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Targeted monetary policy, dual rates and bank risk taking

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Abstract

We assess whether central bank credit operations influence the size and composition of bank credit in a negative interest rate environment. We exploit confidential information from the newly established European credit registry to capture bank lending conditions and bank risk-taking. For identification, we use high-frequency reactions of bank bonds around the announcement of the April 2020 recalibration of the ECB's Targeted Longer-Term Refinancing Operations (TLTROs). We find that the credit easing measures had a strong positive effect on bank credit, even when controlling for possible confounding factors. The increase in lending was not accompanied by excessive risk-taking, especially for banks with low intermediation margin, that is, those that were poised to benefit the most from TLTROs' borrowing rates below the interest rates on central bank reserves.

Keywords: unconventional monetary policy, bank lending, risk-taking, dual rates.
JEL Classification Codes: E51, E52, G01, G21.

Non-technical summary

Targeted longer-term refinancing operations (TLTROs) help to preserve favourable bank financing conditions for households and firms. At the height of the COVID-19 pandemic, this policy tool was recalibrated to enhance its accommodative potential. The new design led to the largest liquidity injection in the history of the European Central Bank and provided a large reduction in the funding cost of euro area banks, as the interest rate charged on borrowed funds could reach a minimum of 50 basis points below the deposit facility rate (DFR) - well below any alternative funding source in that period.

In this paper, we address two questions. First, we ask whether the recalibration of TLTROs on 30 April 2020 generated an increase in loan origination. Second, we investigate whether the policy affected the qualitative composition of credit. To the best of our knowledge, this is the first paper that illustrates empirically the potential of a new form of monetary accommodation, that is, central bank funding at rates below the level at which reserves are remunerated (so-called 'dual rates').

Central to our analysis is transaction-level information from the euro area credit register, which allows to not only disentangle credit supply and demand, but also to control for the riskiness underlying each credit contract.

We find that the funding cost relief brought forth by the recalibration of TLTROs had a strong positive effect on bank credit provision during the COVID-19 crisis, helping to sustain economic activity. This holds also after controlling for the extraordinary surge in loan demand, as well as for the simultaneous support from fiscal (via public sector guarantees) and prudential (via capital relief measures) policies. Moreover, we show that increased lending was not accompanied by excessive risk-taking. Banks with lower intermediation margins could extend more credit as a result of TLTROs and did not need to scale up the risk profile of their loan portfolio. This illustrates how TLTROs with dual rates enable an easing of credit conditions without the increased risk appetite that a standard rate cut might spur under the same circumstances, especially if considered after a prolonged period of low interest rates.

1 Introduction

Targeted longer-term refinancing operations (TLTROs) are designed to support the bank-based transmission mechanism of monetary policy in the euro area. At the height of the COVID-19 pandemic, this policy tool was recalibrated to enhance its accommodative potential and to preserve favourable bank financing conditions for households and firms. The announcement of 30 April 2020 was followed by the largest liquidity injection in the history of the ECB in June 2020, totalling over EUR 1.5 trillion. TLTROs provided banks with a large funding cost relief, as the interest rate charged on borrowed funds could reach a minimum of -1%, well below any alternative funding source in that period.

In this paper, we address two questions. First, we ask whether the recalibration of TLTROs on 30 April 2020 generated an increase in loan origination. Second, we investigate whether this policy affected the qualitative composition of credit.

The first question relates to the effectiveness of longer-term refinancing operations. In particular, our focus is on targeted facilities designed to support bank lending conditions. In contrast with non-targeted longer-term refinancing operations (so-called VLTROs), the TLTROs provide banks with strong incentives to use the liquidity received from the central bank for lending purposes and discourage the potential diversion of funds that could materialise in the absence of an explicit and measurable target. A large number of earlier works which pre-date the introduction of TLTROs analysed the impact of VLTROs and found that, while these operations have worked via the bank lending channel (e.g. Andrade et al. 2018, Darracq-Paries and De Santis 2015), they also increased investment into sovereign bonds (Acharya and Steffen 2015; Crosignani et al. 2020; Carpinelli and Crosignani 2021; Jasova et al. 2021). Recent work focusing on the effectiveness of TLTROs has highlighted the importance of these measures and the relevance of the targeting feature for sustaining the flow of credit to households and firms and for reducing fragmentation (e.g. Esposito et al. 2020; Boeckx et al. 2020; Altavilla et al. 2020a; Benetton and Fantino 2021; Rostagno et al. 2021). We contribute to this literature by stressing the importance of the bank funding cost relief

