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The great lockdown: pandemic response policies and bank lending conditions

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Abstract

This study analyses the policy measures taken in the euro area in response to the outbreak and the escalating diffusion of new coronavirus (COVID-19) pandemic. We focus on monetary, microprudential and macroprudential policies designed specifically to support bank lending conditions. For identification, we use proprietary data on participation in central bank liquidity operations, high-frequency reactions to monetary policy announcements, and confidential supervisory information on bank capital requirements. The results show that in the absence of the funding cost relief and capital relief associated with the pandemic response measures, banks' ability to supply credit would have been severely affected. The results also indicate that the coordinated intervention by monetary and prudential authorities amplified the effects of the individual measures in supporting liquidity conditions and helping to sustain the flow of credit to the private sector. Finally, we investigate the potential real effects of the joint pandemic response measures by estimating the adjustment in labour input variables for firms that in the past have been more exposed to similar policies. We find that, in absence of monetary and prudential policies, the pandemic would lead to a significantly larger decline in firms' employment.

JEL classification: E51, E52, E58, G01, G21, G28.
Keywords: COVID-19 crisis, monetary policy, bank lending, prudential policy.

Non-technical summary

The worldwide spread of the coronavirus and the associated containment measures launched during the first half of 2020 led to a shutdown in many economic activities, including part of the banking sector. Although banks entered this crisis with a higher level of capital and liquidity than other recent crisis episodes, the sharp tightening in financial conditions observed, the heightened funding stress and the major repricing in risky assets have tested their resilience. In this paper we analyse two related questions. First, has the policy response been effective in protecting banks' intermediation capacity? Second, has the coordinated nature of the pandemic response policies triggered any amplification effects above and beyond the impact of their individual announcement and implementation?

The present paper is, to the best of our knowledge, the first to analyse the policy measures taken to sustain borrowing conditions after the pandemic outbreak in the euro area. The main results of the analysis are the following. First, in the absence of the pandemic response measures, persistent impairment in access to market-based funding, coupled with the substantial surge in loan demand for emergency liquidity needs, would have seriously undermined banks' intermediation capacity. The cumulative impact on loan growth of the non-standard monetary policy measures deployed is sizeable. Over the period 2020-22, in the absence of the targeted longer-term refinancing operations, lending to firms would be 3 percentage points lower. Second, the microprudential and macroprudential measures effectively reduced regulatory capital requirements, thus complementing monetary policy action by providing ample space for banks to support the economy, with an estimated contribution to loan growth of around 2.2 percentage points. Third, the analysis documents strong complementarities across the measures. Liquidity provision measures complemented by microprudential and macroprudential interventions have been able to mitigate the adverse impact of the escalating diffusion of COVID-19 on banks' intermediation capacity. These response measures prevented the materialisation of an adverse equilibrium which would have resulted in a substantial further contraction in lending. Finally, the study analyses the adjustment in labour input variables for firms that in the past have been more exposed to similar policies. We find that in absence of the pandemic policies, firms' employment could decline by 1.4% over the next two years, equivalent to more than one million workers.

1 Introduction

The worldwide spread of the coronavirus and the associated containment measures launched during the first half of 2020 have led to a shutdown in many economic activities, impacting also the banking sector. Although banks entered the crisis with a higher level of capital and liquidity than in other recent crisis episodes, the observed sharp tightening in financial conditions, the heightened funding stress and the major repricing in risky assets have tested their resilience. These developments, together with the increasing potential for more adverse scenarios to materialise – leading to substantial mark-to-market and credit losses for banks – triggered unprecedented policy intervention. In many jurisdictions, the policy response to the COVID-19 crisis has actually resulted in a series of new and additional measures by monetary and prudential authorities.

In this paper we analyse two related questions. First, has the policy response been effective in protecting banks' intermediation capacity? Second, has the coordinated nature of the pandemic response policies triggered some amplification effects above and beyond the impact of their individual announcement and implementation?

The first question relates to the effectiveness of individual measures specifically designed to improve bank lending conditions taken by different policy authorities in the euro area in response to the COVID-19 pandemic. These measures primarily include the recalibration of targeted longer-term refinancing operations (TLTROs) and the various initiatives in the sphere of microprudential and macroprudential supervision. However, the analysis does not cover the role of government loan guarantee schemes and other measures taken by individual governments that might have also affected bank lending conditions.

The present paper is, to the best of our knowledge, the first study to analyse the monetary policy measures taken after the pandemic outbreak in the euro area. Previous literature on the effectiveness of targeted liquidity provision highlights the importance of these measures for reducing fragmentation and sustaining the flow of credit to households and firms (e.g. Rostagno et al. 2019; Boeckx et al. 2020; Benetton and Fantino, 2018). The evidence provided in this paper sheds further light on their effectiveness under conditions of extremely severe market distress. Early assessments of the US measures taken in response to the coronavirus crisis indicate that the Federal Reserve's policies should be specifically geared towards injecting liquidity into small and medium-sized firms, i.e. those more liquidity constrained and for which the social costs of bankruptcy are high (Brunnermeier and Krishnamurthy, 2020). In this sense, the TLTROs seem to be the policy best suited to addressing this concern, as they have been explicitly designed to

support bank lending for those activities most affected by the spread of COVID-19, in particular lending to small and medium-sized enterprises. Evidence on the effectiveness of microprudential and macroprudential measures is also very scant. The few available studies focus on the US economy and all start from the idea that the pandemic fallout will most likely translate into large declines in bank capital. These studies generally conclude that, faced with this deteriorated scenario, supervisors should aim at decreasing capital requirements while at the same time encouraging banks to raise new capital (Blank et al., 2020). Regulators should also prevent capital depletion through dividend pay-outs or share buybacks (Acharya and Steffen, 2020).

The second question relates to whether the coordinated nature of the pandemic response policies might have triggered some amplification effects. Accommodative monetary policy has been coupled with an easing of macroprudential and microprudential measures. We are interested in whether the effects on bank lending associated with this combination of measures are larger than the effects associated with the same measures taken in isolation. This is an important question with vast policy implications and it boils down to whether monetary policy and prudential policy are complements or substitutes (see Altavilla, Boucinha, Peydró, Smets, 2020; and Altavilla, Laeven, Peydró, 2020). If the policies are complementary, this would indeed point to benefits of tight coordination of policies. The rationale is related but distinct from the "leaning against the wind" orientation of monetary policy, which involves taking financial stability considerations into account in setting monetary policy objectives (see Woodford, 2012; Borio, 2014; Svensson, 2017).

In general, given that the pandemic is still under way, producing an econometric assessment of the two questions described above is very challenging considering the rather scarce empirical evidence from data observed after the lockdown phase. The support these measures provide for lending conditions is therefore measured by mapping the funding and capital relief associated with similar measures announced in the past onto changes in bank lending. This is done by applying the estimated elasticities on detailed information regarding the pandemic response measures, to calibrate the stimulus and retrieve the impact on lending. In addition, these results are compared with elasticities from a wide range of studies.

The main results of the analysis are the following.

First, in the absence of the pandemic response measures, persistent impairment in access to market-based funding, coupled with the substantial surge in demand for loans to meet emergency liquidity needs, would have seriously undermined banks' intermediation

capacity. Withholding reassurance that further TLTRO funding would be available to meet the increased demand for emergency liquidity would have allowed funding tensions to build up in the banking sector. This could in itself have produced significant dislocations in bank lending conditions. The cumulative impact on loan growth of the non-standard monetary policy measures deployed is sizeable. Over the period 2020-22, in the absence of TLTRO III, lending to firms would have been 3 percentage points lower. In parallel, the microprudential and macroprudential measures effectively reduced regulatory capital requirements by 1.5 percentage points. This therefore complemented monetary policy action by providing ample space for banks to support the economy, with an estimated contribution to loan growth of around 2.2 percentage points.

Second, the analysis documents strong complementarities between the measures. Liquidity providing measures complemented by microprudential and macroprudential interventions have been able to mitigate the adverse impact of the pandemic on banks' intermediation capacity. In other words, these response measures prevented the materialisation of an adverse equilibrium of acute financial market volatility coupled with impaired access to funding, which would have resulted in a substantial further contraction in lending.

Third, we explore the real economic effects of pandemic measures by assessing whether and how these measures influence firms' behaviour. We find that firms more exposed to TLTROs and capital relief measures tend to increase their employment levels significantly.

The paper is structured as follows. Section 2 presents some stylised facts. Section 3 discusses the policy response measures announced after the outbreak of COVID-19. Section 4 focuses on the impact of monetary and prudential measures on bank lending conditions. Section 5 provides evidence of the real effects of pandemic relief measures. Section 6 provides some concluding remarks.

2 Stylised facts

The accelerating spread of the virus in the euro area since mid-February has disrupted intra-euro area mobility and trade. Meanwhile the containment measures across the globe have had a sharp impact on regional and global value chains, and – more directly – on tourism and services. This is visible in the unprecedented drops seen in both soft information and hard data on economic activity (see Figure 1). The severe and abrupt fall in business activity has constrained firms' cash flows in the short term, undermining their ability to meet their commitments towards employees, suppliers and creditors. While significant uncertainty remains about the precise magnitude of the shock and the profile

of the recovery, all information points to a very severe recession in 2020: GDP forecasts estimate the output losses at around 5% for the global economy and in a range of 6% to 10% for the euro area.[1]

Insert Figure 1

The great lockdown, as this period is also referred to in IMF and Wold Bank documents, while required to contain the spread of the virus led to a collapse in firms' revenues, which has had a direct impact on their creditworthiness – at least in the short term. Together with broad-based uncertainty and risk aversion in financial markets, this has translated into a sharp repricing of bank risk and higher funding costs for banks. Once the spread of the infection began to accelerate, bank equity prices fell (see Figure 2). Also, as a consequence of the increased credit risk on banks' balance sheets, spreads on credit default swaps (CDS) and yields on bank bond rose rapidly (see Figure 3 and Figure 4).

Insert Figure 2 to 4

The significantly larger increase in yields on subordinated bank bonds, as compared to covered bonds, illustrates the spike in risk premia. The yields on the riskiest types of bank bonds (contingent convertibles or "CoCos") increased by over 10 percentage points, from below 4% before the outbreak of the pandemic to close to 15% in mid-March. The accompanying increase in corporate bond yields shows the broad-based nature of the shock, which was not concentrated on banks. Importantly, the deterioration in market conditions for banks was widely spread across euro area countries. In the absence of an adequate policy response, these developments would have translated into tighter lending conditions and caused a procyclical drop in lending activity.

The policy response was swift and ample, spanning monetary policy support, an easing of microprudential and macroprudential requirements and direct support from governments and international institutions. In particular, following the announcement of a package of support measures after the 12 March Governing Council meeting and that of the pandemic emergency purchase programme (PEPP) on 18 March, the drop in euro area banks' stock prices halted and CDS spreads and bond yields receded. The decline was broad-based across countries and the dispersion also decreased notably, indicating some easing of concerns about banks' credit risk and solvency.

[1] Eurosystem staff macroeconomic projections for the euro area, June 2020; IMF World Economic Outlook Update, June 2020; World Bank Global Economic Prospects, June 2020.

The support measures ensured that banks were able to accommodate the unprecedented increase in credit demand from euro area companies. Following the outbreak of the COVID-19 pandemic, euro area companies needed to continue to meet their liabilities even while their revenues collapsed. Together with uncertainty-driven cash hoarding, this increased demand for financing for working capital led to an unprecedented spike in credit demand, which banks were able to accommodate, resulting in an unprecedented expansion in lending. From March to May 2020, the increase in lending to firms was around €250 billion – the largest increase on record in a three-month period. The annual growth rate of loans to firms reached an unprecedented 7.3% in May. While the increase in credit demand must have put upward pressure on borrowing costs, this pressure did not translate into higher lending rates for firms, arguably thanks to the support measures that prevented a tightening of borrowing conditions through targeted and sizeable funding cost and liquidity relief.

All in all, the impact of the crisis on credit losses and on the market valuation of debt and equity securities puts pressure on banks' regulatory capital ratios, potentially hampering their intermediation capacity. According to the "COVID-19 Vulnerability Analysis" performed by the ECB, the crisis is expected to lead to a depletion of euro area banks' Common Equity Tier 1 (CET1) capital ratios over the period from 2020 to 2022 of 1.9 percentage points under the baseline scenario and up to 5.7 percentage points in an adverse scenario.[2] The exercise also finds that the policy measures taken, in particular the state guarantees provided and the TLTROs, could mitigate the negative impact on capital ratios by close to 1 percentage point.

3 Policy response and transmission channels

Euro area banks entered this crisis in a better capital and liquidity position than past crisis episodes, as regulatory and supervisory requirements have been stepped up and the Eurosystem had already been providing very ample funding support. However, banks' resilience could be tested in some countries with the potential to trigger financial amplification effects that, if left unchecked, would deepen and prolong the crisis. First, banks will likely face both mark-to-market and credit losses as a result of the sharp slowdown in economic activity, especially if it proves to be long-lasting. Second, liquidity strains have constrained market access and exerted upward pressure on funding costs in the ini-

[2] See the ECB press release:
https://www.bankingsupervision.europa.eu/press/pr/date/2020/html/ssm.pr200728~7df9502348.en.html

tial phase of the crisis, though these strains have been partly mitigated by tapping into Eurosystem funding. Third, profitability remains subdued, due to flat intermediation margins. This means that banks will have less income available to offset losses than in the past.

In the euro area, monetary, supervisory, macroprudential and fiscal authorities have all contributed with different instruments – and to different extents – to mitigating the impact of the lockdowns.

3.1 Monetary policy intervention

The monetary policy response to the COVID-19 crisis has revolved around two main types of tools. The first type are targeted and untargeted facilities for liquidity provision, to support access to credit for firms and households and to help banks secure affordable funding even in the short term, e.g. TLTROs and pandemic emergency longer-term refinancing operations (PELTROs). The second type are asset purchase programmes (e.g. the recalibration of the APP and launch of the new PEPP) to help the economy absorb the shock. These measures were further complemented by temporary adjustments to the ECB collateral framework. These adjustments increase the availability of eligible collateral with which banks can participate in liquidity-providing operations and so mitigate the tightening of financial conditions across the euro area. Finally, swap lines across the globe were also reactivated in response to the current difficult situation.

The changes to TLTRO III modalities introduced on 12 March and 30 April 2020 were pivotal in enhancing the accommodative potential of TLTROs in these extreme scenarios. These changes consisted in: i) increasing the borrowing allowance by €1.2 trillion so as to expand the reach of the programme; ii) removing the per-operation limit so as to better align participation in the operations with the timing of the crisis; iii) providing sizeable pricing incentives to frontload participation in the June 2020 operation by scheduling a temporary rate reduction between June 2020 and June 2021; iv) last but not least, setting the stage for a rapid scaling back of the programme as early as September 2021 if conditions were to improve sufficiently by introducing the option of voluntary repayments for banks.

