) in column 2 increases the magnitude and significance of the coefficient. Considering the result in column 2, a one standard deviation increase in the Management Buffer (2.8 p.p.) leads to an increase in lending growth to firms of around 4.3 p.p.. If not stated, all the analysis that follows uses the specification in column 2 with ΔCredit as the dependent variable, firm fixed effects, and control variables at the bank level as the benchmark.

Next, we investigate the impact of capital headroom on the different margins of lending. In column 3, we use Exit as the dependent variable to examine whether banks with less capital headroom are more likely to end an existing relationship. In column 4, we use Enter as the dependent variable to examine whether banks with greater capital headroom are more likely to start a new relationship. For the intensive margin, in column 5, we estimate the benchmark model for the sample of loans where both Exit and Enter equal zero, i.e., bank-firm relationships that existed before and after the Covid-19 shock.

The results in columns 3 and 4 indicate that a greater management buffer decreases the probability of a bank not lending to a firm that it was lending to before the pandemic and increases the probability of a bank lending to a firm that it previously was not lending to, respectively. Conversely, column 5 shows that at the intensive margin the effect of having a greater management buffer is smaller and only statistically significant at the 10% level.

While the results in columns 3 and 4 are in line with our expectations, the weaker coefficient that the management buffer obtains in column 5 is puzzling. On the one hand, the results for the extensive margin suggest that having a capital buffer over requirements allows banks to increase the number of firms to which they lend. On the other hand, conditional on maintaining the relationship, having greater capital headroom seems not to encourage banks to increase lending to pre-existing lending relationships.

4.2. Management Buffer and Banks' Lending with Public Guarantees

The credit developments in Portugal cannot be dissociated from the role of the public guarantees scheme in response to the Covid-19 pandemic. Hence, in this section, we expand our analysis to study the effect of the use of public guarantees and its interaction with management buffers. Additionally, the effect of the interaction between capital headroom and the use of public guarantees explains the puzzling result of column 5 of Table 3.

More specifically, we extend equation (1) and estimate the following equation:

$$\begin{aligned} \mathsf{Y}_{b,f} =& \beta_1 \text{Management Buffer}_b + \beta_2 \text{Public Guarantees}_{b,f} \\ &+ \beta_3 (\text{Management Buffer}_b \times \text{Public Guarantees}_{b,f}) \\ &+ \gamma \mathsf{X}_b + \alpha_f + \varepsilon_{b,f} \end{aligned} \tag{2}$$

where Public Guarantees is the share of the outstanding amount of loans under a public guarantee scheme from the total outstanding amount of loans between a bank and a firm.

Table 4 shows that the effect of the management buffer on lending has the expected positive sign and is significantly different from zero in all columns except the third column where the coefficient is negative as expected. These results suggest that the overall positive effect of capital buffers on lending among loans not under a public guarantee scheme is present in both the extensive and intensive margin.

The effect of the public guarantee scheme is as expected in both margins. A public guarantee reduces the credit risk that banks incur which allows banks to lend more because it frees regulatory and economic capital. Indeed, having a public guarantee associated with the loan decreases the probability of not lending (column 3), increases the probability of a new bank granting a loan (column 4), and increases the growth rate of lending from banks from which firms were already borrowing from (column 5).

For the overall effect, shown in columns 1 and 2, we do not observe a difference in the effect of the Management Buffer between loans with or without public guarantees. This is because, while the interaction between capital headroom and public guarantees reinforces the effect at the extensive margin, evidenced by the positive coefficient for the interaction in columns 3 and 4, it mitigates at the intensive margin, as shown by the negative coefficient for the interaction in column 5.

To better understand the sign of the interaction term for the intensive margin, we run equation (1) with Public Guarantees as the dependent variable. Table 5 indicates that banks with less capital headroom were more likely to lend under a public guarantee scheme. Together, the results in Table 4 and 5 suggest that, on the one hand, banks with lower capital buffers might have resorted to public guarantees to keep credit relationships and their market share at the cost of the lower expected profitability associated with public-guaranteed loans considering the low risk associated with this type of loans (Mateus and Neugebauer 2022). In particular, the authors state that most of the credit lines under the public guarantee scheme have a maximum maturity of six years, and the spreads of such loans are capped at 1%, 1.25%, and 1.5% on loans with maturity below 1 year, between 1 and 3 years, and between 3 and 6 years, respectively. On the other hand, banks with a higher capital headroom could maintain their level of risk-taking and resort less to public-guaranteed loans. Mateus and Neugebauer (2022) also show that banks were more likely to extend credit under public guarantees for firms they were already lending to, which helps explain why the interaction between the use of

public guarantees and the capital buffer has this mitigation effect on the intensive margin but not for the extensive margin.

4.3. Market Discipline as Impediment to the Use of Capital Buffers

Behn *et al.* (2020), Schmitz *et al.* (2021), and Carvalho *et al.* (2022) note that market pressure to maintain or even increase capital ratios can constrain banks from using their buffers during economic downturns. Banks' funding costs could increase if the market associates a decline in the capital ratio during a crisis with an increase in default risk. Hence, to avoid market stigma, banks might be reluctant to increase lending and reduce their management buffers. Despite the relatively low market dependency of Portuguese banks, we nevertheless test this hypothesis by estimating the following variation of the benchmark model:

$$\begin{aligned}\Delta\text{Credit}_{b,f} =& \beta_1 \text{Management Buffer}_b + \beta_2 \text{Market Discipline}_b \\ &+ \beta_3(\text{Management Buffer}_b \times \text{Market Discipline}_b) \\ &+ \gamma X_b + \alpha_f + \varepsilon_{b,f}\end{aligned} \tag{3}$$

where Market Discipline is the bank's ratio of wholesale funding to total liabilities. If market discipline is an impediment for banks to use their management buffers, we should observe $\beta_2 < 0$ and $\beta_3 > 0$, i.e., banks under stronger market pressure should lend less during a crisis period while having a greater capital headroom alleviate this effect. Another way of interpreting our hypothesis on the interaction is that the effect of having capital headroom should be greater for banks under stronger market pressure.

Contrary to our expectation, in column 1 of Table 6, we obtain a negative coefficient on the interaction between market discipline and the management buffer. However, as shown in the previous section, the use of public guarantees influenced the effect of the management buffer. Similarly, the effect of market discipline could depend on the use of public guarantees.

Indeed, when we expand equation (3) to include a triple interaction term with Public Guarantees, the results, shown in column 2, are in line with our expectations. Now, the coefficient on market discipline is negative, the coefficient on the interaction between capital headroom and market discipline is positive, and both coefficients are statistically significant. Moreover, Management Buffer maintains a positive and significant coefficient, indicating that among loans without public guarantees and banks with lower market pressure, those with greater capital headroom lent more during the crisis. Hence, our hypothesis is likely valid for the subset of loans without a public guarantee associated with them.

Among the loans with public guarantees, the results still suggest that having a public guarantee is associated with greater growth of credit. Moreover, the use of public guarantees not only mitigates the effect on credit growth of capital headroom but also the effect of market discipline. Finally, more exposure to market discipline

narrows the difference in the effect of the Management Buffer between bank-firm relationships not under public guarantees and those covered by this support program.