conveyed by these measures for bank intermediation, especially in a context of prolonged low interest rates. To illustrate this channel, we exploit the unexpected recalibration of the programme announced on 30 April 2020, which reduced the interest rate charged on borrowed funds to a minimum of 50 basis points below the deposit facility rate (DFR).[1] We measure exposure to the policy using high-frequency bank bond yield reactions. We find that the recalibration of TLTROs had a positive and strongly significant impact on loan provision in the months following the announcement, both in the intensive and in the extensive margin. Our baseline model shows that a standard deviation in the exposure to the funding cost relief coming from TLTROs translated into an impact on loan growth of around half of the actual lending registered over the six months after the announcement of the policy measure. Moreover, while previous studies either lack the data granularity to fully control for loan demand or employ credit registries from single countries, we make use of a pan-European credit registry of bank-firm matched data (henceforth, AnaCredit) that allows us to assess the effectiveness of the measure across all euro area countries; while being able to fully control for confounding factors.

The second question relates to whether the TLTRO policy affected the qualitative composition of credit in the aftermath of the pandemic. In particular, we look at the riskiness of lending by banks more exposed to TLTROs and at the effect of the policy on the interest rates charged on corporate loans depending on their underlying risk. In this sense, our paper contributes to the literature on the risk-taking channel of monetary policy (e.g. Jiménez et al. 2014) that emerged after the financial crisis and flourished during the period of low policy interest rates. More recently, this literature has also covered the effect of targeted central bank liquidity operations on banks' risk-taking behaviour and found that these measures did not lead to excessive risk-taking (Andreeva and García-Posada 2021; Esposito et al. 2020). These papers focus on past generations of the TLTRO series, which were conducted in a period that was not yet characterised by a prolonged low interest rate environment. At the inception of TLTRO III (the third series of TLTROs) in September 2019, the policy rate had already been in

[1] See the ECB press release on 30 April 2020.

negative territory for more than five years. Moreover, the unprecedented surge in loan demand at the onset of the pandemic, coupled with the large economic uncertainty and the sharp deterioration in borrower creditworthiness, bore the potential to generate a marked increase in the riskiness of banks' loan portfolios. The ample degree of accommodation may have induced a mispricing of the underlying risk by banks as they scrambled to accommodate loan demand, coming either from borrowers that were riskier to begin with or that turned out to be riskier ex-post, because of their intrinsic characteristics and because they were more exposed to the pandemic shock. We find instead that banks exposed to TLTROs did not increase their supply of credit disproportionately more to ex-ante or ex-post riskier borrowers, and we also do not find evidence of an increased mispricing of riskier loans. Finally, we show that these results are particularly pronounced for banks with low intermediation margins to begin with. We interpret this evidence through the lens of the funding cost relief that TLTROs provide to banks in a low interest rate environment, allowing them to expand credit supply without necessarily having to scale up the risk profile of their loan portfolios to recoup intermediation margins.

To the best of our knowledge, this is the first paper that illustrates empirically the potential of a new form of monetary accommodation, that is, central bank funding at rates below the level at which reserves are remunerated (sometimes referred to as 'dual rates'). Contrary to a standard rate cut in negative territory, TLTRO rates below the deposit facility rate (DFR) imply that intermediation margins are not compressed despite the consequent decrease in lending rates, affording a continued transmission of monetary policy even in presence of an effective lower bound on deposit rates.[2] This partially shields the banking system from some of the potential side effects of monetary policy accommodation highlighted in the literature,[3] with resulting increases in lending volumes not being accompanied by heightened risk-taking or changes in the pricing of underlying risks.