The expansion of the borrowing allowance under TLTRO III, together with the lifting of bid limits, has significantly expanded the scope for the facility to serve as an immediately available source of term funding for euro area banks. The introduction of a temporary rate reduction, during which the TLTRO III rate could be as low as -1%, rendered the programme extremely attractive to all banks across the whole euro area compared to al-

ternative funding sources. Indeed, borrowing under TLTRO III in June 2020 amounted to EUR 1.3 trillion, the largest amount ever allotted in a single liquidity operation. Moreover, the introduction of LTROs priced at the deposit facility rate (DFR), to bridge liquidity needs between the TLTRO announcement and the first operation in June, has also contributed to easing access to ample Eurosystem liquidity. Overall, at the time of writing, Eurosystem funding has expanded by close to €600 billion since 13 March in net terms, with virtually all the increase accounted for by TLTROs (see Figure 5 and Figure 6).

The March 2020 recalibration of the APP, with an additional envelope of €120 billion for 2020, and the introduction of the new pandemic emergency purchase programme (PEPP) both had the same aim: countering the serious risks to the monetary policy transmission mechanism and the outlook for the euro area posed by the coronavirus outbreak. With an initial total envelope of €750 billion to be used until the end of 2020, the PEPP has very likely also had a significant impact on bank lending conditions. Meanwhile, on 4 June 2020 the ECB expanded the size of the PEPP by €600 billion and extended its horizon, so that the programme is now envisaged to last until at least the end of June 2021.

Insert Figure 5 and Figure 6

The impact of monetary policy measures on bank lending conditions can be assessed through the lens of the funding cost relief unlocked by the combination of these measures. This funding cost relief is then transmitted to the real economy via lower lending rates and higher lending volumes. The channels through which monetary policy interventions such as the TLTRO III provide banks with funding cost relief are both direct and indirect. Banks borrowing directly under the programme are allowed to do so at a cost that is more favourable than that of alternative sources of financing. Therefore this direct funding cost relief is proportional to the amount of funds borrowed. At the same time, the fact that many banks are making use of TLTRO funding implies decreased bond issuance in the private market, ensuring lower funding costs for all banks and not only those banks borrowing funds directly from the Eurosystem. This indirect funding cost relief is thus channelled to the entire banking system. In addition, the mere existence of the programme avoids sharp increases in banks' funding costs in a situation of extreme market stress, as markets are reassured by the backstop role of the programme.

3.2 Macroprudential and supervisory measures

In parallel to monetary policy action, a number of temporary supervisory measures have been announced. They are aimed at sustaining banks' ability to keep funding the real economy despite the coronavirus crisis. These supervisory measures have been further enhanced by the relaxation of macroprudential buffers by several national authorities.

Euro area banks entered the crisis with high levels of capitalisation and ample capital buffers (see Figure 7), but the magnitude of the shock is likely to deplete their voluntary buffers and dent the regulatory ones. As of the fourth quarter of 2019, euro area banks' capital ratios stood at 14.8%. While the current levels of capitalisation are much higher than those observed before the global financial crisis and banks have built up significant capital buffers over time, the severity of the current crisis and the depth of the ensuing economic recession pose a significant threat to banks' ability to withstand the shock and continue to support lending to the real economy.

The measures adopted by supervisory and macroprudential authorities can be divided into those affecting minimum regulatory capital requirements and those affecting buffers.

Minimum regulatory capital requirements for euro area banks are partly stated in regulations and partly set out by the supervisor; breaches trigger supervisory sanctions. Under Pillar 1 of the Basel Framework, the minimum CET1 ratio is 4.5% and the minimum total capital ratio is 8%. While the CET1 ratio needs to be covered using CET1 capital instruments, the remaining Pillar 1 requirement can be held in the form of other capital instruments. Supervisors set an additional Pillar 2 requirement (P2R) – a bank-specific requirement determined in the supervisory review and evaluation process (SREP) – which is an add-on to the minimum capital requirement under Pillar 1.

Insert Figure 7

On top of minimum capital requirements, a number of regulatory buffers are applied to each bank, and these can ultimately lead to restrictions on dividend payments in the event of non-compliance. These buffers include the capital conservation buffer (CCoB), which applies to all banks, as well as other macroprudential buffers set at the national level. The combination of the CCoB, the countercyclical capital buffer (CCyB), the systemic buffers for global systemically important institutions (G-SIIs) and other systemically important institutions (O-SIIs) and the systemic risk capital buffer (SyRB) make up the "combined buffer requirement", which is unique to each bank and is added to the Pillar 1 and Pillar 2 requirements.

In addition to these requirements, the capital demand resulting from the SREP also includes the Pillar 2 guidance (P2G) which, unlike the P2R, is not legally binding and indicates the level of capital to be maintained in order to provide a sufficient buffer to withstand stressed situations.

Under Basel III, whenever a bank's capital falls below the sum of its Pillar 1, Pillar 2 and buffer requirements, regulators automatically restrict earnings distributions, including dividends, coupons on bonds eligible as Tier 1 capital and variable remuneration. The "maximum distribution amount" (MDA) is the portion of a bank's earnings that may be distributed even when buffer requirements are not fully met. Non-compliance with the P2G, as it is not a requirement, does not result in automatic action by the supervisor and is not used to determine the MDA trigger.

The new measures implemented by European banking supervision and the national macroprudential authorities in the wake of the coronavirus crisis will release around €140 billion of capital (see Figure 8).

In what concerns microprudential adjustments, banks are allowed to temporarily operate below the level of capital defined by the P2G, a measure that effectively delivers another €90 billion in capital relief. In addition, banks are now allowed to make some use of lower quality capital instruments that do not qualify as CET1 capital to meet the P2R, thus anticipating the implementation of a measure that was supposed to come into effect in January 2021. Under the latest revision of the Capital Requirements Directive (CRD V), banks can hold a certain amount of instruments classed as Additional Tier 1 (AT1) and Tier 2 (T2) towards fulfilling their P2R. CET1 is the highest quality of own funds and is mainly composed of shares and retained earnings from previous years. AT1 and Tier 2 capital can be equity or liability instruments and are of lower quality. The frontloading of the new rules on the P2R will result in approximatively €30 billion of capital relief. The amount of relief could turn out even larger, depending on the extent to which banks are able to issue lower quality capital instruments.

The combination of macroprudential measures implemented by the ECB and by several national authorities to reduce or deactivate regulatory buffers is expected to release around €20 billion of capital. The CCyB has been reduced to 0% in three of the seven jurisdictions where it had been implemented with positive rates (France, Ireland and Lithuania), while its activation has been revoked in two countries that had previously announced its activation (Belgium and Germany). The SyRB has been dropped to 0% by Estonia and Finland, while the authorities in the Netherlands have reduced the existing 3% SyRB for three institutions to which it had been applied. As for the buffer for other

systemic institutions (O-SII buffer), Finland and the Netherlands have initially decided to lower the buffer for one bank each, which was triggered by the reduction in the SyRB. Another three jurisdictions intend to delay phasing in the O-SII buffer by one year. In addition, the supervisory measure adopted on 12 March 2019 allows banks to temporarily operate below the level of the CCoB. However, banks may be reluctant to make use of this, as the CCoB cannot be deactivated by European banking supervision or the ECB and non-compliance with it would trigger a restriction on dividend distributions.

In the current situation, banks may have an incentive to use the additional balance sheet capacity resulting from the supervisory and macroprudential measures for pay-outs, in an attempt to boost their value and signal to investors a situation of restored financial health. This would divert resources away from the intended policy objective of shielding the economy from the adverse impact of the coronavirus crisis. In order to avoid such incentives and to boost banks' capacity to absorb losses and continue lending, the ECB has advised banks not to distribute dividends or buy back any shares until at least January 2021.[3] This extends the period over which restrictions on distributions are recommended to apply, which initially ran only until October 2020, and is in line with a recommendation of the European Systemic Risk Board (ESRB) adopted on 27 May 2020. The ECB recommendation not to distribute dividends, together with recent monetary policy measures which have further lowered banks' funding costs tilt their incentives towards expanding the balance sheet through lending, using the capital relief to provide funding to the real economy.

Overall, the microprudential and macroprudential measures implemented so far effectively reduce the regulatory capital requirement and increase the fully usable buffer by 1.5 percentage points. This is a conservative quantification which does not consider the impact stemming from restrictions on dividend distributions A larger management buffer will afford banks increased flexibility to absorb losses and to continue to support lending to non-financial corporations and households. In general, there might be constraints in banks' use of available buffers, as this might be seen as sign of weakness by market participants. However, such incentives should be limited in the current environment, characterised by a widespread exogenous shock primarily hitting the real economy (as opposed to one concentrated on specific banks). Moreover, supervisors have actively and publicly encouraged the use of capital buffers in order to support lending, as evident in the following citation of the Chair of the Supervisory Board: "it is all the more important to encourage banks

[3] See ECB Recommendation release 28 July 2020
https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm_2020_35_f_sign~ab7166596a.en.pdf

to use their capital and liquidity buffers now to continue focusing on this overarching task: lending, whilst of course maintaining sound underwriting standards".[4]

In addition to measures affecting regulatory capital requirements and buffers, the ECB has introduced measures to limit excessive volatility in loan loss provisioning and to mitigate credit risk as well as market risk. Supervisors will exercise flexibility on the classification of debtors as "unlikely to pay" when banks call on public guarantees granted in the context of coronavirus as well in the case of loans under public moratoria related to COVID-19. Moreover, loans which become non-performing and are subject to public guarantees will benefit from preferential prudential treatment in terms loss provisioning. Full flexibility will also be deployed in discussions between supervisors and banks about the implementation of non-performing loan (NPL) reduction strategies. As for the initiative to limit excessive volatility in loan loss provisioning, banks have been encouraged to avoid excessive procyclical effects when applying IFRS 9. On 16 April 2020, in response to the heightened levels of volatility recorded in financial markets since the coronavirus outbreak, the ECB also introduced a temporary relief from capital requirements for market risk.

Insert Figure 8

4 Estimating the impact on bank lending conditions

In the absence of sufficient post-crisis data to conduct a fully-fledged econometric analysis on the effects of the pandemic measures, we study the impact of similar measures adopted in the past and assess the overall effects on lending by calibrating the parameters of the model using detailed information on the pandemic responses. Importantly, we are interested not only in the effectiveness of the individual measures announced, but also in potential amplification effects stemming from the joint intervention of monetary and prudential authorities.

In what follows we take stock of past experiences with TLTROs and changes in capital requirements to illustrate these complementarities. We show that credit easing measures found their way to the real economy mostly through intermediaries that had the necessary capital leeway to enable such a transmission. The first part of this section illustrates the unique data we use to conduct our empirical analysis. The second and third parts show

[4] Press release on ECB Recommendation not to pay dividends until January 2021 and clarification of timeline to restore buffers:
https://www.bankingsupervision.europa.eu/press/pr/date/2020/html/ssm.pr200728_1~42a74a0b86.en.html

the impact of TLTROs and changes in capital buffers in general. The fourth part weaves these two threads together to illustrate the combined effect of credit easing and capital relief measures.

Throughout this section we make use of local projection methods (Jordà, 2005) in a panel setting to estimate the dynamic effects of exogenous policy induced shocks, as well of as a high-frequency variable to tackle potential endogeneity issues related to banks' participation in ECB liquidity operations. We also estimate panel pass-through regressions to illustrate the evolution of various bank characteristics, such as loan volumes, in the aftermath of certain shocks like participation in TLTRO operations or changes in capital buffers, controlling for potentially confounding factors.

4.1 Data

Our empirical analysis relies on several data sources. We obtain information on bank-level loan volumes from the individual Balance Sheet Indicators (iBSI) dataset. This is a proprietary database maintained by the ECB, which reports the main asset and liability items of over 300 banks resident in the euro area at a monthly frequency. We gather direct information on TLTRO uptake and borrowing allowances from the confidential templates that each participant bank has submitted as part of its reporting obligations in order to participate in the monetary policy operations. This tells us exactly how much each bank was entitled to borrow under the various TLTROs and how much it actually borrowed. We complement the iBSI and TLTRO templates with information from bank-specific capital requirements resulting from the supervisory review of each bank. We use data on CET1 capital ratios from S&P Market Intelligence (SNL Financial), cross-checked with information from banks' supervisory reports. The combination of bank-level information on both capital requirements and endowments is key to fully characterising banks' capital buffers. Lastly, we gather the information on daily movements of bank bond yields from Markit iBoxx.

Table 1 summarises the rich set of bank characteristics that we obtain from merging the above datasets. Covering a total of 305 banks, our sample provides comprehensive coverage of banks in the euro area from August 2007 to April 2020.

Insert Table 1

4.2 Targeted liquidity operations and lending growth

TLTROs are term funding operations with attractive pricing and a design that provides incentives to participating banks to extend loans to the private sector (with the exclusion of mortgages). Thus, banks that borrow under these operations not only see their funding costs decrease, which already activates a standard bank lending channel of monetary policy, but also tend to direct that lending towards the targeted sector in order to reap the full benefits from the operations.

In what follows we study whether and how, following the take-up of funds, the behaviour of participating banks is different from that of non-participating banks. To allow for delayed responses, we estimate impulse response functions for individual banks' loan volumes, as well as other relevant balance sheet characteristics, to changes in participation. We do so using local projection models (Jordà, 2005; Ramey, 2016). The specification is the following:

$$\Delta L_{i,t+h} = \alpha_{c,t,h} + \beta_h TLTRO_{i,t}^{uptake} + \epsilon_{i,t+h} \tag{1}$$

where we allow for a delayed response within 24 months, that is, $h = 1, \ldots, 24$. Each observation is a bank i in month t. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs of bank i between t and $t + h$. The variable $TLTRO_{i,t}^{uptake}$ takes a value of 1 if bank i has participated in a TLTRO operation (TLTRO I, TLTRO II or TLTRO III) in the last three months and is 0 otherwise. Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h.

The results are reported in Figure 9. TLTRO operations have been highly supportive of loan developments since their inception in 2014. Banks that participate in TLTROs show an increasingly higher loan volume compared to banks that do not participate, even controlling for macroeconomic developments at the country level. Participation in itself is associated with a loan volume around 2.5% higher after one year and 7.5% higher after two years.

The impact is gradual, reflecting the well-known delayed response of loan origination. The impacts of participation 12 and 24 months ahead are equivalent to 8% and 14% of a standard deviation of changes in the loan volumes at the two horizons, respectively. Finally, the impact is persistent, which is in line with the design of TLTROs as term operations which provide liquidity over longer maturities.[5] Conditional on a positive

[5] TLTRO I consisted in eight quarterly operations expiring in September 2018, with the possibility to repay early two years after allotment. TLTRO II consisted in four quarterly operations with a four-year

effect of TLTROs on lending, net flows are bound to be positive, at least until the first loans originated over the first horizons start to mature. Therefore the cumulative impact on the total volume of loans increases over time.[6]

Insert Figure 9

A reasonable concern is that there may be other, potentially unobserved factors driving both loan dynamics and the decision to participate in TLTROs. For example, a bank-specific ability to attract borrowers, not aligned with the aggregate demand dynamics captured by country-time fixed effects, could potentially prompt higher loan volumes and the willingness to participate in TLTROs. This is because confidence on the side of prospective participants in meeting the conditions required by the programme would increase. Thus, it is important to isolate an exogenous variation related to TLTRO to identify its effect on bank lending.