To better understand our interpretation of the triple interaction term, Figure 2 plots the marginal effect of Management Buffer conditional on the level of Market Discipline. The blue line plots the marginal effects for the subset of loans without a public guarantee and the yellow line plots the marginal effects for the average value of Public Guarantees. The positive slope of both lines is the result of $\beta_3 > 0$ and shows that the incentive of banks with lower management buffer to lend is weaker the higher the market discipline is. However, the positive coefficient for the triple interaction means a steeper slope for the loans under a public guarantee scheme. For low values of Market Discipline, the effect of capital headroom is similar to the previous analyses: positive for the subset of loans without public guarantee and negative among loans with a public guarantee, again reflecting the incentives of banks with less capital headroom to lend under these schemes. But as we increase the degree of market pressure, the difference in the effect of capital headroom between these groups of loans reduces. The reduction is such that the difference is no longer statistically significant at the highest level of market pressure.

4.4. Management Buffer and Risk-taking

Altunbas *et al.* (2017) document a large degree of heterogeneity in risk aversion across euro-area banks, consistent with theories that treat banks as risk-averse agents operating in uncertain environments (Sealey 1980; Ratti 1980; Ho and Saunders 1981; Koppenhaver 1985; Angbazo 1997). Deyoung *et al.* (2015) find that during the global financial crisis community banks reduced loan supply elasticities suggestive of increased risk aversion. In this section, we study the hypothesis that increased risk aversion is an impediment for banks to use their management buffers during a crisis. For this purpose, we estimate the following variation of the benchmark model:

$$\begin{aligned}\Delta\text{Credit}_{b,f} =& \beta_1 \text{Management Buffer}_b \\ &+ \beta_2(\text{Management Buffer}_b \times \text{Vulnerable}_f) \\ &+ \gamma \mathbf{X}_b + \alpha_f + \varepsilon_{b,f}\end{aligned} \tag{4}$$

where Vulnerable is a variable that measures the degree of vulnerability of the borrower. To reduce endogeneity concerns, we use borrowers' information from the end of the year of 2019. We use three variables. The first, Low Profitability, is a dummy variable that equals 1 if the firm's interest coverage ratio is higher than 0.5 or if its EBITDA was non-positive (Augusto *et al.* 2021). The interest coverage ratio is given by interest expenses over EBITDA. The second, High Leverage, is a dummy variable that equals 1 if the firm's leverage ratio is higher than 1. The firm's leverage is measured by the ratio between liabilities and assets. The last, Most Affected Sectors, is a dummy variable that equals 1 if the firm belongs to a sector that had a break in its average sales above the median. If increased risk

aversion is an impediment for banks to use their management buffers, we should observe $\beta_2 > 0$, i.e., the effect of having a greater capital headroom should be stronger among riskier borrowers.

With specification (4), we cannot estimate the effect of the level of Vulnerable as it is collinear with the firm-level fixed effect. To obtain this estimate, we follow Degryse *et al.* (2019) and use an alternative specification where we replace the firm-level fixed effects with industry-location-size fixed effects. Although not as robust in controlling for credit demand, it allows us to estimate the level of Vulnerable and to include single-relationship borrowers in the sample.

Table 7 shows the results. In all but one regression, the coefficient on Management Buffer is positive and statistically significant in line with the previous results. In column 1, the coefficient on the interaction between Management Buffer and Low Profitability is positive and statistically significant as expected. In column 2, the results are similar with the addition of the negative coefficient for Low Profitability suggesting that banks decreased lending growth relatively more to less profitable firms. The positive coefficient for the interaction indicates that more capitalized banks were less sensitive to the borrowers' riskiness. Columns 3 and 4 show that the conclusions are the same if we replace Low Profitability with High Leverage. Conversely, column 5 shows that there was no statistically significant difference in the effect of Management Buffer on lending between firms more and less affected by the Covid-19 crisis.[5]

Given the nature of the Covid-19 shock, we find the last result rather surprising. On the one hand, the shock affected sectors very differently. On the other hand, firms in certain affected sectors were impacted equally and irrespective of their prior financial performance. To better explore the interaction of management buffer and firms' sector exposure, we extend the previous specification and estimate the following model:

$$\begin{aligned}\Delta\text{Credit}_{b,f} =& \beta_1 \text{Management Buffer}_b \\ &+ \sum_{k=6th}^{10th} \beta_k (\text{Management Buffer}_b \times I(\text{Affected Sectors}_k)_f) \\ &+ \gamma \mathbf{X}_b + \alpha_f + \varepsilon_{b,f}\end{aligned} \tag{5}$$

Where $I(\text{Affected Sectors}_k)_f$ is a dummy variable that equals 1 if the firm f belongs to the sector in kth decile in the distribution of fall of sales after the Covid-19 shock. We consider only the range from the 6th to the 10th decile, hence the base group contains all firms belonging to the sectors below the median. Column 6 shows that the effect of management buffers is stronger only for the most adversely affected sectors (those with a fall in sales on the 10th and 9th decile).

5. We do not show the alternative specification using *Most Affected Sectors* because this variable is collinear with the industry-location-size fixed effect.

In sum, the results indicate that banks with a greater management buffer supported more firms that were vulnerable before the Covid-19 shock.

5. Extensions and Robustness Tests

5.1. The Effect of Management Buffer on Loans Characteristics

In addition to the volume of lending, banks can adjust other loan characteristics during a crisis. In this section, we study whether banks with different management buffers offer different lending conditions, coupled with the incidence of public guarantees on each bank-firm relationship since this government support program is aimed at supporting firms by providing liquidity at reduced costs. In fact, in the Covid-19 aftermath, public-guaranteed loans granted by domestic banks exhibit longer maturities compared to those with no public guarantee and are concentrated around six years (the maximum maturity length envisaged in this program). Moreover, the distribution of interest rates on new loans to firms benefiting from this scheme has a lower density in the right tail compared to the distribution of those that did not benefit from the scheme (Banco de Portugal 2022b).

In column 1 of Table 8, we estimate equation (1) using the change in interest rate instead of the change in loans as the dependent variable. The coefficient on Management Buffer is negative and statistically significant, indicating that banks with more capital headroom charged lower interest rates than less capitalized banks. Column 2 shows that loans with a public guarantee have on average lower interest rates and it is even lower if granted by a bank with more capital headroom. Together with the previous results, these findings suggest that banks with less capital headroom reacted during the Covid-19 shock by relatively increasing interest rates and reducing the number of relationships rather than loan quantities.

Next, we investigate the changes in maturity and collateralization. Columns 4 and 6 show that banks with greater capital headroom lend loans with higher maturity and ask for less collateral, respectively. They also show that loans with a public guarantee have higher maturity and less collateral. The interaction of management buffer and public guarantee seems to not affect maturity. Conversely, the higher the management buffer the weaker is the effect of the public guarantees on the collateral. These results are consistent with loans under the public-guarantee scheme reducing banks' credit risk but being much less flexible in terms of loan conditions. For instance, Mateus and Neugebauer (2022) show that, in Portugal, the median loan with a public guarantee is 35,000 larger, more than 5 years longer, and charged 1p.p. less in interest rate than the median loan without a public guarantee.