Our paper also contributes to a growing literature on unconventional monetary

[2]See e.g. Lane (2020) and Schnabel (2021).
[3]See e.g. Jiménez et al. (2014), Acharya et al. (2019) and Acharya et al. (2021).

policies introduced throughout the major economies to support economic activity in response to the COVID-19 crisis (Altavilla et al. 2020a, Bordo and Duca 2020, Rebucci et al. 2020). We are also among the first to use loan-level data from multiple countries in a single framework.[4] The pan-European coverage of AnaCredit allows observing the workings of the policy intervention across very disparate segments of the euro area banking system, mitigating the concern that our conclusions may be due to the specific circumstances of a single jurisdiction.

The paper is organized as follows. Section 2 describes the relevant institutional features of TLTROs and the data employed for the analysis. Section 3 details the identification strategy and how we address its potential pitfalls. Section 4 provides empirical evidence on the impact of TLTROs on credit origination as well as on the qualitative composition of credit. Section 5 concludes.

2 Institutional setting and data

2.1 Institutional setting

TLTROs were first introduced in June 2014 (TLTRO I), with a second (TLTRO II) and a third series (TLTRO III) launched in March 2016 and March 2019 respectively. They aim at stimulating the provision of credit to the economy, by providing banks with longer-term financing at attractive rates. The latest incarnation of TLTRO III consisted of a series of quarterly operations running from September 2019 to December 2021. Each operation had a maturity of three years, with the possibility to repay early after one year since the settlement of each operation.[5]

Multiple TLTRO III parameters were significantly changed against the backdrop of the outbreak of the COVID-19 pandemic in March 2020 and the sharp deterioration in bank funding conditions and the economic outlook that followed. The first recalibration took place on 12 March 2020, and brought about larger borrowing allowances and a more favourable pricing scheme, among other things. Banks could borrow up to 50%

[4] See e.g. Altavilla et al. 2020b and Da Silva et al. 2021 for other examples.

[5] The full design of the operations became increasingly complex as the programme was progressively tailored to the evolving circumstances. For technical details, see the ECB dedicated explainer.

of their loan book to the eligible sectors (non-financial corporations and households with the exclusion of mortgages) and could access the central bank funds at an interest rate as low as -0.75% (down 25 bps, from -0.5%), subject to a non-negative lending performance between 1 April 2020 and 31 March 2021. The interest was computed as a negative wedge of 25 basis points from the rate at which central bank reserves are remunerated (the deposit facility rate, DFR), which was -0.5%. The wedge was actually temporary and meant to last only between June 2020 and June 2021, which implied that operations repaid after that date would be charged with an interest rate that was a weighted average of the resulting rates throughout the life of the operation. The result was a strong incentive to front-load participation into the earliest available operations.

The intensification of the pandemic and the increasing financing needs of households and firms spurred a further recalibration on 30 April 2020, which lowered the wedge from the DFR by another 25 basis points, making it possible to borrow funds from the central bank at a minimum achievable rate of -1%. The recalibration also enabled the inclusion of the unprecedented lending flows recorded since 1 March 2020 in the assessment of a bank's lending performance necessary to attain the lowest possible rate. Concomitantly with the decision to lower the rates, the ECB also published the last legal acts of the new design of TLTROs on the same day, finally providing the public with a full understanding of the new framework. As a result of the 30 April 2020 recalibration and the resulting attractive conditions, the subsequent TLTRO III operation in June 2020 saw the largest injection of liquidity in the history of the Eurosystem, reaching well above €1.5 trillion, or 5% of total bank assets at the time.[6]

There was an additional recalibration of the programme in December 2020, with an extension of the period of application of the wedge from June 2021 to June 2022 subject to additional lending performance requirements, together with three additional quarterly operations (until December 2021 instead of the original last operation in March 2021) and an increased borrowing allowance (to 55% of the stock of eligible loans).