Moreover, there may be effects of TLTROs that are not necessarily transmitted via actual participation. For example, as discussed in Section 3.1, banks that do not directly participate in TLTROs benefit from the lower funding costs generated by lower supply of bank bonds in the market, as other banks indeed shift their funding in favour of ECB's operations.

With this in mind, we look at the reaction to movements in bank bond yields that occur at high frequency around TLTRO-related announcements. The set of events considered covers the dates on which TLTRO programmes were announced, or on which certain technical details and recalibrations were released; it excludes dates on which actual TLTRO borrowings took place, as changes in banks' bond yields then might be directly related to the extent of participation into the programme and therefore still be endogenous.[7]

The specification is the following:

$$\Delta L_{i,t+h} = \alpha_{c,t,h} + \alpha_{i,h} + \beta_h TLTRO_{i,t}^{shock} + \Gamma X_{i,t-1} + \epsilon_{i,t+h} \quad (2)$$

maturity and an early repayment option after two years. At its announcement in March 2019, TLTRO III was to cover seven quarterly operations with a two-year maturity and no early repayment option. In September 2019, ahead of the first operation, the maturity was extended to three years and early repayment was allowed after two years. In March 2020, amid the pandemic emergency and ahead of the third TLTRO III operation, early repayment was allowed after one year from allotments starting in September 2021.

[6] See Appendix A for the robustness of these findings and for a discussion of the transmission mechanism of TLTROs.

[7] See Table A.2 and Figure A.2 in the appendix for the list of events and associated changes in bank bond yields included in our sample.

where we allow for a delayed response of 24 months, that is, $h = 24$. Each observation is a bank i in month t. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs of bank i between t and $t+h$. The variable $TLTRO_{i,t}^{shock}$ measures the change in bank bond yields observed between the day before and day after TLTRO-related announcements, cumulated over month t. The regressions include country-time fixed effects $\alpha_{c,t,h}$ and, when stated, bank fixed effects $\alpha_{i,h}$, each specific to the horizon h, as well as and additional controls $X_{i,t-1}$.

Table 2 reports the results of this exercise. The sample over which these regressions are estimated is considerably reduced but still meaningful, covering 102 banks for which bank bond yields are available. Column 1 presents the estimation of the specification in equation (2), where lending growth is directly regressed onto the identified TLTRO-related bond movements. Column 2 adds bank fixed effects, and column 3 adds a wide range of additional observable bank characteristics, with marginal impact on the estimated coefficient. These specifications show that a 10 basis point reduction in bank bond yields at the time of TLTRO announcements, which is just below the average shock, anticipates an increase in lending of around 6%.

Insert Table 2

The impact of TLTROs at the aggregate level of lending has been studied extensively in the literature. TLTROs are able to activate a large variety of channels of transmission. The mere participation of banks and the extent of their participation offer only a partial view. Aggregate effects, for example, are for the most part absorbed by country-time fixed effects in our specification. Thus, it is important to place our impact in the overall range of estimates explored by previous studies, once the appropriate rescaling has been applied. Figure 10 illustrates the impact on lending growth per annum implied by 17 estimates collected in the literature.

Insert Figure 10

This meta-analysis shows a wide range of estimates. Higher impacts are normally found in studies that use aggregate data and model the dynamic impact of the measures, whereas cross-sectional studies using micro data tend to isolate specific channels or heterogeneity along the lines of specific bank characteristics. All estimates are expressed as a function of the aggregate utilisation rate, that is, the ratio of actual uptake to borrowing allowance under the various programmes. The uptake in the June operation of TLTRO III was just

above €1.3 trillion. Compared with a theoretical borrowing allowance of €2.9 trillion this yields a change in the utilisation rate of around 45%. Based on the evidence reported in Figure 9, the increase in loan growth would be around 1.7 percentage points each year. Similarly, if we isolate the compression in bank bond yields observed around TLTRO III-related announcements, the estimate reported in Table 2 (column 3) yields a similar aggregate impact of 1.1 percentage points each year, which is close to the median of the wide range of studies considered in the meta-analysis. Thus, the June 2020 operation alone has the potential to avert around 3 percentage points of loan volume decline over the period 2020-22.

4.3 Capital requirements and lending growth

An increase in capital buffers generates the necessary leeway for banks to bear more risk and expand their exposure towards the private sector. Similarly, a sudden drop in capital buffers bears the potential to prompt a large deleveraging. The response of loan volumes to sudden changes in this key determinant of banks' risk-bearing capacity is difficult to isolate, as buffers are per se very endogenous to banks' business practices and to macroeconomic developments. Past increases in capital requirements offer a natural laboratory for evaluating the impact of sudden reductions in capital buffers. Where capital buffers have suddenly narrowed or there have even been outright capital shortfalls due to increases in capital requirements, this isolates the reaction of lending conditions to changes in capital buffers.

We illustrate how the behaviour of banks hit by an increase in capital requirements varies, distinguishing between banks that had a sufficient capital buffer before the shock to absorb the increased requirement and banks that did not.

The specification is the following:

$$\begin{aligned} \Delta L_{i,t+h} &= \alpha_{c,t,h} + \delta_h Requirement_{i,t}^{shock} \times D_{i,t-1} + \\ &\quad \gamma_h Requirement_{i,t}^{shock} \times (1 - D_{i,t-1}) + \epsilon_{i,t+h} \end{aligned} \tag{3}$$

where we allow for a delayed response up to 24 months, that is, $h = 1, \ldots, 24$. Each observation is a bank i in month t. $\Delta L_{i,t+h}$ is the percentage change in the volume of loans to NFCs granted by bank i between t and $t+h$, t the variable $Requirement_{i,t}^{shock}$ is equal to the increase in capital requirements (in percentage points of risk-weighted assets – RWA) that occurred for bank i at time t (extended to cover periods one quarter before

and after month t), and $D_{i,t-1}$ is equal to 1 if the difference (in percentage points of RWA) between the CET1 ratio and the capital requirement of bank i in month $t-1$ is strictly greater than 1. Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h.

Past experience shows that buffer depletion is not particularly impactful for banks that actually have a positive buffer before the shock (see Figure 11, left panel). In fact, a higher capital requirement in this case generates only a mild and transitory deleveraging. Meanwhile the medium to long-term effect consists in a stimulus to lending activity. This may be on account of a positive signal, leading investors to lower funding costs for banks that show the ability to smoothly weather a marginal decrease in capital availability. The trough in lending is reached half a year after the increase in requirement and is no more than 0.5% below the level before the shock. After that, lending activity resumes and increases to a level that after two years is 1% higher than the starting point, although uncertainty increases substantially at horizons over one year.

At the same time, capital depletion can be severely detrimental for loan developments if the buffer is close to nil (see Figure 11, right-hand panel). A bank with less than one percentage point of capital buffer experiencing an increase in capital requirements immediately starts a rapid deleveraging process that continues for a year, reaching a maximum impact of almost -1.5%. After that, the bank resumes a more standard level of intermediation activity, although even after two years the loan volume is below the pre-shock level. Also in this case, uncertainty after the first year makes it difficult to reject the hypothesis that the impact after two years is different from 0.

Drops in capital buffers that are not necessarily related to increases in capital requirements generally have a different impact on loan developments, especially over longer horizons (see Figure A.3 in the appendix). First, there is no distinguishable increase in lending after two years for banks that already had a solid capitalisation before the shock. Second, the impact on banks that did not have buffers to begin with is extremely negative, with lending volumes decreasing by as much as 8% after two years.[8]

Insert Figure 11

A sudden windfall in buffers has seldom been observed in the euro area, unlike increases in capital requirements. Thus, it is difficult to draw inference from past episodes on the potential impact of the capital relief measures recently adopted by microprudential and

[8] The results are robust to the use of either a continuous explanatory variable or a discrete version, the latter using capital drops of the same size as the average increase in requirements.

macroprudential authorities in the euro area. For banks with a large enough buffer the impact of an increase in the buffer is likely to be limited. However, for banks that have close to no buffer it is more reasonable to expect a more symmetric impact, at least as a counterfactual to a situation where such capital relief had not occurred (and perhaps conditional on loan demand remaining evenly distributed across banks, irrespective of their capitalisation). If that were the case, the impact of the recently adopted capital relief measures on lending volumes would likely be sizeable. In this sense, it is also important to note that the magnitude of the crisis is likely to significantly dent capital buffers.

Insert Figure 12

Consider that the CET1 ratio at the onset of the crisis in December 2019 was 14.8% and the pre-crisis capital requirement was around 11% on average. Therefore in the absence of capital relief measures, the capital depletion implied by rising NPLs and a generalised increase in the riskiness of exposures would have implied a capital buffer very close to zero, if not negative, by the end of the year for the average euro area bank. This would have severely impaired any ability, let alone willingness, on the part of banks to respond to the unprecedented demand for liquidity coming from firms and to channel the monetary stimulus provided by the TLTROs. The capital relief of 1.5 percentage points granted through the actions of macroprudential authorities and supervisors may thus have created space for an impact on lending growth as high as 2.2 percentage points a year (using the elasticity from the right-hand panel in Figure 11). Considering the size of the capital relief, the expected impact based on this analysis is in line with the median impact from a wide range of studies covering both cross-sectional analyses and model-based assessments (see Figure 12).

4.4 Policy complementarities

The term funding at cheap rates provided by TLTROs sustains banks' intermediation capacity in general. However, it is particularly able to stimulate lending if it can rely on banks' ability to leverage up. The increased availability of capital buffers elevates the benefits of the TLTROs from merely providing a substitute for more expensive forms of funding to enabling outright balance sheet expansion, thereby enhancing the monetary stimulus that is eventually conveyed to the real economy.

In what follows we complement the analysis conducted in Section 4.2 with a particular focus on TLTROs' interaction with capital availability. This allows us to shed light on the

synergies between the recent recalibrations in the design of TLTRO III and the capital relief measures adopted by macroprudential and microprudential authorities.

The specification is the following:

$$\begin{aligned} \Delta L_{i,t+h} &= \alpha_{c,t,h} + \beta_h TLTRO_{i,t}^{uptake} + \delta_h Buffer_{i,t-1} + \\ &\quad \gamma_h TLTRO_{i,t}^{uptake} \times Buffer_{i,t-1} + \epsilon_{i,t+h} \end{aligned} \tag{4}$$

where we allow for a delayed response within 24 months, that is, $h = 1, \ldots, 24$. Each observation is a bank i in month t. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs issued by bank i between t and $t+h$, the variable $TLTRO_{i,t}^{uptake}$ takes a value of 1 if bank i has participated in a TLTRO operation (TLTRO I, TLTRO II or TLTRO III) in the previous three months and is 0 otherwise, and $Buffer_{i,t-1}$ is the difference (in percentage points of RWA) between the CET1 ratio of bank i in month $t-1$ and its bank-specific capital requirement in month $t-1$ (when the bank-specific requirement is not available, the capital requirement is the average in country c). Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h.

The results show that there is complementarity between the funding relief provided by TLTRO participation and the risk-bearing capacity necessary to deliver the eventual increase in loan volumes. Each percentage point of capital buffer can guarantee up to one additional percentage point increase in loan volumes for participating banks relative to non-participating banks (see Figure 13). This effect is gradual and stabilises at around one and a half years from take-up, which is approximately the horizon beyond which the bulk of any new lending that may be included in banks' business plans as a consequence of TLTRO participation starts to be fully operationalised and implemented. By creating space for banks' leveraging, capital relief measures can therefore significantly boost the effectiveness of the TLTROs.

Insert Figure 13

In Section 4.3 we have seen how capital relief measures in response to large, exogenous drops in capitalisation can potentially be highly supportive of loan developments. This is all the more relevant against the backdrop of a monetary stimulus that relies on banks' ability to leverage up in order to be effective. Thus, there may be a significant non-linearity in the interaction between the two support measures, with capital relief becoming particularly relevant for TLTRO effectiveness when capital buffers are narrowed down by

an exogenous shock. To illustrate this point, we adopt the following specification:

$$\begin{aligned} \Delta L_{i,t+h} &= \alpha_{c,t,h} + \delta_h TLTRO_{i,t}^{uptake} \times D_{i,t-1} + \\ & \gamma_h TLTRO_{i,t}^{uptake} \times (1 - D_{i,t-1}) + \epsilon_{i,t+h} \end{aligned} \tag{5}$$

where we allow for a delayed response up to 24 months, that is, $h = 1, \ldots, 24$. $\Delta L_{i,t+h}$ is the percentage change in the volume of loans to NFCs issued by bank i between t and t+h, the variable $TLTRO_{i,t}^{uptake}$ is the change that occurred over the last three months in the ratio of uptake over borrowing allowance of bank i in period t in any of the TLTRO programmes (TLTRO I, TLTRO II or TLTRO III), and $D_{i,t-1}$ is equal to 1 if the difference (in percentage points of RWA) between the CET1 ratio and the capital requirement of bank i in month $t-1$ is strictly greater than 1. Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h.

In Figure 14 we show that banks that do not have capital buffers and yet participate in TLTRO operations do not expand their balance sheet, while banks that do have a buffer extend more loans than non-participants.

Consider a change in the utilisation rate of 45%, equal to what was registered with the June 2020 TLTRO III operation. This increase in participation implies that a bank with a capital buffer of above one percentage point can expand its loan portfolio almost by 5%, whereas a bank with no such buffer can barely extend any additional loans at all.[9] The uncertainty surrounding the estimates for banks that do not have a buffer is large. This may be because TLTROs benefit banks' intermediation capacity even when they cannot commit to a balance sheet expansion, for instance via the substitution away from more costly forms of funding. However, the large differences in the impact on the lending volumes of banks that do have buffers confirm that the availability of risk-bearing capacity is crucial to banks participating in the programme actually channelling the monetary stimulus to firms. Therefore the capital relief measures adopted in concomitance with the recalibration of the TLTRO III were highly conducive to bringing the intended support to the real economy.

[9] In fact, the design of TLTROs allows banks that had a negative lending pattern before the announcement of each programme to continue deleveraging at the same pace over the evaluation period. Hence, banks with low capital buffers, which are likely to be in a process of deleveraging already, may be participating in TLTROs to access the cheap funding and nonetheless experience a mild contraction in their exposures to the eligible sectors of borrowers.

Insert Figure 14

5 The real effects of pandemic measures

In the previous section, we find that monetary and prudential measures are estimated to effectively increase lending volumes. In this section we investigate the potential real economic effects of the pandemic measures by assessing whether and how these measures can also influence firms' behaviour. More precisely, we are interested in whether following policy interventions firms more exposed to pandemic measures increase their employment.

We investigate these questions by matching bank level information with firm level data obtained from Bureau Van Dijk's Orbis – a comprehensive database of financial statements of companies worldwide. Importantly, for each firm Orbis also provides information on the names of the most important banks. While we do not directly measure the amount of credit a particular bank extends to a specific firm, we assume that firms connected with intermediaries more affected by TLTROs (i.e. experiencing larger declines in funding costs around TLTRO-related events) or with higher capital buffers as a result of capital relief measures are more exposed to the pandemic measures.