5.2. Management Buffer and Firms' Overall Access to Credit

In this section, we turn our attention to firms' overall access to funds. We study whether differences in the supply of credit driven by the difference in capital headroom persist at the firm level. For this purpose, we collapse our loan-level data to the firm level and estimate the following model:

$$\begin{aligned}\Delta\text{Credit}_f =& \beta \sum_{b=1}^{20} \frac{\text{loan}_{f,b}}{\text{loan}_f} \times \text{Management Buffer}_b \\ &+ \gamma \sum_{b=1}^{20} \frac{\text{loan}_{f,b}}{\text{loan}_f} \times \text{X}_b + \alpha_{i,l,s} + \varepsilon_f\end{aligned} \tag{6}$$

where $\text{loan}_{f,b}$ is the amount of loan from bank b to firm f and loan_f is the total amount of credit of firm f. Hence, our variable of interest is the average management buffer weighted by the share of each bank in the firm's total loan volume. If firms can offset a reduction in loans from a bank with low capital headroom, by increasing their borrowing from another bank with high capital headroom, then β should be close to zero. If that is not the case, then management buffers have an aggregated impact on firms' access to credit.

Column 1 of Table 9 shows the results. The management buffer still maintains a positive and statistically significant coefficient, suggesting that firms cannot completely offset the impact of lower credit supply from banks with lower capital headroom by borrowing from banks with greater capital buffers. The economic impact is economically meaningful: a one standard deviation increase in the firm-level weighted Management Buffer (2.7 p.p.) is associated with an increase in lending growth to firms of around 4.6 p.p..

Finally, we also examine whether firms' exposure to banks with low Management Buffer are associated with other firm-level outcomes. Columns 2 and 3 indicate that firms more exposed to banks with greater capital headroom had a higher growth rate of their wage bill and employment during the pandemic period, respectively. We also find an association with sales growth, suggesting that the advantage of having a relationship with a bank with more capital headroom translated into better business opportunities during the Covid-19 shock. Conversely, we do not find a significant association with cash growth, which indicates that firms more exposed to banks with greater capital headroom did not use the extra supply of credit associated with this exposure to hoard cash.

5.3. Robustness Tests

The results in most specifications come from a sample that include only firms with multiple relationships, as this is the condition for the inclusion of firm-fixed effects. However, supply shocks can impact firms with multiple relationships and single relationship firms differently. To address concerns about the external validity of our results to single relationship firms, we follow Degryse *et al.* (2019) and replace the

firm-level fixed effects with industry-location-size fixed effects in Tables 3 and 4. As discussed in section 4.4, although not as robust to control for credit demand, it allows us to include single-relationship borrowers in the sample.

Tables A2 and A3 show that the results are qualitatively similar when we replace firm fixed effects with industry-location-size fixed effects and include single-relationship borrowers. The coefficients for Management Buffer increase in magnitude, which suggests that the effect of having a greater capital headroom on lending is stronger for loans to single-relationship borrowers. Conversely, the coefficient on the interaction between Management Buffer and Public Guarantees is smaller when we include single-relationship borrowers. These results are consistent with the stronger effect of Management Buffer observed among riskier firms that industry-location-size fixed effects cannot capture all risk factors. Alternatively, it could be costly for single-relationship firms to switch or lend from a second bank due to a hold-up problem. For instance, Sharpe (1990) and Rajan (1992) find that incumbent lenders gain monopoly power over their borrowers through their informational advantage over competitor lenders.

Next, because we have only 20 banks in our sample, we cannot cluster the standard errors at the level of treatment, i.e., the bank level. Instead, in our main analysis, we choose to double cluster the standard errors at the bank-borrower's industry and the borrower level. Because the choice of using the borrower's industry to increase the number of clusters might seem arbitrary, we run the specifications in Tables 3 and 4 by substituting the industry for the borrower's size bucket. Albeit slightly less statistically significant, Tables A4 and A5 show that the results are qualitatively similar.

Additionally, our dependent variable of lending does not consider uncommitted credit facilities. However, the effect that we observe on committed facilities could be offset by uncommitted facilities. Therefore, we run the specifications in Tables 3 and 4 by including uncommitted credit facilities in our variable of change in credit. Tables A6 and A7 show that the results are robust to uncommitted credit facilities.

Finally, our main variable of interest, Management Buffer, is the capital headroom above the overall capital requirement, i.e., it includes the P2G. However, Couaillier *et al.* (2022b) find that, contrarily to macroprudential buffers, allowing banks to operate below the P2G had no significant impact on their lending behavior during the pandemic which they argue could be the result of the uncertainty surrounding that buffer usability, regardless of the press releases issued by the ECB and national competent authorities in the European outbreak of Covid-19. Hence, to account for the possibility that banks were also reluctant to use their P2G, we run the specifications in Tables 3 and 4 by substituting Management Buffer for Voluntary Buffer, which is the Management Buffer minus the P2G. Tables A8 and A9 show that most of the coefficients for Voluntary Buffer are qualitatively similar to the coefficients for Management Buffer in Tables 3 and 4. Together, the results in Tables A8 and A9 suggest a stronger effect of capital headroom when we do not consider the P2G as available to banks, consistent with the findings of Couaillier *et al.* (2022b).

6. Discussion of Assumptions and Interpretation

We interpret the positive coefficient on management buffer as evidence that banks with greater capital headroom above regulatory requirements, which includes buffer requirements, used their management buffer. Implicitly, we assume that banks are not willing to use their regulatory buffers and therefore, holding everything else constant, the positive coefficient reflects that banks with greater headroom are lending relatively more and, consequently, reducing their buffers. This interpretation follows Abad and Pascual (2022) reasoning that for a bank to use *any capital buffer* it must clear three hurdles. These hurdles are related to the capacity to use buffers, expectations of supervisory scrutiny following the use of the buffer, and expectations of value creation from using the buffers.

However, if we would assume that banks with enough management buffer would always lend, then we would interpret our results as a test of the willingness of banks to use their regulatory buffers. In fact, that is the interpretation Berrospide *et al.* (2021), Couaillier *et al.* (2022a), and Mathur *et al.* (2023) have. In their interpretation, the positive coefficient on the management buffer means that banks are not willing to use their regulatory buffers, despite these being designed to be used. In other words, if we see that banks with larger management buffers are lending more than banks with less management buffer, we could interpret as evidence that banks are not willing to use their regulatory buffers.

Although we recognize this alternative interpretation, we prefer ours for two reasons: first, for the reasons shown by Abad and Pascual (2022), it is not trivial that banks would always be willing to use their management buffers. For instance, Couaillier (2021) shows that banks' target capital ratio is procyclical, as a fall in expected GDP growth leads to increases in target capital ratios. Second, banks closer to the regulatory buffer threshold are also closer to the level of their minimum requirements. Hence, unless regulatory capital buffers are so high that banks are no longer sensitive to the minimum requirement, we cannot disentangle the sensitivity of banks to the regulatory buffer threshold and the minimum requirements using the management buffers.