[6]Technically, the net liquidity injection per se was smaller, discounting the rollover of remaining TLTRO II funds that were expiring and of so-called bridge LTROs. The latter were temporary weekly operations introduced along with the 12 March 2020 recalibration and designed to expire exactly at the inception of the TLTRO III June 2020 operation, so as to effectively 'bridge' the immediate liquidity needs of prospective participants, while in waiting for the key TLTRO III appointment.

Since our sample ends in October 2020, we do not consider this recalibration in our analysis.[7]

2.2 Data sources and descriptive evidence

Our analysis combines several data sources. Central to the study of the effects of the TLTRO recalibration on bank credit provision is transaction-level data from AnaCredit - a novel, unique credit registry maintained by the European System of Central Banks, covering close to the universe of corporate loans in the euro area. AnaCredit collects harmonized data on individual loans from all Member States, whereby banks are required to report information on loans to firms for exposures above €25,000. Information is available at a monthly frequency.

AnaCredit includes a rich set of information on loan-specific characteristics. For each loan, we observe the outstanding nominal amount, the applied interest rate, the probability of default of the borrower and the amount in arrears, among others. The data also includes a wide set of borrower attributes such as firm age, size and sector of economic activity, allowing us to saturate our models with a battery of firm-level controls. Thanks to the granularity of this information, we are able to disentangle credit supply and demand, and to control for the risk-profile of borrowers.

We merge AnaCredit to bank balance sheet data from iBSI (individual Balance Sheet Items statistics), a proprietary database maintained at the ECB, and we further augment our database with data sourced from bank financial statements, as maintained by Bureau van Dijk's Orbis Bank Focus. This allows us to observe heterogeneity across banks in terms of asset and liability composition, as well as capital adequacy, profitability and asset quality. Importantly, we are able to derive our measure of 'TLTRO shock' by further augmenting our database with daily bank bond yields series from IHS Markit iBoxx.

Our final sample consists of 98 banks resident in 13 countries[8] and extending credit

[7]For a fully fledged analysis of the impact of TLTRO III on bank lending conditions, money market rates, its impact on reserves, and its interaction with other policy measures, see Barbiero et al. 2021.

[8]These countries include Austria, Belgium, Cyprus, Germany, Spain, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Slovakia.

to 1,872,685 euro area firms in a total of 2,466,921 bank-firm relationships as of April 2020. Firms are distributed across 19 countries, 89 2-digit NACE industries and 1,058 NUTS 3 locations. Our analysis covers the period between January 2020 and October 2020. Table 1 shows summary statistics on the variables used in the empirical analysis.

Insert Table 1.

3 Empirical strategy

3.1 Isolating the impact of TLTROs on credit growth

Loan growth developments since the outbreak of the pandemic have been characterised by a large expansion of lending to firms, concentrated especially among banks that eventually have participated in TLTROs (Figure 1). Bidders and non-bidders in the TLTRO III series did not experience different lending dynamics before the introduction of TLTRO III or even at the inception of the pandemic.

Insert Figure 1.

Yet, casting a causal link between exposure to TLTROs and the reaction of lending volumes requires identifying the dominant transmission channel of the policy and to disentangle it from all the confounding factors that might have emerged in the extraordinary context of the pandemic. With this in mind, our identification strategy relies on a standard set-up exploiting the unexpected recalibration of the programme announced on 30 April 2020 and the rich set of controls that are made possible by the granularity and availability of data at the bank-firm level. This allows us to address key challenges to identification such as reverse causality, common determinants, selection into treatment and omitted variables.

TLTROs provide direct and indirect funding cost relief to euro area banks. TLTROs compress all the funding cost components of banks' intermediation wedge by offering long-term borrowing from the central bank at attractive rates, which can be used to re-

place more expensive sources of funding. The resulting funding cost relief has a direct and an indirect component. For participating banks, the direct relief stems from the direct substitution of more expensive funds and is a function of each bank's take-up in the operations. For banks not participating in the programme, the relief is indirect and originates from a positive externality: since banks participating in TLTROs are likely to cancel or postpone their bond issuance, the resulting "bond scarcity" generates a reduction in the external funding cost even for those banks that do not directly borrow under the operations. This twofold funding cost relief activates the bank lending channel and leads to higher credit volumes.