The sample used in the empirical analysis consists of a cross-section of 117,062 firms and 59 banks, followed between 2014 and 2018.[10] Table 3 summarizes the main variables of the firm-level dataset. Overall, our sample is highly representative of aggregate and cross-sectional patterns in the euro area. In this respect, it allows us to analyze the real effects of monetary and prudential policies, relying on a sample with large coverage.

Given that the policy shocks we are interested in occur at the bank level and we are interested in developments at the firm level, we associate to each firm the average shock that the counterpart banks of each firm experience. As shocks, we consider the change in bank bond yields occurred around TLTRO-related events during 2014 and the change in bank capital requirements introduced in January 2015. These shocks are arguably exogenous to firm behaviour for two reasons. First, they are eminently related to banks and have no connection with euro area firms except the channel that passes via banks. Second, bank bond developments are identified at a high frequency before the implementation of

[10] The construction of our sample is similar to Altavilla et al. (2019). We restrict our sample to 12 euro area countries for which Orbis provides information on counterpart banks (Austria, Estonia, France, Germany, Greece, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, and Spain) and to the 102 banks that have traded bank bonds for which we can observe high-frequency changes around TLTRO-related announcements.

TLTRO operations, which started only in September 2014.

Insert Table 3

In order to explore the impact on firms, we adopt the following specification:

$$\Delta E_{f,h} = \alpha_{c,s,H} + \delta_H TLTRO_f^{shock} + \gamma_H Requirement_{i,t}^{shock} + \epsilon_{f,H} \quad (6)$$

where $\Delta E_{f,h}$ is the percentage change in firm f's employment occurred between 2014 and year H, with $H = 2015, \ldots, 2018$; $TLTRO_f^{shock}$ is the average bank bond shock experienced by banks connected to firm f and $Requirement_{i,t}^{shock}$ is the average capital requirement shock experienced by the same banks of firm f. Each regression includes country-sector $\alpha_{c,s,H}$ fixed effects to capture demand and industry-specific components and is specific to the horizon H.[11]

Table 4 reports the results of this specification for the two-year horizon ($H = 2016$) for consistency with the horizon explored at the bank level.

Column 1 reports that firm employment expands as a result of TLTRO-related shocks and contracts for capital requirement shocks. Impacts are economically meaningful, as standard deviations of bank bond shocks (4 bp) and capital requirement shocks (0.9 pp) are symmetrically associated to a half percentage point change in employment.

Column 2 shows that the expansion in employment is associated also with a parallel increase in firms' total assets, which points to a generalised size effect of the policies. The easing of bank lending conditions brought forth by TLTRO announcements allows firms to expand their business size, whereas the symmetric and opposite effect occurs in case of a tightening in capital requirements that leads to a contraction of capital buffers. For TLTRO-related shocks, this effect is also accompanied by a reduction in firm leverage as shown in column 3, which suggests that firms do not simply get access to larger volumes of cheap credit but rather receive more favourable borrowing conditions which allow them to expand.

Insert Table 4

Column 4 checks whether the observed increases in employment does not come to the detriment of productivity, measured as sales per worker. In fact, business volumes seem

[11] Given that shocks occur at the bank level, we cluster errors at the bank level, which is the most conservative approach. We associate one bank to each firm for those firms (less than 50%) that report more than one bank.

to expand sufficiently to fully offset the increase in employment, leaving no significant impact on productivity. The symmetric argument applies to capital shortages generated by changes in capital requirements. While pandemic measures do not seem to enable firms to obtain productivity gains, they equally do not cause productivity losses despite supporting employment.

Figure 15 illustrates the impact on firm employment of a one standard deviation shock for both TLTRO announcements and capital requirements at different horizons. The effects of TLTRO-related shocks stabilize after the second year, whereas capital requirement shocks take more time to cumulate, progressively reaching a -0.8% impact after 4 years.[12] Translating the funding cost relief and the capital relief observed over the period between March and April 2020, the overall impact of the pandemic measures bears the potential to forestall an employment decline in the corporate sector over the next 2 years of 1.4%, equivalent to more than 1 million workers.[13]

Insert Figure 15

6 Conclusions

The unprecedented policy response to the COVID-19 crisis, in the form of new and more targeted measures, has been crucial for counteracting the adverse economic consequences associated with the outbreak and intensification of the crisis. In the euro area, national and supranational policymakers have reacted promptly with several policy initiatives. This paper assessed a subset of these measures: those directly targeted at improving bank lending conditions.

In general, given that the pandemic is still under way, producing an assessment of the effectiveness of the policies implemented so far is very challenging. The support these measures provided for lending conditions is therefore measured by mapping the funding and capital relief associated with each measure onto changes in bank lending using the

[12] Table A.3 in the appendix illustrates how the change in employment is associated with the bank TLTRO shock, with the component of TLTRO utilisation ratio predicted the reaction in bond yields, and with the higher lending growth induced by TLTRO shocks and yet not by bank lending growth in general. It also presents the robustness of the baseline results to the addition of more firm-level covariates, as well as the test for pre-existing trends for firms affected by TLTRO shocks.

[13] The 1 million figure is obtained by applying the increase of 1.4% predicted by the coefficients reported in Table 4, column 1, to 80 million private sector employees in the euro area on average in the last 3 years, which result from subtracting from total employment the self-employed and the employees of the public sector.

estimated elasticities. The results are then compared with elasticities from a wide range of studies.

We reach three main conclusions.

First, the pandemic response policies have prevented the materialisation of an adverse equilibrium of acute financial market volatility coupled with impaired access to funding, which would have resulted in a substantial contraction in lending and an even sharper collapse in real economic activity. The measures had significant repercussions on banks' capacity to remain active carriers of the monetary stimulus.

Second, the analysis reveals important complementarities between a targeted stimulus for loan origination via funding operations and the preservation of the capital buffers necessary to produce the intended increase in exposures. The close coordination between monetary policy and prudential measures has generated an amplification effect on lending and the additional impact on lending from a coordinated intervention is found to be sizeable.

Finally, we assess the potential real effects of the joint pandemic response measures by estimating the adjustment in labour input variables for firms that in the past have been more exposed to similar policies. We find that in absence of monetary and prudential policies firms' employment would significantly decline.

References

[1] Acharya, V., and Steffen, S. (2020) "'Stress Test' for Banks as Liquidity Insurers in a time of COVID", mimeo

[2] Albertazzi, U., Altavilla, C., Barbiero, F., Boucinha, M. and Di Maggio, M. (2019), "The incentive channel of monetary policy: quasi-experimental evidence from liquidity operations", mimeo

[3] Aiyar, S., Calomiris, D., Wieladek, T. (2012), "Does Macro-Pru Leak? Evidence from a UK Policy Experiment", NBER Working Papers, No 17822

[4] Altavilla, C., Boucinha M., Peydró J. L., Smets F.R. (2020a), "Banking Supervision, Monetary Policy and Risk-Taking: Big Data Evidence from 15 Credit Registers", ECB Working Paper Series, No. 2349

[5] Altavilla, C., Burlon, L., Giannetti, M., Holton, S. (2019), "Is there a zero lower bound? The effects of negative policy rates on banks and firms", ECB Working Paper Series, No. 2289

[6] Altavilla, C., Canova, F. and Ciccarelli, M. (2020b), "Mending the broken link: Heterogeneous bank lending rates and monetary policy pass-through", Journal of Monetary Economics, Vol. 110, pp. 81-98

[7] Altavilla C., Laeven L., Peydró J. L. (2020c) "Monetary and Macroprudential Policy Complementarities: Evidence from European Credit Registers", mimeo

[8] Afonso, A. and Sousa-Leite, J. (2019), "The transmission of unconventional monetary policy to bank credit supply: evidence from the TLTRO", Working Papers, No 201901, Banco de Portugal;

[9] Andreeva, D. C. and García-Posada, M. (2019), "The impact of the ECB's targeted long-term refinancing operations on banks' lending policies: the role of competition", Working Papers, No 1903, Banco de España

[10] Arce, O., Gimeno, R. and Mayordomo, S. (2017), "Making Room for the Needy: The Credit-Reallocation Effects of the ECB's Corporate QE", Working Papers, No 1743, Banco de España

[11] Balfoussia, H. and Gibson, H. D. (2016), "Financial conditions and economic activity: the potential impact of the targeted long-term refinancing operations (TLTROs)", Applied Economics Letters, Vol. 23(6), pp. 449-456;

[12] Bats, J. and Hudepohl, T. (2019), "Impact of targeted credit easing by the ECB: Bank-level evidence", DNB Working Papers, No 631, De Nederlandsche Bank

[13] Benetton, M. and Fantino, D. (2018), "Competition and the pass-through of unconventional monetary policy: evidence from TLTROs" Working Papers, No 1187, Banca d'Italia

[14] Berrospide, J. M. and Edge, R. M. (2019), "The Effects of Bank Capital Buffers on Bank Lending and Firm Activity: What Can We Learn from Five Years of Stress-Test Results?", Finance and Economics Discussion Series 2019, No 050, Board of Governors of the Federal Reserve System, United States

[15] Blank, M., Hanson, S. G., Stein, J. C. and Sunderam, A. (2020), "How should U.S. bank regulators respond to the COVID-19 crisis?", Hutchins Center Working Papers, No 63

[16] Boeckx, J., de Sola Perea, M. and Peersman, G. (2020), "The transmission mechanism of credit support policies in the euro area" European Economic Review, Vol. 124(C)

[17] Borio, C. (2014) "Monetary policy and financial stability: what role in prevention and recovery?", BIS Working Paper, No 440

[18] Bridges, J., Gregory, D., Nielsen, M., Pezzini, S., Radia, M. and Spaltro, M. (2014), "The impact of capital requirements on bank lending", Bank of England Working Papers, No 486

[19] Brunnermeier M. and Krishnamurthy A. (2020), "Corporate Debt Overhang and Credit Policy", Brooking Paper on Economic Activity, June 2020

[20] Coenen, G., Karadi P., Schmidt S. and Warne A. (2018), "The New Area-Wide Model II: an extended version of the ECB's micro-founded model for forecasting and policy analysis with a financial sector", ECB Working Papers, No 2200

[21] Cravo Ferreira, M. (2019), What happens when the ECB opens the cash tap? An application to the Portuguese credit market, dissertation, Universidade Católica Portuguesa

[22] Darracq Pariès, M., Jacquinot, P. and Papadopoulou, N. (2016), "Parsing financial fragmentation in the euro area: a multi-country DSGE perspective", ECB Working Papers, No 1891

[23] Darracq Pariès, M., Kok-Sorensen, C. and Rodriguez-Palenzuela, D. (2011) "Macroeconomic Propagation under Different Regulatory Regimes: Evidence from an Estimated DSGE Model for the Euro Area", International Journal of Central Banking, Vol. 7(4): 49–113

[24] De Nicolò, G. (2019), "The costs and benefits of bank capital requirements", Global Finance Journal, Elsevier, Vol. 39(C), pages 21-25

[25] De Nicolò, G., Gamba, A. and Lucchetta, M. (2014), "Microprudential Regulation in a Dynamic Model of Banking", Review of Financial Studies, Vol. 27(7), pages 2097-2138

[26] Esposito, L., Fantino, D. and Sung, Y. (2020), "The impact of TLTRO2 on the Italian credit market: some econometric evidence", Working Papers, No 1264, Banca d'Italia

[27] Flanagan, T. (2020), "Stealth Recapitalization and Bank Risk Taking: Evidence from TLTROs", available at SSRN No 3442284

[28] Fraisse, H., Lé, M. and Thesmar, D. (2020), "The Real Effects of Bank Capital Requirements", Management Science Vol. 66(1), pp.5-23

[29] Gibson, H. D., Hall, S. G., Petroulas, P., and Tavlas, G. S. (2020), "On the effects of the ECB's funding policies on bank lending", Journal of International Money and Finance Vol. 102, pp. 1021-12

[30] Greenwald D. L., J. Krainer, P. Paul (2020) "The Credit Line Channel" Federal Reserve Bank of San Francisco Working Paper 2020-26

[31] Jordà, Ò. (2005), "Estimation and Inference of Impulse Responses by Local Projections", American Economic Review Vol. 95, 161-182

[32] Krishnamurthy, A. and Brunnermeier, M. (2020), "Corporate Debt Overhang and Credit Policy", Stanford Business School Working Papers, No. 3876

[33] Laine, O. (2019), "The Effect of TLTRO-II on Bank Lending", Bank of Finland Research Discussion Papers, No 7/2019

[34] Mendicino, C., Nikolov K., Suarez J. and Supera D. (2018), "Optimal Dynamic Capital Requirements", Journal of Money, Credit and Banking, Vol. 50(6), pp. 1271-1297

[35] Offermans, C. J. and Blaes, B. A. (2019), "The Effects of Unconventional Monetary Policies on the Lending Activity of German Banks", mimeo

[36] Ramey, V (2016), "Macroeconomic Shocks and Their Propagation", Chapter 2 in Handbook of Macroeconomics, 2016, Vol. 2, pp. 71-162

[37] Rostagno, M., Altavilla, C., Carboni, G., Lemke, W., Motto, R., Saint Guilhem, A., Yiangou, J. (2019), "A tale of two decades: the ECB's monetary policy at 20", ECB Working Papers, No 2346, European Central Bank

[38] Svensson, L. E. O., 2017, "Cost-benefit analysis of leaning against the wind", Journal of Monetary Economics, Vol. 90, pp. 193-213

[39] van Dijk, M. and Dubovik, A. (2018), "Effects of Unconventional Monetary Policy on European Corporate Credit" Discussion Papers, No 372, CPB Netherlands Bureau for Economic Policy Analysis

[40] Woodford, M. (2012), "Inflation targeting and financial stability", NBER Working Paper No. 17967