One way we see to disentangle the effect of having a higher management buffer from the willingness to use regulatory buffers is to estimate a model with the management buffer, the CBR, and the minimum requirements (Pillar 1 plus Pillar 2 requirements). Hence, conditional on having the same management buffer and minimum requirement, a positive coefficient for the CBR is evidence that banks are willing to use their regulatory buffers. However, in the Portuguese context, we do not have enough CBR variation, and therefore cannot precisely estimate the coefficients.

7. Conclusions

In this paper, we study whether banks with greater headroom above capital requirements lent more than banks with lower headroom in Portugal during the Covid-19 shock. We find that banks with greater headroom above their overall capital requirements lent more than banks with lower headroom after the Covid-19 shock, i.e., banks used, at least to some extent, their buffers. Our estimates indicate that a one standard deviation increase in the management buffer leads to an increase in lending growth to firms from 4.3 to 5.0 percentage points. We also find that the overall positive effect of having greater management buffers on credit supply was driven by the extensive margin. Conversely, the effect was negative on the intensive margin. This divergence is explained by our finding that while the public guarantees reinforced the positive effect of the management buffer on lending at the extensive margin, public guarantees mitigated the effect at the intensive margin. Moreover, we find that banks with a larger management buffer lend more to riskier or vulnerable firms or if they have lower market pressure. We also find that having a higher management buffer is associated with loans with lower interest rates and maturity, and more collateral. Finally, our results suggest that firms cannot completely offset the impact of lower credit supply from banks with lower capital headroom by borrowing from banks with greater capital buffers.

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Tables

Table 1. Descriptive statistics - bank-firm level analysis

This table provides the descriptive statistics of the variables used in the analysis at the bank-firm level, specified in section 3.1.

VARIABLES	N	mean	sd	min	p25	p50	p75	max
Loan level								
ΔCredit	492,615	-0.009	1.060	-2.000	-0.340	0.000	0.257	2.000
Entry	416,799	0.113	0.316	0.000	0.000	0.000	0.000	1.000
Exit	445,649	0.170	0.376	0.000	0.000	0.000	0.000	1.000
Public Guarantees	492,615	0.118	0.279	0.000	0.000	0.000	0.000	1.000
ΔInterest Rate	397,019	-0.458	2.344	-9.248	-0.332	0.000	0.000	5.531
ΔCollateral	397,019	0.196	1.400	-4.112	0.000	0.000	0.295	5.404
ΔMaturity	397,019	0.091	1.114	-1.405	-0.404	0.000	0.000	4.134
Bank level								
Management Buffer	492,615	0.033	0.028	0.009	0.011	0.026	0.043	0.327
Market Discipline	492,615	0.095	0.031	0.012	0.077	0.098	0.116	0.149
Average RW	492,615	0.443	0.074	0.272	0.433	0.446	0.497	0.744
Overall Capital Requirement	492,615	0.107	0.014	0.070	0.100	0.105	0.123	0.156
Size	492,615	24.316	0.970	18.242	23.634	24.536	25.121	25.207
Provisioning	492,615	0.005	0.004	0.000	0.002	0.004	0.008	0.014
Firm Level								
Low Profitability	374,346	0.258	0.438	0.000	0.000	0.000	1.000	1.000
High Leverage	492,615	0.361	0.480	0.000	0.000	0.000	1.000	1.000
Affected Sectors (median)	492,615	0.428	0.495	0.000	0.000	1.000	1.000	1.000
Affected Sectors ($10^{\text{th decile}}$)	492,615	0.039	0.193	0.000	0.000	0.000	0.000	1.000
Affected Sectors ($9^{\text{th decile}}$)	492,615	0.143	0.350	0.000	0.000	0.000	0.000	1.000
Affected Sectors ($8^{\text{th decile}}$)	492,615	0.147	0.354	0.000	0.000	0.000	0.000	1.000
Affected Sectors ($7^{\text{th decile}}$)	492,615	0.061	0.239	0.000	0.000	0.000	0.000	1.000
Affected Sectors ($6^{\text{th decile}}$)	492,615	0.039	0.193	0.000	0.000	0.000	0.000	1.000

Table 2. Descriptive statistics - bank-firm level analysis

This table provides the descriptive statistics of the variables used in the analysis at the bank-firm level, specified in section 3.1.

VARIABLES	N	mean	sd	min	p25	p50	p75	max
Loan level								
ΔCredit	238,982	-0.312	0.886	-2.000	-0.613	-0.106	0.0790	2.000
Bank level								
Management Buffer	238,982	0.034	0.027	0.009	0.019	0.027	0.043	0.327
Market Discipline	238,982	0.095	0.030	0.012	0.080	0.098	0.116	0.149
Average RW	238,982	0.442	0.071	0.272	0.433	0.446	0.493	0.744
Overall Capital Requirement	238,982	0.107	0.013	0.070	0.100	0.105	0.121	0.156
Size	238,982	24.324	0.897	18.242	23.713	24.534	25.122	25.207
Provisioning	238,982	0.005	0.004	0.000	0.002	0.004	0.006	0.014
Firm Level								
ΔSales	180,574	-0.144	0.690	-2.000	-0.374	-0.084	0.118	2.000
ΔWage	165,526	-0.049	0.589	-2.000	-0.163	0.000	0.127	2.000
ΔCash	181,640	0.138	0.957	-2.000	-0.403	0.131	0.782	2.000
ΔEmployees	175,932	-0.050	0.498	-2.000	-0.044	0.000	0.000	2.000

Table 3. Management Buffer and Banks' Lending

The table shows the relationship between management buffer and lending. In columns 1, 2, and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post-Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is the Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	0.558***	1.527***	-0.489***	0.187***	0.214*
	(0.187)	(0.182)	(0.065)	(0.067)	(0.121)
Market Discipline		-2.162***	0.783***	0.0386	-0.973***
		(0.216)	(0.080)	(0.050)	(0.130)
Average RW		-0.0609	0.0789***	0.191***	-0.341***
		(0.104)	(0.024)	(0.046)	(0.051)
Overall Capital Requirement		-0.284	-0.321**	-0.912***	1.228***
		(0.364)	(0.129)	(0.123)	(0.219)
Size		0.113***	-0.0222***	-0.00179	0.100***
		(0.007)	(0.002)	(0.002)	(0.006)
Provisioning		-8.770***	-0.974**	-1.255**	-9.912***
		(1.551)	(0.430)	(0.606)	(0.906)
Observations	265,944	265,944	233,956	211,336	181,722
R-squared	0.440	0.445	0.439	0.475	0.416
Firm FE	Yes	Yes	Yes	Yes	Yes