In order for this indirect channel to be sizable, participation to TLTROs must be widespread and deep enough to actually affect the overall funding structure of the euro area banking system. Previous experiences with TLTRO I and TLTRO II never reached the penetration in bank balance sheets that was achieved with TLTRO III after the pandemic recalibrations. Participation in previous programmes was concentrated among banks resident in certain jurisdictions, where the offered pricing of borrowed funds was attractive enough compared to alternative sources of funding. The pricing of TLTRO III operations, starting from the June 2020 one, reached rates as low as -1%, lying 50 basis points below the short-term rates hovering around the deposit facility rate. The recalibration prompted unprecedented participation in the programme across the whole euro area, exerting a widespread downward pressure on bank funding costs. Expectations of future TLTRO participation jumped up after the announcement on 30 April 2020, finding substantiation in the June 2020 operation, which saw the largest injection of central bank liquidity in the history of the euro area. Figure 2 shows that a large share of banks which eventually participated in the June 2020 operation were still undecided in the ECB Bank Lending Survey (BLS) rounds immediately preceding the easing of the terms of the programme in April 2020.

Insert Figure 2.

Isolating the contribution of TLTROs to the improvement of banks' funding condi-

tions is challenging. The decision to participate in the programme is endogenous, as for instance it is more likely for banks with higher funding costs. Moreover, the presence of the aforementioned bond scarcity channel, whereby bond yields are likely to decrease as TLTROs become a relevant component of banks' balance sheets, swamps cross-sectional differences as measured by participation alone. Thus, we use as a treatment variable the unexpected daily change in funding costs associated with the announcement of the recalibration of the programme on 30 April 2020. We measure this change by exploiting high-frequency data on bond yields traded around the announcement date. The daily change in these bank bond yields around the announcement is less likely to reflect the fundamental shocks that determined the constellation of prices prevailing during the pandemic, and thus less prone to be endogenous to participation.[9] The correlation between the reaction of bond yields and other pre-existing bank characteristics is also weak, which indicates that the drivers of such a reaction are mostly forward-looking and relating to the exposure to the benefits of the TLTRO design that resulted from the recalibration. Table 2 shows how bank characteristics are homogeneous across the banks with high and low bond yield reactions, which means that the reaction of bond yields at announcement is arguably an adequate treatment variable to identify the impact on lending volumes of the exposure to TLTROs. The significant difference across exposure groups in the lending performance between March and April 2020 is consistent with the reaction of bond yields being related to the design of TLTROs. In end-April 2020, the lending performance in the first two months of the evaluation period (March and April 2020) was the parameter determining the eligibility of banks for the rates below the DFR most likely to be known by market participants.

Insert Table 2.

TLTROs were recalibrated in April 2020 to support the bank-based transmission

[9]To further rule out potentially confounding factors, one could also look at the intradaily changes during the announcement. The market for bank bonds is not liquid enough to get a meaningful number of reactions during the press conference of the ECB when the announcement took place. Yet, we can look at the reaction of bank stock prices, which are indeed liquid enough. Figure A1 in the appendix shows that the return on bank stocks between the 15-min windows before (14:15-14:30) and after (15:30-15:45) the press conference is positive and correlates well with the reduction in bond yields registered over the course of the day.

mechanism of monetary policy in response to the COVID-19 crisis, providing cheap term funding with an interest rate that depends on a bank's future lending performance. The policy decision that led to the redesign of TLTROs was taken against the backdrop of the potential credit crunch that could have followed the financial strains brought about by the pandemic. In order to control for changes in loan demand, when evaluating the reaction of lending volumes to exposure to the policy, we make use of the information available at the bank-firm level from AnaCredit. In particular, we saturate the model with a collection of fixed effects that span the main dimensions of demand components, that is firm sectoral specialisation, geographical location, and size (so-called industry-location-size (henceforth ILS) fixed effects, see Degryse et al. 2019). We consider 2-digit NACE industries, NUTS 3 geocodes and deciles of firms' total exposures in April 2020. This provides 207,173 industry-location-size clusters. The granularity of these clusters is crucial to capture demand and isolate the reaction of credit supply. Moreover, we provide a specification with firm fixed effects, thus relying on the sub-sample of multiple-lender borrowers as in Khwaja and Mian (2008) to control for firm-specific unobservable heterogeneity in loan demand, and rely on variation stemming from exposure to TLTRO at the bank level within each firm to achieve identification.[10]