Table 1: Summary statistics for bank level data

Variable name	Units	Definition	Obs.	Mean	St.Dev.	p5	p25	p50	p75	p95
Loan volume	€Mln	Outstanding amounts of loans to NFC.	33335	11531	19248	86	1207	4515	11993	53771
Loan growth 1 month ahead	%	Percentage change in loan volume from month *t-1* to month *t*.	33335	0.25	5.22	-5.26	-0.91	0.06	1.23	5.92
Loan growth 12 months ahead	%	Percentage change in loan volume from month *t-1* to month *t+11*.	33335	2.52	29.80	-33.66	-5.81	1.73	9.50	42.19
Loan growth 24 months ahead	%	Percentage change in loan volume from month *t-1* to month *t+23*.	33335	4.40	50.58	-64.63	-10.64	3.20	17.16	68.29
Loan growth 24 months back	%	Percentage change in loan volume from month *t-1* to month *t-25*.	25851	-4.75	46.39	-69.31	-16.17	-2.39	10.68	55.12
Change in TLTRO participation	Cat.	Dummy variable equal to 1 if a bank increases its outstanding amount of TLTRO I, TLTRO II or TLTRO III between month *t* and month *t-3*, and 0 otherwise.	33335	0.04	0.20	0.00	0.00	0.00	0.00	0.00
Utilisation ratio	%	Ratio between uptake in TLTRO I, TLTRO II or TLTRO III and the respective borrowing allowances.	32795	6.32	21.37	0.00	0.00	0.00	0.00	64.88
Change in utilisation ratio	p.p.	Change in utilisation ratio between month *t-3* and month *t* if a given bank increases its outstanding amount of TLTRO I, TLTRO II or TLTRO III between month *t-3* and month *t*.	32552	1.10	9.77	0.00	0.00	0.00	0.00	0.00
Capital requirement	%	Capital requirement of a bank. Before 2015, 8%.	33335	8.68	1.30	8.00	8.00	8.00	9.09	11.15
Capital buffer	%	Difference between level of CET1 ratio and country-specific capital requirement. 1 month lag.	28885	4.49	6.45	-2.18	0.69	2.99	6.49	15.99
With capital buffer	Cat.	Dummy variable equal to 1 if a bank has a capital buffer above 1% in month *t*, and 0 otherwise.	28885	0.72	0.45	0.00	0.00	1.00	1.00	1.00
Shock to capital requirement	p.p.	Increase in capital requirement occurred in any month between *t-3* and *t+2*.	33095	0.20	0.74	0.00	0.00	0.00	0.00	1.18
Shock to cap. req.*With cap. buffer	p.p.	Increase in capital requirement occurred in any month between *t-3* and *t+2* for banks with a capital buffer above 1%.	28678	0.17	0.68	0.00	0.00	0.00	0.00	1.09
Shock to cap. req.*W/o cap. buffer	p.p.	Increase in capital requirement occurred in any month between t-3 and t+2 for banks with a capital buffer equal or below 1%.	28678	0.03	0.34	0.00	0.00	0.00	0.00	0.00
Assets	log	Log of main assets (total assets minus remaining assets, check BSI statistics for details), in €Mln.	33335	10.23	1.46	7.86	9.25	10.28	11.22	12.72
ROA	%	Return on assets.	30253	0.19	1.70	-1.15	0.06	0.29	0.58	1.38
Capitalisation	%	CET1 ratio.	28885	13.10	6.65	6.01	9.04	11.61	15.10	25.00
Deposit ratio	%	Ratio of total deposits to NFC over main liabilities.	33335	32.72	26.25	0.00	4.89	31.91	53.01	76.96
Excess liquidity	%	Ratio of excess liquidity (current account + deposit facility - minimum reserve requirements) over main assets.	28160	4.50	103.21	0.00	0.00	0.01	1.09	13.50
Government bond holdings	%	Ratio of holdings of securities issued by general governments over main assets.	33240	5.93	6.39	0.00	0.59	4.26	8.85	19.16
Bond shock	b.p.	Change in bank bond yields (with opposite sign so a decrease is reported with positive sign) occurred between the day before and the day of TLTRO-related announcements cumulated over month *t*.	4091	13.36	16.82	0.00	0.00	13.05	20.11	35.28

Notes: Observations are reported at the bank and month level. Our sample consists of a panel of 305 banks over the period from August 2007 to April 2020.

Table 2: TLTRO shocks and loan growth

	(1)	(2)	(3)
Dependent Variable:	Loan growth (24 months ahead)	Loan growth (24 months ahead)	Loan growth (24 months ahead)
TLTRO shock	0.357***	0.718***	0.574***
	(0.079)	(0.145)	(0.105)
Assets			-104.667***
			(10.394)
ROA			2.136**
			(1.048)
Capitalisation			0.497
			(0.650)
Deposit ratio			-2.308***
			(0.240)
Excess liquidity			-0.061
			(0.319)
Government bond holdings			-0.556
			(0.450)
Country-time fixed effects	Yes	Yes	Yes
Bank fixed effects	-	Yes	Yes
Observations	4,091	4,091	3,543
R-squared	0.013	0.059	0.244

Notes: The table reports the reaction of lending growth to TLTRO shocks identified by using information on high frequency movements in bank bond yields around TLTRO-related announcements Standard errors are clustered at the country-time level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3: Summary statistics for firm level data

Variable name	Units	Definition	Obs.	Mean	St.Dev.	p5	p25	p50	p75	p95
Bank bond TLTRO shock	b.p.	Change in bank bond yields occurred between the day before and the day of TLTRO-related announcements cumulated over 2014. Average across counterpart banks.	117062	14.59	3.98	9.96	13.26	14.43	15.31	22.50
Bank capital requirement shock	p.p.	Increase in bank-specific capital requirements occurred between 2014 and 2015. Average across counterpart banks.	117062	1.02	0.89	0.00	0.61	0.83	1.00	3.33
Change in employment	%	Percentage change in firm's number of employees between 2014 and 2016.	117062	5.74	27.83	-40.55	-3.26	0.00	18.23	53.90
Change in assets	%	Percentage change in the volume of firm assets between 2014 and 2016.	117062	7.57	27.79	-33.29	-6.40	4.73	19.65	57.54
Change in leverage	p.p.	Change in the firm ratio of liabilities over assets between 2014 and 2016.	117062	-2.16	10.98	-21.04	-6.98	-1.33	2.74	15.52
Change in productivity	%	Percentage change in firm sales per worker between 2014 and 2016.	117025	2.82	35.70	-54.77	-13.31	2.81	19.29	60.25
Change in employment (backwards)	%	Percentage change in firm's number of employees between 2014 and 2012.	113242	0.68	30.37	-49.53	-11.78	0.00	13.35	51.08
Bank predicted TLTRO utilisation ratio	p.p.	Change in bank TLTRO utilisation ratio predicted at the bank level by bank bond shocks occurred over 2014. Average across counterpart banks.	117062	0.49	0.13	0.33	0.44	0.48	0.51	0.75
Bank predicted credit growth	%	Change in bank loan volume between 2014 and 2016 predicted at the bank level by bank bond shocks occurred over 2014 (specification with country-month fixed effects). Average across counterpart banks.	117062	5.20	1.42	3.55	4.73	5.15	5.46	8.02
Bank predicted credit growth with fixed effects	%	Change in bank loan volume between 2014 and 2016 predicted at the bank level by bank bond shocks occurred over 2014 (specification with country-month and bank fixed effects). Average across counterpart banks.	117062	10.48	2.86	7.15	9.52	10.37	10.99	16.16
Bank credit growth	%	Change in bank loan volume between 2014 and 2016. Average across counterpart banks.	117062	-7.14	9.23	-22.78	-13.62	-7.24	-2.35	6.66
Liquid assets/Assets	%	Firm ratio of current assets over assets in 2014.	117062	65.04	26.92	12.84	45.92	70.31	88.46	98.64
Assets	log	Log of firm assets in 2014.	117062	14.08	1.53	11.75	13.06	13.96	14.96	16.91
Interest payments	%	Firm ratio of interest paid over total liabilities in 2014.	117050	2.06	2.06	0.03	0.53	1.52	2.95	5.98
ROA	%	Firm return on assets in 2014.	116327	1.74	8.71	-12.15	0.09	1.39	4.66	15.11

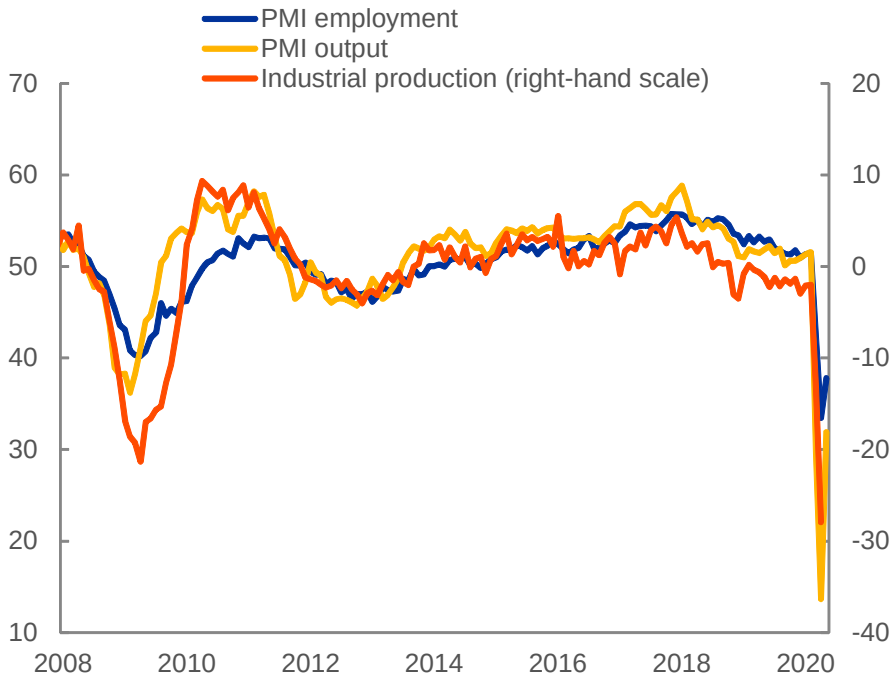
Notes: Observations are reported at the firm level. Our sample consists of a cross-section of 117,062 firms matched with 59 banks.

Table 4: Impact of TLTRO and capital requirement shocks on firms

	(1)	(2)	(3)	(4)
Dependent variable:	Change in employment	Change in assets	Change in leverage	Change in productivity
Bank TLTRO shock	0.121*	0.150**	-0.050**	0.026
	(0.065)	(0.063)	(0.022)	(0.029)
Bank capital requirement shock	-0.598*	-0.667*	0.062	0.063
	(0.342)	(0.333)	(0.075)	(0.259)
Country-sector fixed effects	Yes	Yes	Yes	Yes
Observations	117,062	117,062	117,062	117,025
R-squared	0.024	0.038	0.021	0.031

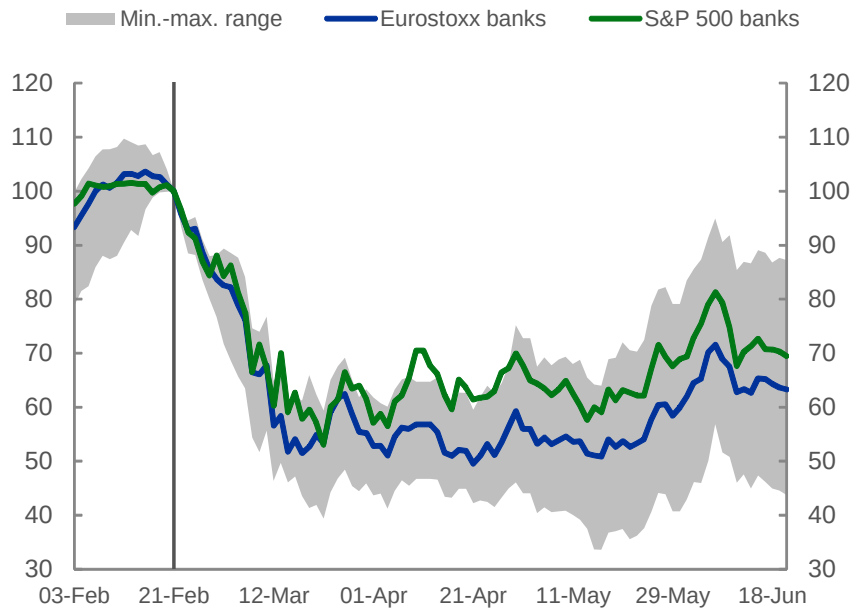
Notes: Standard errors are clustered at the bank level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Figure 1: Industrial production and euro area Purchasing Managers Index (PMI) - Left-hand scale: index, 50=no change; right-hand scale, year-on-year growth rate



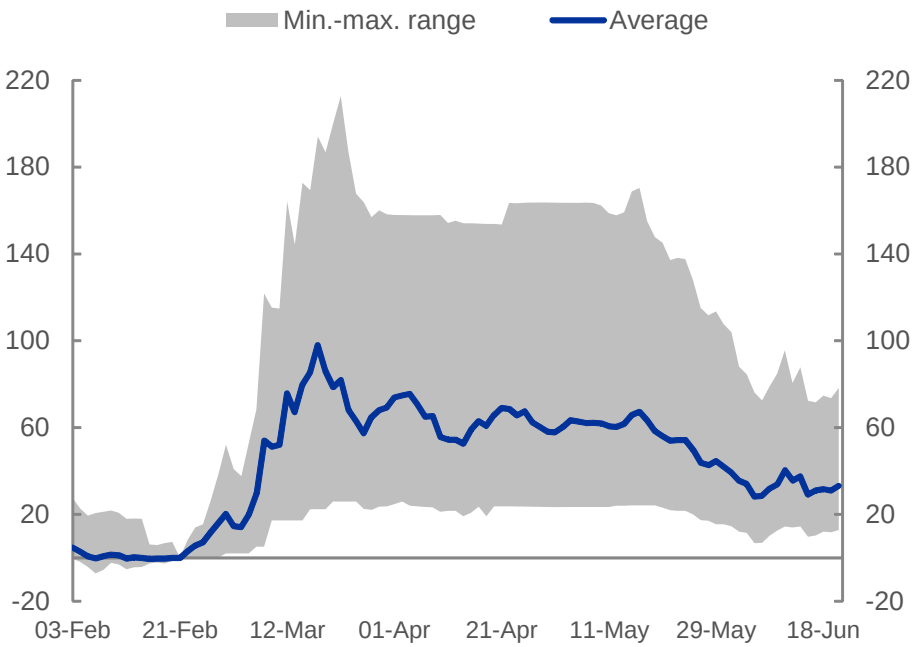
Notes: Latest observation: May 2020

Figure 2: Stock prices of selected banks (Index: 21-Feb-2020 = 100)



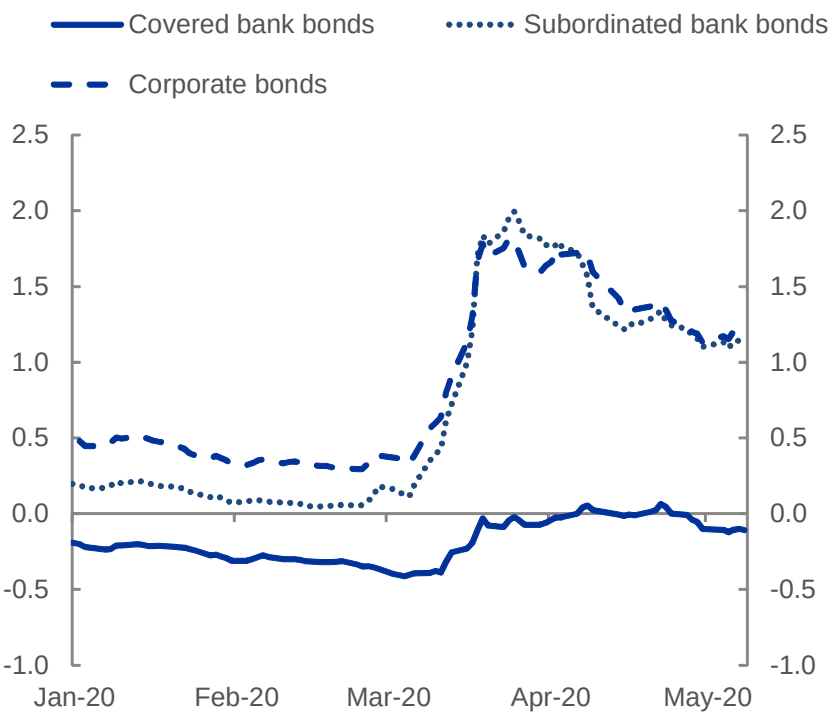
Notes: Latest observation: 22 June 2020.