Table 4. Management Buffer and Banks' Lending With Public Guarantees

The table shows the importance of the interaction of management buffer and the use of public guarantees on lending. In columns 1, 2, and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post-Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is the Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Public Guarantees is the share of credit under the public guarantees scheme. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	0.809***	1.795***	-0.499***	0.182***	0.614***
	(0.149)	(0.187)	(0.068)	(0.067)	(0.108)
Public Guarantees	0.872***	0.838***	-0.175***	0.0587***	0.515***
	(0.048)	(0.045)	(0.005)	(0.010)	(0.037)
Management Buffer × Public Guarantees	-0.004	0.737	-1.339***	0.659***	-2.815***
	(0.967)	(0.942)	(0.141)	(0.246)	(0.727)
Market Discipline		-1.912***	0.757***	0.0387	-0.746***
		(0.206)	(0.086)	(0.049)	(0.102)
Average RW		-0.0507	0.0779***	0.198***	-0.362***
		(0.111)	(0.025)	(0.047)	(0.053)
Overall Capital Requirement		0.166	-0.514***	-0.817***	1.431***
		(0.358)	(0.128)	(0.126)	(0.210)
Size		0.071***	-0.013***	-0.006***	0.080***
		(0.006)	(0.002)	(0.002)	(0.004)
Provisioning		-12.10***	-0.193	-1.681***	-11.53***
		(1.667)	(0.468)	(0.600)	(0.913)
Observations	265,944	265,944	233,956	211,336	181,722
R-squared	0.474	0.477	0.454	0.478	0.439
Firm FE	Yes	Yes	Yes	Yes	Yes

Table 5. Management Buffer and the Incentive to Lend With Public Guarantees

The table shows that the relationship between management buffer and lending is different between loans with and without public guarantees.In all columns, the dependent variable is Public Guarantees, which is the share of credit under the public guarantees scheme. In column 1, the sample is restricted to loans without public guarantees. In column 3, the sample is restricted to loans used in the intensive margin. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively

	(1)	(2)	(3)
			Intensive margin
		Public Guarantees	
Management Buffer	-0.288***	-0.361***	-0.520***
	(0.079)	(0.089)	(0.102)
Market Discipline		-0.319**	-0.305*
		(0.145)	(0.168)
Average RW		-0.007	0.006
		(0.029)	(0.033)
Overall Capital Requirement		-0.478***	-0.866***
		(0.169)	(0.207)
Size		0.0490***	0.0458***
		(0.004)	(0.004)
Provisioning		3.817***	4.210***
		(0.717)	(0.804)
Observations	265,944	265,944	181,722
R-squared	0.443	0.468	0.488
Firm FE	Yes	Yes	Yes

Table 6. Market Discipline and the Use of the Management Buffer

The table shows that the use of the management buffer depends on the funding structure of the bank. The dependent variable is ΔCredit, the change in total credit between the pre- and post-Covid-19 shock period at the bank-firm level. The main independent variable the is Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Public Guarantees is the share of credit under the public guarantees scheme. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)
	ΔCredit	
Management Buffer	2.201***	1.340***
	(0.277)	(0.245)
Market Discipline	-1.723***	-2.963***
	(0.289)	(0.275)
Management Buffer × Market Discipline	-11.51**	12.04***
	(5.347)	(4.324)
Public Guarantees		0.449***
		(0.095)
Management Buffer × Public Guarantees		-72.68***
		(7.150)
Public Guarantees × Market Discipline		12.16***
		(0.994)
Management Buffer × Public Guarantees × Market Discipline		427.8***
		(49.44)
Average RW	-0.184	0.216
	(0.132)	(0.143)
Overall Capital Requirement	-0.723*	-0.131
	(0.403)	(0.345)
Size	0.110***	0.0678***
	(0.007)	(0.007)
Provisioning	-7.675***	-12.12***
	(1.614)	(1.690)
Observations	265,944	265,944
R-squared	0.445	0.482
Firm FE	Yes	Yes

Table 7. Management Buffer and Banks' Risk-taking

The table shows how the effect of management buffer on lending depends on the level of riskiness or vulnerability of the borrower. The dependent variable is ΔCredit, the change in total credit between the pre- and post-Covid-19 shock period at the bank-firm level. The main independent variable is the Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Low profitability is a dummy variable that equals 1 if the firm's interest coverage ratio is higher than 0.5 or if EBITDA is negative. High leverage is a dummy variable that equals 1 if firm's leverage ratio is higher than 1. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. Columns 1, 3, 5, and 6 include firm fixed effects, and columns 2 and 4 include industry-location-size fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
				ΔCredit		
Management Buffer	1.224***	0.925***	0.813***	0.741***	1.344***	1.352***
	(0.210)	(0.214)	(0.204)	(0.238)	(0.212)	(0.213)
Low Profitability		-0.219***				
		(0.014)				
Management Buffer × Low Profitability	0.927***	0.871***				
	(0.258)	(0.255)				
High Leverage				-0.443***		
				(0.026)		
Management Buffer × High Leverage			2.958***	2.573***		
			(0.381)	(0.484)		
Most affected sectors:						
Management Buffer × Above median					0.520	
					(0.348)	
Management Buffer × 10th decile						1.812***
						(0.562)
Management Buffer × 9th decile						0.596*
						(0.334)
Management Buffer × 8th decile						0.612
						(0.944)
Management Buffer × 7th decile						0.164
						(0.489)
Management Buffer × 6th decile						-0.0839
						(0.681)
Market Discipline	-2.211***	-1.916***	-2.182***	-2.238***	-2.163***	-2.170***
	(0.181)	(0.202)	(0.206)	(0.278)	(0.215)	(0.216)
Average RW	0.182	0.090	-0.080	-0.129	-0.064	-0.063
	(0.126)	(0.123)	(0.104)	(0.097)	(0.105)	(0.105)
Overall Capital Requirement	-0.141	-1.445***	-0.248	-1.871***	-0.276	-0.261
	(0.392)	(0.420)	(0.360)	(0.473)	(0.365)	(0.365)
Size	0.141***	0.091***	0.114***	0.074***	0.113***	0.113***
	(0.008)	(0.009)	(0.007)	(0.009)	(0.007)	(0.007)
Provisioning	-12.56***	-10.27***	-8.781***	-6.839***	-8.791***	-8.818***
	(1.818)	(1.752)	(1.555)	(1.605)	(1.554)	(1.564)
Observations	216,932	370,682	265,944	488,878	265,944	265,944
R-squared	0.434	0.072	0.446	0.078	0.445	0.445
Firm FE	Yes	No	Yes	No	Yes	Yes
Industry-location-size FE	-	Yes	-	Yes	-	-