Figure 3: Senior five-year CDS of selected banks (basis points: 21 February 2020 = 0)



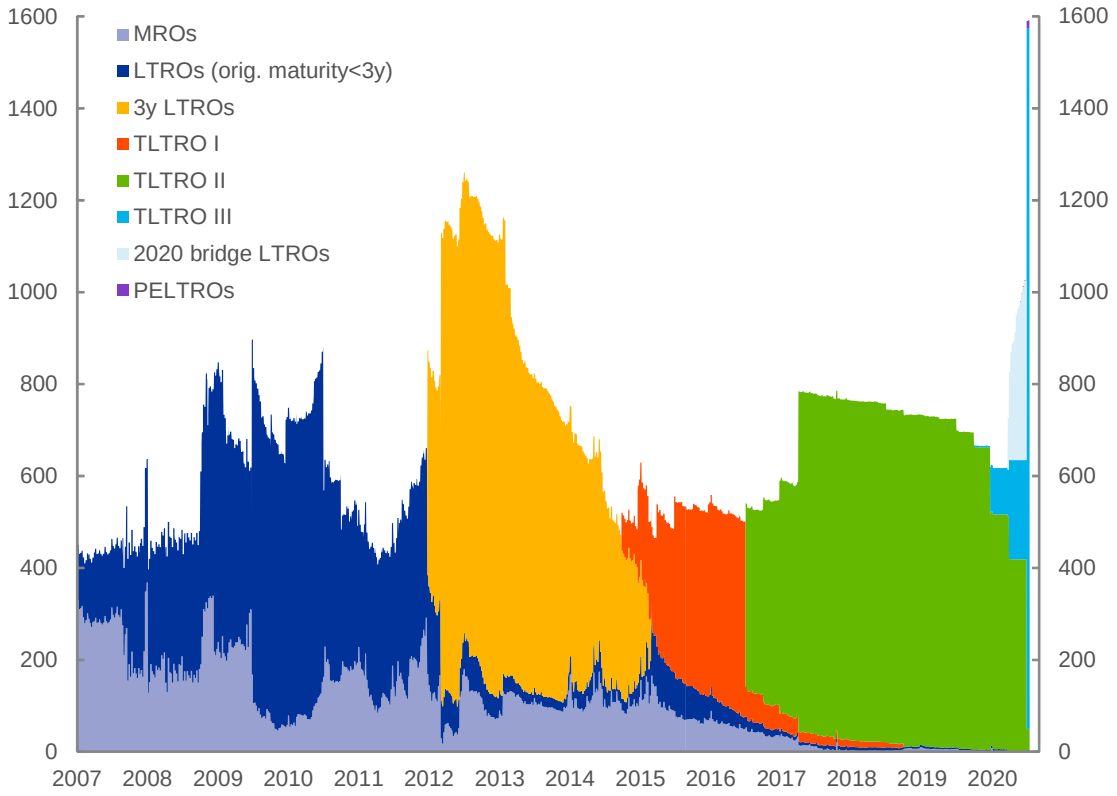
Notes: Latest observation: 22 June 2020.

Figure 4: Yields on euro area bank and corporate bonds (percentages per annum)



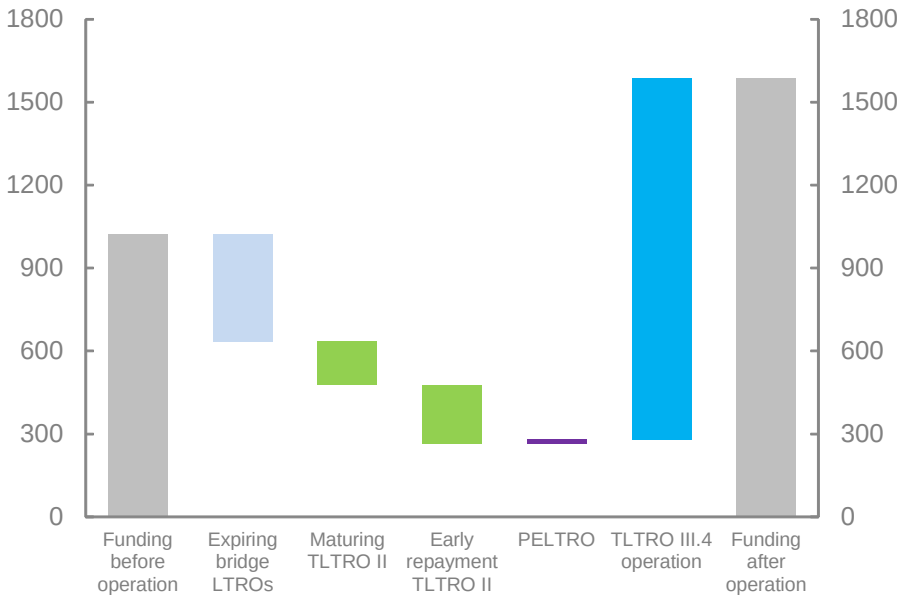
Notes: The bond yields are computed as the daily weighted average yields (by notional amount) for covered bonds and subordinated bonds with a residual maturity of between one and five years issued by banks in selected euro area countries. Latest observation: 8 May 2020.

Figure 5: Borrowing from the Eurosystem (in EUR billions)



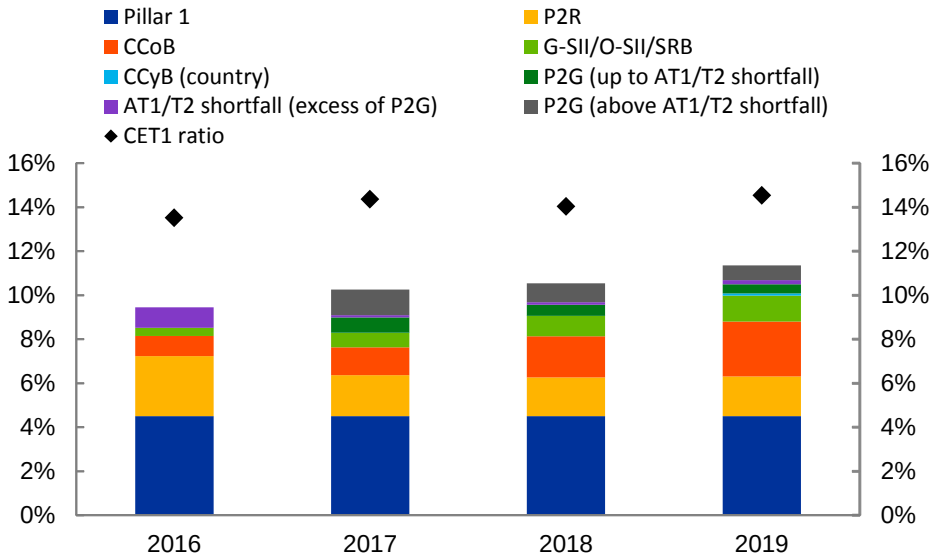
Notes: The chart shows the borrowing from the Eurosystem. Latest observation: June 2020.

Figure 6: TLTRO III borrowing (in EUR billions)



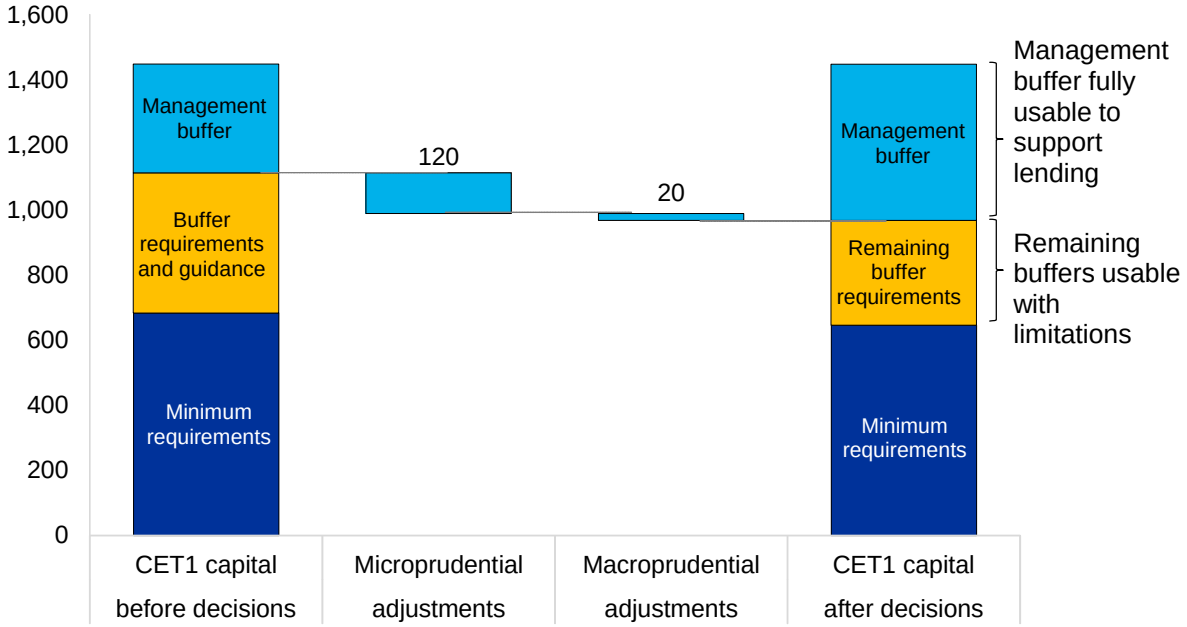
Notes: Latest observation: June 2020.

Figure 7: Capital requirements and CET1 ratios (percentages of risk-weighted assets)



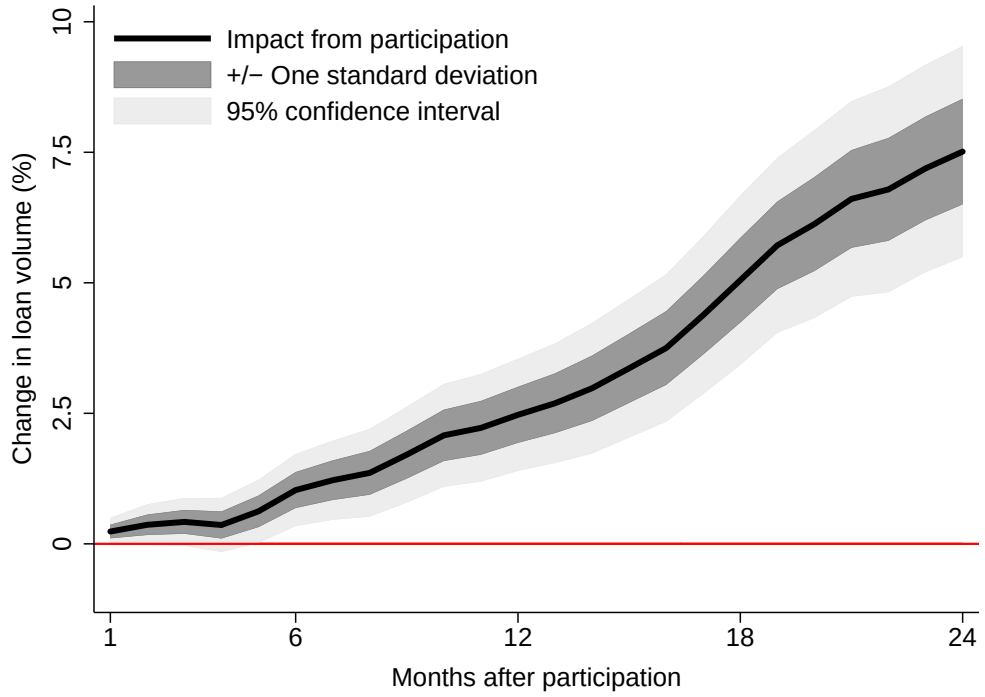
Notes: Based on a balanced sample of 90 significant institutions (SIs). AT1: additional Tier 1; CCoB: capital conservation buffer; CCyB: countercyclical capital buffer; CET1: Common Equity Tier 1; G-SII: global systemically important institution; O-SII: other systemically important institution; P2G: Pillar 2 guidance; P2R: Pillar 2 requirement; RWAs: risk-weighted assets; SyRB: systemic risk buffer; T2: Tier 2.

Figure 8: CET1 capital stack and remaining macroprudential capital buffers in the euro area (Q4 2019 - EUR billions)



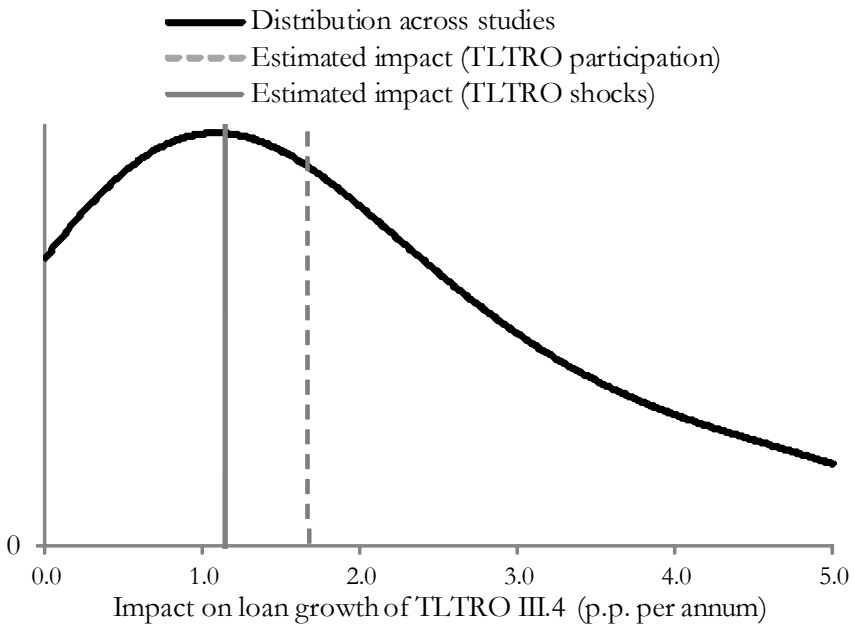
Notes: The sample covers significant and less significant institutions, consolidated at the euro area level. Microprudential adjustments include the decision on the regulatory adjustment of the P2R and making P2G temporarily usable (see press the release by European banking supervision dated 20 March 2020). Macroprudential adjustments include the releases of the CCyB, the SyRB and the other systemically O-SII buffer.