Table 8. Management Buffer and Loans Characteristics

The table shows the relationship between management buffer and other loan characteristics. In columns 1 and 2, the dependent variable is ΔInterest Rate, the change in the interest rate charged to the borrower between the periods pre- and post Covid-19 shock at the bank-firm level. In columns 3 and 4, the dependent variable is ΔMaturity, the change in the residual maturity of the loans to the borrower between the pre- and post Covid-19 shock period at the bank-firm level. In columns 5 and 5, the dependent variable is ΔCollateral, the change in the percentage of the loan covered by collateral between the periods pre- and post Covid-19 shock at the bank-firm level. Public Guarantees is the share of credit under the public guarantees scheme. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔInterest rate		ΔMaturity		ΔCollateral	
Management Buffer	-1.314***	-1.003***	0.409	1.143***	-0.913***	-1.788***
	(0.402)	(0.376)	(0.315)	(0.260)	(0.329)	(0.282)
Public Guarantees		-0.505***		1.075***		-0.274***
		(0.069)		(0.093)		(0.053)
Management Buffer × Public Guarantees		-12.77***		-2.739		15.47***
		(1.881)		(1.868)		(1.317)
Market Discipline	4.086***	4.191***	-1.889***	-1.441***	4.372***	3.926***
	(0.486)	(0.423)	(0.357)	(0.226)	(0.373)	(0.356)
Average RW	3.068***	2.972***	-0.439***	-0.429***	-0.795***	-0.702***
	(0.168)	(0.158)	(0.117)	(0.122)	(0.158)	(0.150)
Overall Capital Requirement	9.254***	7.868***	1.972***	2.468***	-6.098***	-5.013***
	(0.811)	(0.745)	(0.559)	(0.504)	(0.565)	(0.550)
Size	-0.087***	-0.047***	0.242***	0.193***	-0.176***	-0.180***
	(0.012)	(0.011)	(0.015)	(0.010)	(0.014)	(0.013)
Provisioning	12.72***	17.53***	-17.63***	-21.87***	16.92***	15.05***
	(2.541)	(2.452)	(2.268)	(2.111)	(2.583)	(2.498)
Observations	182,584	182,584	182,584	182,584	182,584	182,584
R-squared	0.413	0.423	0.433	0.467	0.394	0.398
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 9. Capital Headroom and Firms' Overall Access to Credit

The table shows the relationship between the management buffer and the change in the firm's credit and other financial structure characteristics such as sales, wage, employment, and cash. In column 1, the dependent variable is ΔCredit, the change in credit borrowed by firm f, between the pre- and post-shock period. In columns 2-5, the dependent variable are ΔWage, ΔEmployment, ΔSales, and ΔCash, which are respectively the change in the firm's wage bill, employees, sales, and cash between the pre- and post-Covid-19 shock periods. Management Buffer is the average management buffer weighted by the share of each bank in the firm's total loan volume. Market Discipline is the average of non-deposits liabilities in total liabilities weighted by the share of each bank in the firm's total loan volume. Average RW is the average ratio of the risk-weighted assets to total assets, weighted by the share of each bank in the firm's total loan volume. Overall Capital Requirement is the sum of P1R, P2R, and the CBR, weighted by the share of each bank in the firm's total loan volume. Size is the average logarithm of total assets, weighted by the share of each bank in the firm's total loan volume. Provisioning is the average ratio of provisions to total assets, weighted by the share of each bank in the firm's total loan volume. All regressions include firm's industry-location-size fixed effects. Robust standard errors adjusted for clustering at the firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
	ΔCredit	ΔWage	ΔEmployment	ΔSales	ΔCash
Management Buffer	1.697***	0.173**	0.130**	0.224***	0.104
	(0.090)	(0.076)	(0.062)	(0.080)	(0.124)
Market Discipline	-2.518***	-0.164*	-0.142**	-0.177*	-0.0294
	(0.092)	(0.086)	(0.069)	(0.091)	(0.127)
Average RW	-0.143***	0.0934***	0.0522**	0.0389	0.0392
	(0.035)	(0.031)	(0.026)	(0.034)	(0.0467)
Overall Capital Requirement	-3.210***	-0.581***	-0.392***	0.333*	0.161
	(0.183)	(0.167)	(0.134)	(0.172)	(0.253)
Size	0.048***	-0.004	-0.002	0.008***	0.009**
	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)
Provisioning	-1.653***	-3.219***	-1.712***	-4.051***	-0.801
	(0.618)	(0.540)	(0.441)	(0.578)	(0.809)
Observations	231,007	157,888	168,156	172,875	173,946
R-squared	0.074	0.079	0.077	0.110	0.080
Industry-location-size FE	Yes	Yes	Yes	Yes	Yes

Figures

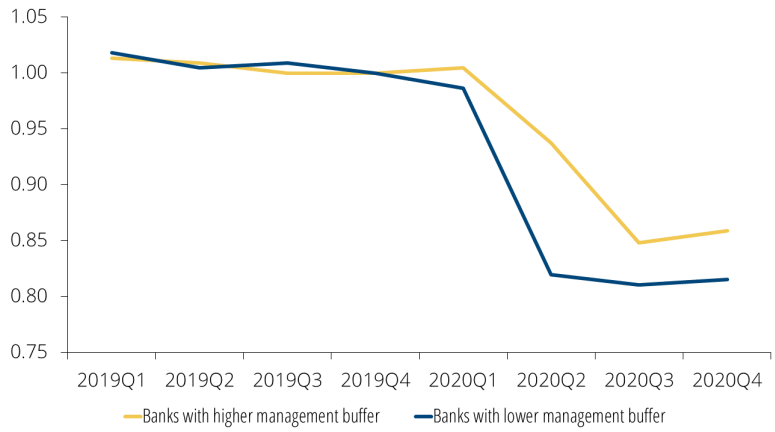

Figure 1: Lending by Management Buffer over 2019q1-2020q4

This figure compares the trends of the average bank-firm level lending between banks with a lower management buffer and those with a higher management buffer. Banks that are less capitalized are in the first quartile of the distribution of management buffer in the fourth quarter of 2019. Bank-firm lending under the public guarantees scheme was not included in these trends. Lending trends are normalized to equal 1 in the fourth quarter of 2019.

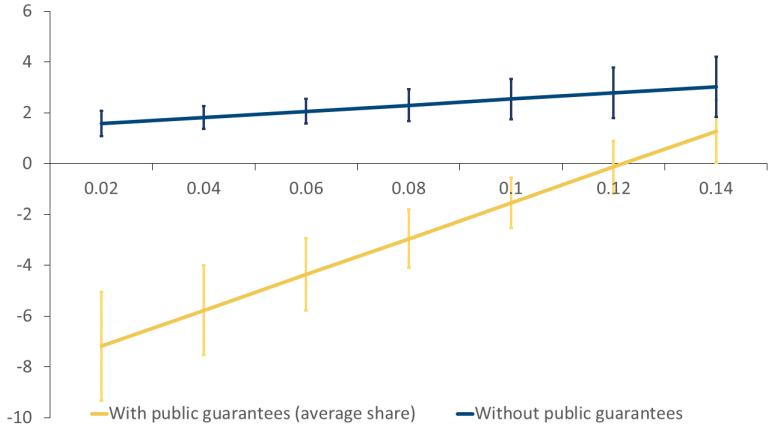

Figure 2: Average Marginal Effect of Management Buffer, by the use of Public Guarantees and the level of Market Discipline

This figure shows the average marginal effect of management buffers on credit change taking into account differences in the use of public guarantees scheme and the intensity of market discipline in banks. The corresponding results are shown in column 2 of Table 6. The average share of public guarantees in bank-firm lending relationships is around 14%.

A. Appendix

Table A1. Variables Description and Sources

This table describes the variables employed in this study, by data level

Variables	Description	Source
Loan level		
ΔCredit	Change in credit granted by bank b to firm f, between the pre- and post-shock period	Central Credit Register
Entry	Dummy equal to 1 if a bank starts a new credit relationship with a firm after the shock and lasts during the whole post-shock period	
Exit	Dummy equal to 1 if a bank ceases a credit relationship that existed before the shock	
Public Guarantees	Share of credit under the public guarantees scheme	
ΔInterest Rate	Change in the bank-firm average annualized agreed interest rate, between the pre- and post-shock period	
ΔCollateral	Change in the bank-firm average maturity, between the pre- and post-shock period	
ΔMaturity	Change in the bank-firm average collateral, between the pre- and post-shock period	
Bank level		
Management Buffer	Management Buffer, given by the difference between the capital ratio and the overall capital requirement	FINREP-COREP
Market Discipline	Market discipline, given by the share of non-deposits liabilities in total liabilities	
Average RW	Average risk-weight, given by the ratio between the risk-weighted assets and total assets	
Overall Capital Requirement	Overall capital requirement, given by the sum of pillar 1 requirement, pillar 2 requirement, and the combined buffer requirement	
Size	The logarithm of total assets	
Provisioning	Ratio between provisions and total assets	
Firm Level		
Low Profitability	Low profitable firm: dummy equal to 1 if firm's interest coverage ratio is higher than 0.5 or if EBITDA is negative	Simplified Business Information (IES)
High Leverage	High leverage ratio: dummy equal to 1 if firm's leverage ratio is higher than 1	
Affected Sectors (median)	Affected economic activity sectors by the Covid-19 pandemic, given by the distribution of sales decrease of each sector between the pre- and post-shock period	
ΔSales	Change in firm's structure between the pre- and post-shock period, which include sales, wage, employment, and cash	
ΔWage	Change in firm's sales between the pre- and post-shock period	
ΔEmployees	Change in firm's wage bill between the pre- and post-shock period	
ΔCash	Change in firm's cash between the pre- and post-shock period	

Table A2. Management Buffer and Banks' Lending Including Single-relationship Firms

The table shows the relationship between management buffer and lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include industry-location-size fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	1.076***	1.697***	-0.444***	0.329***	0.304***
	(0.262)	(0.246)	(0.130)	(0.127)	(0.108)
Market Discipline		-2.396***	0.971***	-0.105	-0.613***
		(0.309)	(0.199)	(0.0993)	(0.134)
Average RW		-0.0624	-0.0109	0.105	-0.298***
		(0.102)	(0.0666)	(0.0697)	(0.0520)
Overall Capital Requirement		-2.397***	0.258	-1.147***	0.626***
		(0.505)	(0.303)	(0.239)	(0.223)
Size		0.0782***	-0.0102*	-0.000214	0.0770***
		(0.00918)	(0.00520)	(0.00361)	(0.00541)
Provisioning		-8.222***	-2.862***	-2.884***	-9.891***
		(1.593)	(1.057)	(0.955)	(0.838)
Observations	488,878	488,878	441,758	412,719	365,593
R-squared	0.054	0.059	0.059	0.064	0.071
Industry-location-size FE	Yes	Yes	Yes	Yes	Yes

Table A3. Management Buffer and Banks' Lending with Public Guarantees Including Single-relationship Firms

The table shows the importance of the interaction of management buffer and the use of public guarantees on lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Public Guarantees is the share of credit under the public guarantees scheme. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include industry-location-size fixed effects. Robust standard errors adjusted for double clustering at the bank-industry and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	1.221***	1.800***	-0.407***	0.333**	0.545***
	(0.267)	(0.279)	(0.137)	(0.136)	(0.0983)
Public Guarantees	0.965***	0.947***	-0.188***	0.129***	0.498***
	(0.0763)	(0.0744)	(0.0101)	(0.0207)	(0.0602)
Management Buffer × Public Guarantees	1.151	1.870	-2.044***	0.659	-2.367**
	(1.770)	(1.763)	(0.307)	(0.591)	(1.184)
Market Discipline		-2.234***	0.968***	-0.104	-0.495***
		(0.322)	(0.201)	(0.106)	(0.0894)
Average RW		-0.153	0.00891	0.0929	-0.357***
		(0.115)	(0.0662)	(0.0716)	(0.0541)
Overall Capital Requirement		-1.428***	-0.0483	-0.963***	0.929***
		(0.519)	(0.304)	(0.253)	(0.205)
Size		0.0436***	-0.00303	-0.00586	0.0629***
		(0.00874)	(0.00505)	(0.00389)	(0.00376)
Provisioning		-10.83***	-2.182**	-3.301***	-10.84***
		(1.788)	(1.107)	(0.947)	(0.840)
Observations	488,878	488,878	441,758	412,719	365,593
R-squared	0.117	0.121	0.085	0.081	0.104
Industry-location-size FE	Yes	Yes	Yes	Yes	Yes

Table A4. Management Buffer and Banks' Lending with Alternative Clustering

The table shows the relationship between management buffer and lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-firms' size and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	0.558	1.527***	-0.489***	0.187**	0.214
	(0.464)	(0.291)	(0.0942)	(0.0784)	(0.227)
Market Discipline		-2.162***	0.783***	0.0386	-0.973***
		(0.434)	(0.126)	(0.100)	(0.222)
Average RW		-0.0609	0.0789**	0.191***	-0.341***
		(0.114)	(0.0300)	(0.0345)	(0.0964)
Overall Capital Requirement		-0.284	-0.321*	-0.912***	1.228***
		(0.599)	(0.179)	(0.160)	(0.364)
Size		0.113***	-0.0222***	-0.00179	0.100***
		(0.0153)	(0.00386)	(0.00275)	(0.0116)
Provisioning		-8.770***	-0.974	-1.255***	-9.912***
		(2.146)	(0.644)	(0.468)	(1.772)
Observations	265,944	265,944	233,956	211,336	181,722
R-squared	0.440	0.445	0.439	0.475	0.416
Firm FE	Yes	Yes	Yes	Yes	Yes

Table A5. Management Buffer and Banks' Lending with Public Guarantees with Alternative Clustering

The table shows the importance of the interaction of management buffer and the use of public guarantees on lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Public Guarantees is the share of credit under the public guarantees scheme. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-size and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	0.809**	1.795***	-0.499***	0.182**	0.614***
	(0.352)	(0.332)	(0.107)	(0.0804)	(0.182)
Public Guarantees	0.872***	0.838***	-0.175***	0.0587***	0.515***
	(0.118)	(0.109)	(0.0104)	(0.0192)	(0.0947)
Management Buffer × Public Guarantees	-0.00401	0.737	-1.339***	0.659*	-2.815
	(2.105)	(1.977)	(0.294)	(0.353)	(1.716)
Market Discipline		-1.912***	0.757***	0.0387	-0.746***
		(0.451)	(0.158)	(0.0977)	(0.123)
Average RW		-0.0507	0.0779**	0.198***	-0.362***
		(0.148)	(0.0372)	(0.0359)	(0.113)
Overall Capital Requirement		0.166	-0.514**	-0.817***	1.431***
		(0.620)	(0.197)	(0.159)	(0.384)
Size		0.0714***	-0.0131***	-0.00564*	0.0799***
		(0.0133)	(0.00405)	(0.00286)	(0.00748)
Provisioning		-12.10***	-0.193	-1.681***	-11.53***
		(2.662)	(0.784)	(0.516)	(1.798)
Observations	265,944	265,944	233,956	211,336	181,722
R-squared	0.474	0.477	0.454	0.478	0.439
Firm FE	Yes	Yes	Yes	Yes	Yes