Figure 9: TLTRO participation and loan growth (percentage of ex ante volume)



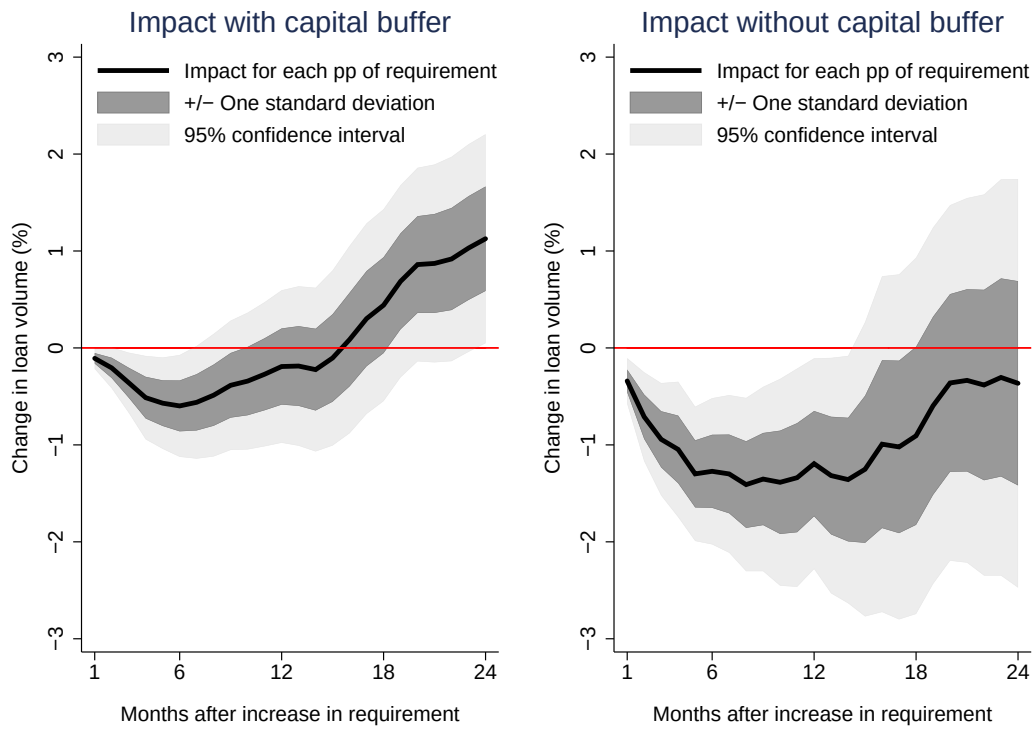
Notes: The figure reports the coefficients resulting from the regressions $\Delta L_{i,t+h} = \alpha_{c,t,h} + \beta_h TLTRO_{i,t}^{uptake} + \epsilon_{i,t+h}$, for $h = 1, \ldots, 24$. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs issued by bank i between t and $t+h$. The variable $TLTRO_{i,t}^{uptake}$ takes a value of 1 if bank i has participated in a TLTRO operation (TLTRO I, TLTRO II or TLTRO III) in the last three months and is 0 otherwise. Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h. The solid line reports the coefficients β_h while the grey area reports the 95% confidence intervals for each horizon h with standard errors clustered at the country-time level. The darker grey area highlights the coefficient plus/minus one standard deviation. The sample starts in September 2014.

Figure 10: Distribution of the impact on loan growth of TLTROs across studies



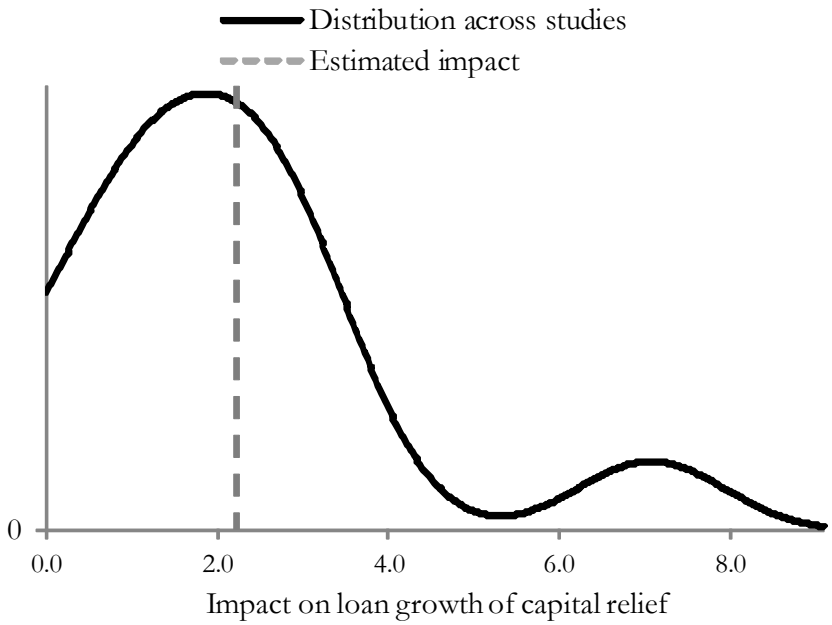
Notes: The grey dashed vertical line reports the estimate based on Figure 9 (1.7 percentage points, 24 months ahead). The grey solid vertical line reports the estimate based on Table 2, column 3 (1.1 percentage points, at the same horizon of 24 months ahead). The solid line shows the kernel density of the distribution of 17 estimates, truncated at the minimum and maximum estimate. The studies included in the meta-analysis are: Afonso, A. and Sousa-Leite, J. (2019; Albertazzi et al (2019); Altavilla et al. (2020b); Andreeva and García-Posada, M. (2019); Arce et al. (2017); Balfoussia and Gibson (2016); Bats and Hudepohl (2019); Benetton and Fantino (2018); Boeckx et al. (2020); Cravo Ferreira (2019); Esposito et al. (2020); Flanagan (2020); Gibson et al. (2020); Laine (2019); Offermans and Blaes (2019); Rostagno et al. (2019); van Dijk. and Dubovik (2018).

Figure 11: Capital requirements and loan growth by initial capital buffer (percentage of ex ante volume)



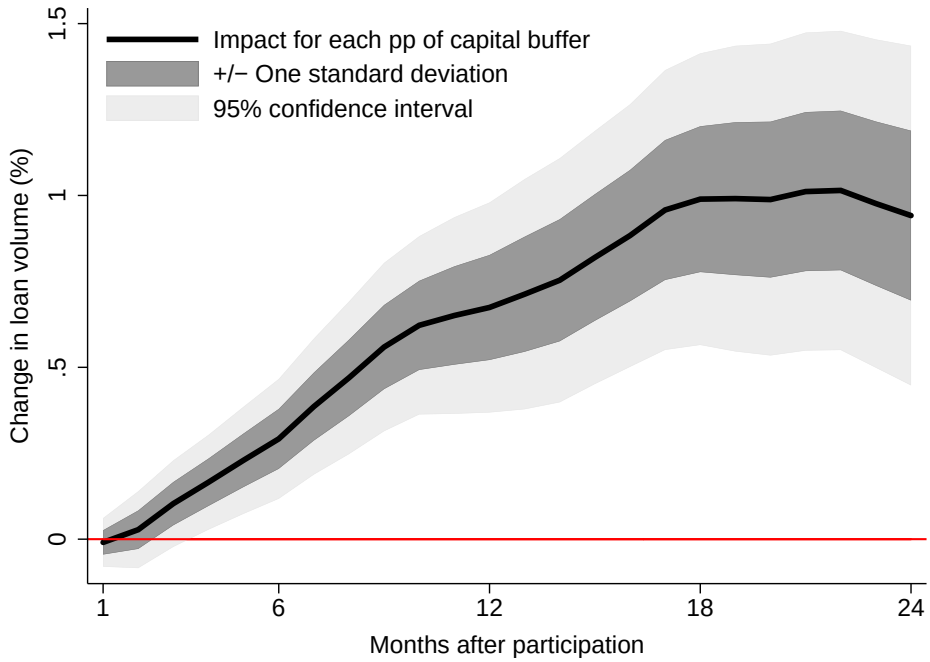
Note: The figure reports the coefficients δ_h and γ_h resulting from the regressions $\Delta L_{i,t+h} = \alpha_{c,t,h} + \delta_h Requirement^{shock}_{i,t} \times D_{i,t-1} + \gamma_h Requirement^{shock}_{i,t} \times (1 - D_{i,t-1}) + \epsilon_{i,t+h}$, for $h = 1, \ldots, 24$. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs issued by bank i between t and t+h, the variable $Requirement^{shock}_{i,t}$ is equal to the increase in capital requirements (in percentage points of RWA) that occurred for bank i at time t (one quarter before or after month t), and $D_{i,t-1}$ is equal to 1 if the difference (in percentage points of RWA) between the CET1 ratio and the capital requirement of bank i in month t-1 is strictly greater than 1. Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h. The solid line on the left-hand scale (right-hand scale) reports the coefficients δ_h (γ_h) while the grey area reports the 95% confidence intervals for each horizon h with standard errors clustered at the country-time level. The darker grey area highlights the coefficient plus/minus one standard deviation. The sample starts in September 2014.

Figure 12: Distribution of the impact on loan growth of the reduction in capital requirement



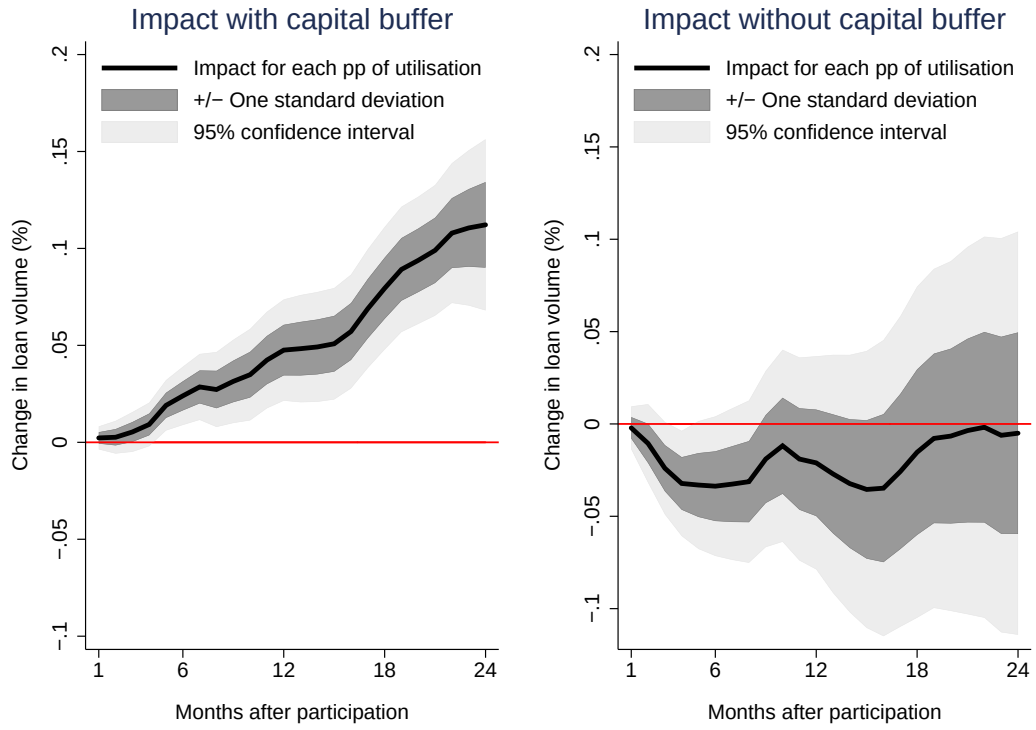
Notes: The dashed vertical line reports the estimated impact based on Figure 11 (2.2 percentage points for banks without a capital buffer, 12 months ahead). The solid line shows the kernel density of the distribution of 10 estimates, truncated at the minimum and maximum estimates. The studies included in the meta-analysis are: Aiyar et al. (2012); Berrospide et al. (2019); Bridges et al. (2014); Coenen et al. (2018); Darracq Pariès et al. (2011); Darracq Pariès et al. (2016); De Nicolò (2019); De Nicolò et al. (2014); Fraisse et al. (2020); and Mendicino et al. (2018).

Figure 13: TLTRO participation and ex ante capital buffer (percentage of ex ante volume)



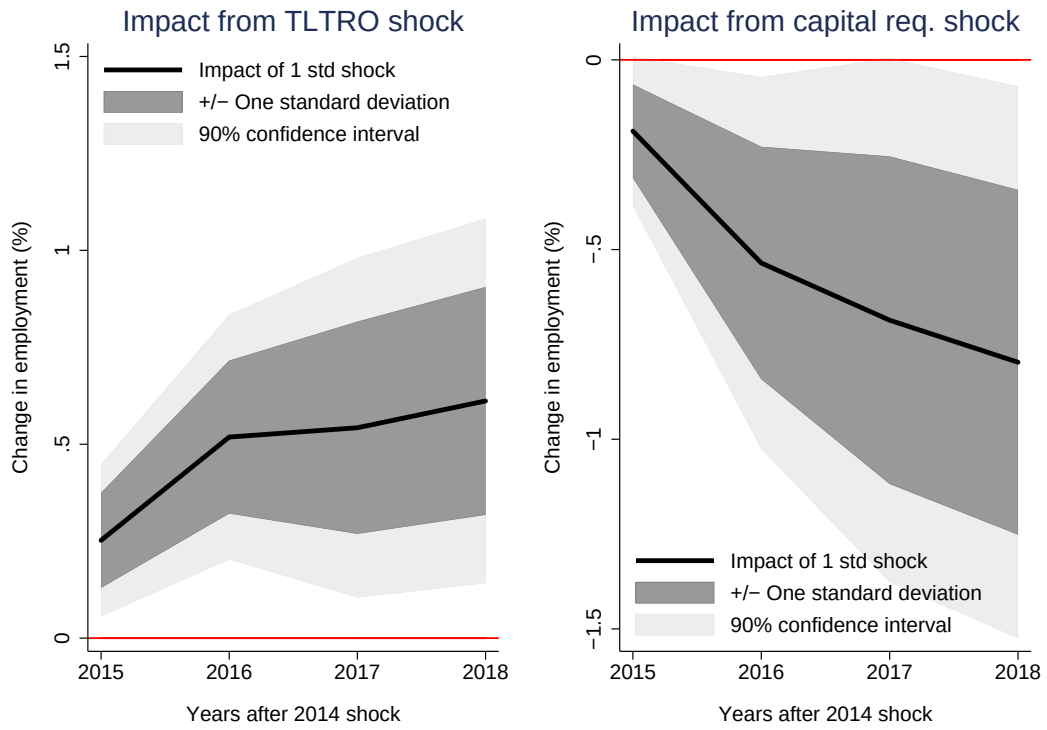
Notes: The figure reports the coefficients γ_h resulting from the regressions $\Delta L_{i,t+h} = \alpha_{c,t,h} + \beta_h TLTRO^{uptake}_{i,t} + \delta_h Buffer_{i,t-1} + \gamma_h TLTRO^{uptake}_{i,t} \times Buffer_{i,t-1} + \epsilon_{i,t+h}$, for h=1,...,24. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs issued by bank i between t and $t+h$, the variable $TLTRO^{uptake}_{i,t}$ takes value of 1 if bank i has participated in a TLTRO operation (TLTRO I, TLTRO II or TLTRO III) in the previous three months and is 0 otherwise, and $Buffer_{i,t-1}$ is the difference (in percentage points of RWA) between the CET1 ratio of bank i in month t-1 and its bank-specific capital requirement in month $t-1$ (when the bank-specific requirement is not available, the capital requirement is the average in country c). Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h. The black solid line reports the coefficients γ_h while the grey area reports the 95% confidence intervals for each horizon h with standard errors clustered at the country-time level. The darker grey area highlights the coefficient plus/minus one standard deviation. The sample starts in September 2014.

Figure 14: TLTRO uptake and loan growth for banks with and without capital buffers (percentage of ex ante volume)



Notes: The figure reports the coefficients δ_h and γ_h resulting from the regressions $\Delta L_{i,t+h} = \alpha_{c,t,h} + \delta_h TLTRO_{i,t}^{uptake} \times D_{i,t-1} + \gamma_h TLTRO_{i,t}^{uptake} \times (1 - D_{i,t-1}) + \epsilon_{i,t+h}$, for $h = 1, \ldots, 24$. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs issued by bank i between t and $t+h$, the variable $TLTRO_{i,t}^{uptake}$ is the change that occurred over the last three months in the ratio of uptake over borrowing allowance of bank i in period t in any of the TLTRO programmes (TLTRO I, TLTRO II or TLTRO III), and $D_{i,t-1}$ is equal to 1 if the difference (in percentage points of RWA) between the CET1 ratio and the capital requirement of bank i in month $t-1$ is strictly greater than 1. Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h. The solid line on the left-hand scale (right-hand scale) reports the coefficients δ_h (γ_h) while the grey area reports the 95% confidence intervals for each horizon h with standard errors clustered at the country-time level. The darker grey area highlights the coefficient plus/minus one standard deviation. The sample starts in September 2014.

Figure 15: TLTRO shocks, capital requirement shocks and firm employment (percentage of ex ante volume)



Notes: The figure reports the coefficients δ_H and γ_H resulting from the regressions $\Delta E_{f,h} = \alpha_{c,s,H} + \delta_H TLTRO_f^{shock} + \gamma_H Requirement_{i,t}^{shock} + \epsilon_{f,H}$, for $H = 2015, \ldots, 2018$. $\Delta E_{f,h}$ is the percentage change in firm f's employment occurred between 2014 and year H, with $H = 2015, \ldots, 2018$, $TLTRO_f^{shock}$ and $Requirement_{i,t}^{shock}$ are the average TLTRO shock and average capital requirement shock experienced by the same banks of firm f, respectively. Each regression includes country-sector $\alpha_{c,s,H}$ fixed effects and is specific to the horizon H. Solid lines report the coefficients δ_H and γ_H, while grey areas report 90% confidence intervals for each horizon H with standard errors clustered at the bank level. Darker grey areas highlight the coefficients plus/minus one standard deviation.

APPENDIX A: TLTRO participation, robustness and transmission

Table A.1 offers a series of robustness checks. First, in columns 1 and 5 we report the estimates reported in Figure 9 for the horizon of 24 months ahead for the two alternative measures of participation. The sample for these regressions starts in September 2014, that is, with the first TLTRO, so as to compare the lending patterns of the two types of banks over the relevant period. Columns 2 and 6 expand the sample to the earliest data point, that is, August 2007. This allows the inclusion of bank fixed effects, which isolate the component of lending not related to either unobserved bank heterogeneity or aggregate loan developments as captured by the country-time fixed effects. The correlation between participation in TLTROs and higher loan growth remains strong, despite the increase in the saturation of the model. The explained variance of loan developments passes from below 8% to above 40%, despite the sample size almost tripling.

Table A.1: Robustness on TLTRO participation and loan growth

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Loan growth	24 months ahead	24 months ahead	24 months back	24 months ahead	24 months ahead	24 months ahead	24 months back	24 months ahead
Change in TLTRO participation	7.513**	5.920**	-0.991	5.446**				
	(3.092)	(2.627)	(2.729)	(2.485)				
Change in utilisation ratio					0.073*	0.054*	0.027	0.069**
					(0.040)	(0.032)	(0.028)	(0.035)
Assets				-21.575***				-25.217***
				(7.904)				(8.222)
ROA				1.351				1.187
				(0.943)				(0.943)
Capitalisation				0.244				-0.078
				(0.524)				(0.493)
Deposit ratio				0.218				0.218
				(0.173)				(0.179)
Excess liquidity				0.189				0.270
				(0.268)				(0.300)
Government bond holdings				0.138				0.343
				(0.421)				(0.401)
Country-time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	-	Yes	Yes	Yes	-	Yes	Yes	Yes
Observations	11,304	33,335	25,851	24,250	11,201	32,549	25,684	23,711
R-squared	0.078	0.410	0.442	0.474	0.078	0.391	0.436	0.473

Notes: Standard errors are double-clustered at the bank and country-time level, and reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Columns 3 and 7 of Table A.1 explore whether the higher lending associated with TLTROs is the result of spurious correlation due to pre-existing trends between participant and non-participant banks. In order to shed light on this, we run the same regressions

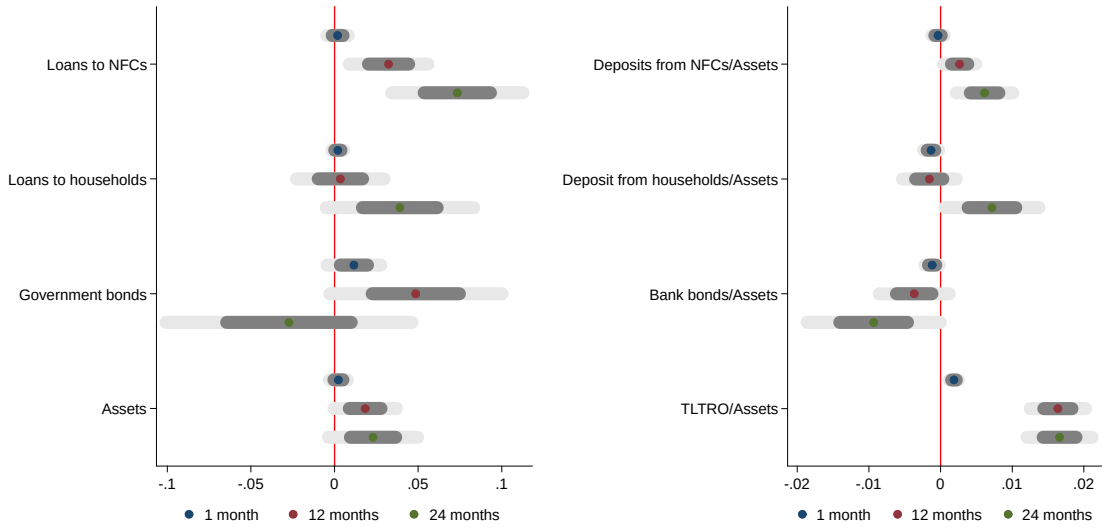
as in columns 2 and 6 but substituting the dependent variable with the difference in loan volumes 24 months before the month in which participation in TLTROs occurs. The exercise reveals that there is no evidence of pre-existing trends, thus providing support for the interpretation of the coefficient as an actual impact of participation on lending.

Lastly, columns 4 and 8 of Table A.1 control for a wide range of additional observable bank characteristics, without any sizeable impact on the estimated coefficient. The relation between lending and participation in TLTROs is not affected by the size of the bank in terms of assets, nor by its profitability, level of capitalisation, funding structure, level of excess liquidity or its holdings of government securities at the time of participation.

While TLTRO participation has an impact on lending, it also affects the overall asset and liability management of banks. The impact on lending to NFCs is not accompanied by a parallel significant expansion in lending to untargeted sectors like households, for funding house purchases, or to governments in the form of higher holdings of public sector securities (see Figure A.1). In fact, as the horizon necessary for loan origination approaches, banks that participate in TLTROs rebalance away from government securities that they may have initially accumulated as a temporary and liquid way to store the additional funds. This accounts for a positive yet not statistically significant expansion of the overall balance sheet of banks once we control for the country-wide developments captured by country fixed effects. Loans to households increase at longer horizons, although not significantly, possibly on account of the positive effects that participation has on net interest income early on. This in turn naturally increases the general intermediation capacity of banks in the longer run.

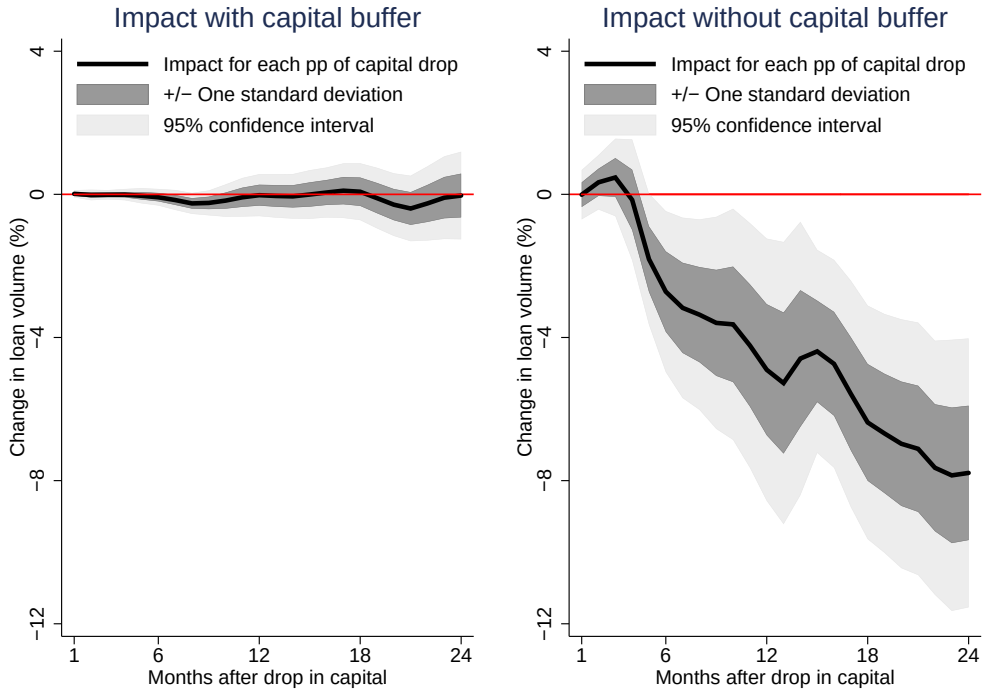
The liabilities of banks are also affected by TLTRO participation, as banks that start relying on this form of funding accumulate funds up to a constant level of TLTRO reliance, reached after one year from participation. At the same time, banks substitute away from bank bonds. The latter are the marginal form of term funding and tend to be the most expensive when unsecured, and thus the most likely to be replaced by TLTROs. Deposits instead follow developments on the asset side, with reliance on deposits from NFCs increasing symmetrically to higher loan volumes to NFCs, and reliance on deposits from households increasing only over longer horizons.

Figure A1: TLTRO participation and banks' assets and liabilities



Notes: The figure reports the coefficients resulting from the regressions $\Delta X_{i,t+h} = \alpha_{c,t,h} + \beta_h TLTRO_{i,t}^{uptake} + \epsilon_{i,t+h}$, for $h = 1, \ldots, 24$. $\Delta X_{i,t+h}$ is the percentage change in volume of, respectively, loans to NFCs, loans to households, holdings of government securities, or main assets of bank i between t and $t + h$. For the rest of the variables, it is the change in percentage points of the ratio to main assets of, respectively, deposits from NFCs, deposits from households, bank securities issued, as well as of the volume of TLTRO funding. The specifications are defined as in Figure 9. The dots report the coefficients β_h, the darker areas the coefficients plus-minus one standard deviation and the lighter areas the 95% confidence intervals, for each horizon h with standard errors clustered at the country-time level. The results one month ahead are shown in blue, 12 months ahead in red, and 24 months ahead in green.

Figure A2: Impact on loan volume of capital decreases by capital buffers (percentage of ex ante volume)



Note: The figure reports the coefficients resulting from the regressions $\Delta L_{i,t+h} = \alpha_{c,t,h} + \delta_h Capital\ decrease_{i,t} \times D_{i,t-1} + \gamma_h Capital\ decrease_{i,t} \times (1 - D_{i,t-1}) + \epsilon_{i,t+h}$, for $h = 1, \ldots, 24$. $\Delta L_{i,t+h}$ is the percentage change in volume of loans to NFCs issued by bank i between t and $t + h$, the variable $Capital\ decrease_{i,t}$ is equal to a decrease in capital buffer (in percentage points of RWA) that occurred for bank i at time t, and $D_{i,t-1}$is equal to 1 if the difference (in percentage points of RWA) between the CET1 ratio and the capital requirement of bank i in month t is strictly greater than 1. Each regression includes country-time $\alpha_{c,t,h}$ fixed effects and is specific to the horizon h. The solid line on the left-hand scale (right-hand scale) reports the coefficients δ_h (γ_h) while the grey area reports the 95% confidence intervals for each horizon h with standard errors clustered at the country-time level. The darker grey area highlights the coefficient plus/minus one standard deviation. The sample starts in September 2014.

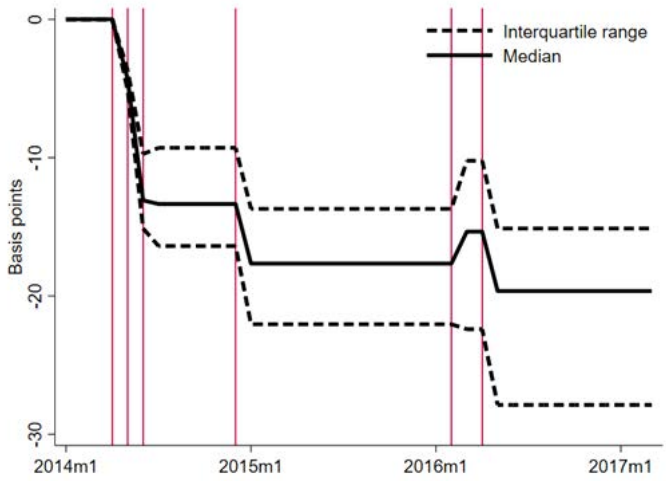
APPENDIX B: Additional tables and figures

Table A.2: TLTRO-related events

Date	Event type	Event
08-May-14	Governing Coucil meeting	Draghi ready to act at next meeting
05-Jun-14	Governing Coucil meeting	TLTRO-I announcement
03-Jul-14	Governing Coucil meeting	TLTRO-I technical details
29-Jul-14	Press Release	TLTRO-I legal acts publication
22-Jan-15	Governing Coucil meeting	TLTRO-I modified interest rate
10-Mar-16	Governing Coucil meeting	TLTRO-II announcement
03-May-16	Press Release	TLTRO-II legal acts publication

Notes: The table reports the TLTRO events.

Figure A3: Changes in bank bond yields around TLTRO-related events



Notes: The figure displays the cumulated shocks given by the two-day changes in individual banks' bond yields around TLTRO-related events.

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