Table A6. Management Buffer and Banks' Lending with Uncommitted Facilities

The table shows the relationship between management buffer and lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-size and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	0.562***	1.565***	-0.550***	0.227***	0.214*
	(0.169)	(0.169)	(0.0662)	(0.0641)	(0.114)
Market Discipline		-1.729***	0.507***	-0.00183	-0.865***
		(0.188)	(0.0764)	(0.0484)	(0.124)
Average RW		0.0309	0.0224	0.194***	-0.310***
		(0.0972)	(0.0225)	(0.0449)	(0.0457)
Overall Capital Requirement		0.240	-0.756***	-1.041***	1.273***
		(0.332)	(0.123)	(0.120)	(0.202)
Size		0.107***	-0.0181***	-0.00334*	0.0993***
		(0.00635)	(0.00204)	(0.00188)	(0.00509)
Provisioning		-7.604***	-1.732***	-0.971*	-9.511***
		(1.390)	(0.388)	(0.581)	(0.779)
Observations	265,944	265,944	235,170	217,913	189,174
R-squared	0.455	0.460	0.453	0.484	0.422
Firm FE	Yes	Yes	Yes	Yes	Yes

Table A7. Management Buffer and Banks' Lending with Public Guarantees with Uncommitted Facilities

The table shows the importance of the interaction of management buffer and the use of public guarantees on lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Management Buffer, which is the difference between the total actual capital and the overall capital requirement, i.e., the sum of the P1R, the P2R, and the CBR. Public Guarantees is the share of credit under the public guarantees scheme. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-size and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Management Buffer	0.781***	1.798***	-0.582***	0.211***	0.608***
	(0.146)	(0.178)	(0.0702)	(0.0633)	(0.0993)
PublicGuarantees	0.748***	0.713***	-0.169***	0.0385***	0.487***
	(0.0426)	(0.0405)	(0.00521)	(0.00806)	(0.0331)
Management Buffer × Public Guarantees	-0.0440	0.549	-0.146	0.425**	-2.723***
	(0.881)	(0.861)	(0.101)	(0.176)	(0.639)
Market Discipline		-1.515***	0.482***	-0.0116	-0.623***
		(0.191)	(0.0877)	(0.0477)	(0.0978)
Average RW		0.0392	-0.00904	0.215***	-0.323***
		(0.103)	(0.0230)	(0.0447)	(0.0460)
Overall Capital Requirement		0.617*	-0.881***	-0.963***	1.485***
		(0.334)	(0.127)	(0.122)	(0.192)
Size		0.0716***	-0.0102***	-0.00586***	0.0787***
		(0.00592)	(0.00217)	(0.00201)	(0.00363)
Provisioning		-10.42***	-1.218***	-1.207**	-10.87***
		(1.498)	(0.432)	(0.577)	(0.758)
Observations	265,944	265,944	235,170	217,913	189,174
R-squared	0.484	0.486	0.466	0.486	0.448
Firm FE	Yes	Yes	Yes	Yes	Yes

Table A8. Voluntary Buffer and Banks' Lending

The table shows the relationship between voluntary buffer and lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Voluntary Buffer, which is the difference between the total actual capital and the sum of the P1R, the P2R, the CBR, and the P2G. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-size and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Voluntary Buffer	0.677***	1.805***	-0.562***	0.235***	0.305**
	(0.191)	(0.190)	(0.0695)	(0.0717)	(0.121)
Market Discipline		-2.093***	0.758***	0.0436	-0.973***
		(0.202)	(0.0763)	(0.0483)	(0.128)
Average RW		-0.0187	0.0680***	0.198***	-0.328***
		(0.105)	(0.0243)	(0.0472)	(0.0521)
Overall Capital Requirement		0.332	-0.511***	-0.828***	1.357***
		(0.357)	(0.129)	(0.118)	(0.228)
Size		0.117***	-0.0232***	-0.00119	0.102***
		(0.00733)	(0.00212)	(0.00201)	(0.00558)
Provisioning		-10.05***	-0.596	-1.437**	-10.20***
		(1.591)	(0.426)	(0.636)	(0.934)
Observations	265,944	265,944	233,956	211,336	181,722
R-squared	0.440	0.446	0.440	0.475	0.416
Firm FE	Yes	Yes	Yes	Yes	Yes

Table A9. Voluntary Buffer and Banks' Lending with Public Guarantees

The table shows the importance of the interaction of voluntary buffer and the use of public guarantees on lending. In columns 1, 2 and 5, the dependent variable is ΔCredit, the change in total credit between the pre- and post Covid-19 shock period at the bank-firm level. In column 3, the dependent variable is Exit, which is a dummy variable equal to 1 for lending relationships that ceased to exist during the post-shock period. In column 4, the dependent variable is Enter, which is a dummy variable equal to 1 for lending relationships that did not exist in 2019 and existed during the whole post-shock period. In column 5, the sample is restricted to loans that existed before and after the Covid-19 shock. The main independent variable is Voluntary Buffer, which is the difference between the total actual capital and the sum of the P1R, the P2R, the CBR, and the P2G. Public Guarantees is the share of credit under the public guarantees scheme. Market Discipline is the share of non-deposits liabilities in total liabilities. Average RW is the ratio of the risk-weighted assets to total assets. Overall Capital Requirement is the sum of P1R, P2R, and the CBR. Size is the logarithm of total assets. Provisioning is the ratio of provisions to total assets. All regressions include firm fixed effects. Robust standard errors adjusted for double clustering at the bank-size and firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level respectively.

	(1)	(2)	(3)	(4)	(5)
			Extensive margin		Intensive margin
	ΔCredit	ΔCredit	Exit	Enter	ΔCredit
Voluntary Buffer	0.858***	2.019***	-0.561***	0.222***	0.666***
	(0.155)	(0.200)	(0.0733)	(0.0726)	(0.113)
Public Guarantees	0.873***	0.848***	-0.192***	0.0663***	0.481***
	(0.0399)	(0.0376)	(0.00444)	(0.00880)	(0.0302)
Voluntary Buffer × Public Guarantees	-0.0654	0.594	-1.190***	0.631***	-2.623***
	(0.909)	(0.878)	(0.141)	(0.232)	(0.668)
Market Discipline		-1.804***	0.718***	0.0488	-0.730***
		(0.194)	(0.0830)	(0.0470)	(0.101)
Average RW		-0.0185	0.0706***	0.204***	-0.351***
		(0.113)	(0.0254)	(0.0477)	(0.0539)
Overall Capital Requirement		0.808**	-0.700***	-0.734***	1.617***
		(0.359)	(0.129)	(0.122)	(0.213)
Size		0.0743***	-0.0137***	-0.00518**	0.0810***
		(0.00652)	(0.00211)	(0.00216)	(0.00414)
Provisioning		-13.37***	0.157	-1.851***	-11.90***
		(1.725)	(0.467)	(0.630)	(0.948)
Observations	265,944	265,944	233,956	211,336	181,722
R-squared	0.474	0.477	0.454	0.478	0.439
Firm FE	Yes	Yes	Yes	Yes	Yes

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