Since we want to look at the reaction of lending to the announcement in April 2020, we focus on changes in loan volume after the announcement. Our model is then as follows:

$$\text{Loan growth}_{b,f} = \alpha_{i,l,s} + \beta \text{TLTRO shock}_b + X_b + X_f + \epsilon_{b,f}, \tag{1}$$

where $\text{Loan growth}_{b,f}$ is the percentage change of loan volume between bank b and firm f in the months after April 2020, TLTRO shock_b is our treatment variable, X_b are bank characteristics and X_f are firm characteristics, and $\alpha_{i,l,s}$ are the ILS fixed effects, which in some specifications we substitute with a firm fixed effect α_f. Since our treatment is at the bank level, we control for the spurious correlation in errors introduced in this way by clustering standard errors at the bank level. As a benchmark, we look at changes in the six months following April 2020, that is, until October 2020. This allows

[10] See also Amiti and Weinstein 2018 and Jiménez et al. 2014.

us to analyse credit dynamics in the months before the outbreak of the second wave of the pandemic and the corresponding policy response.

3.2 Addressing identification challenges

Our empirical strategy addresses several challenges related to possible confounding factors. We can group these factors into four main categories. First, there are additional transmission mechanisms of TLTROs at play. Second, TLTROs took place in parallel with other policy initiatives adopted in the wake of the pandemic crisis. Third, banks may have changed their risk attitudes because of the pandemic. Fourth, the event chosen to study the effect of TLTROs with dual rates was not unique.

Our set of controls and fixed effects in Section 4 absorb alternative transmission mechanisms of TLTROs, and the diff-in-diff set-up washes out the extent to which these mechanisms operate only in the aggregate. In addition to granting a funding cost relief, TLTROs are different from standard non-targeted operations in that they require the achievement of lending targets by participants. The higher propensity to lend for participants increases competitive pressures in lending markets, inducing also non-participants to ease lending criteria in order to protect their market share (Andreeva and García-Posada 2021). TLTROs also ease regulatory constraints related to liquidity requirements, and ultimately inject further central bank liquidity in the system, exerting downward pressure on the cost of interbank funding. They also offer a backstop against escalations in funding stress, provided that there is sufficient unused borrowing allowance. While our exercise isolates the contribution to credit conditions related to the specific channel of funding cost relief, our assessment is likely to constitute a lower bound of the credit easing effects of the policy measure as a whole.

Section 4 and Section 4.2 report a wide range of specifications that include additional controls and robustness checks on the impact of the pandemic and of the policy response measures it triggered. First, we control for bank capitalisation as of end-April 2020 to account for the series of interventions by micro- and macro-prudential authorities in the euro area between March and April 2020. Second, we explicitly show that the effect of fiscal support measures such as public guarantee schemes increased the ef-

fectiveness of TLTROs as a stimulus to bank lending but did not prevent TLTROs from stimulating lending on their own. Third, we account for banks' exposure to ECB's asset purchase programmes and negative interest rate policy, both on the liability and asset side of banks' balance sheets.

In response to the TLTROs announcement, banks may have either changed their risk tolerance or reacted differently to the rapidly declining borrower creditworthiness. This would have meant that the transmission of TLTROs, rather than relying on a funding cost relief, would have passed through another channel with possibly detrimental consequences for future financial stability. Soft information from banks actually suggests substantial tightening pressures on credit standards coming from lower risk tolerance over the same period.[11] Moreover, in Section 4.3 and Section 4.4 we show that the funding cost relief afforded to banks by TLTROs with dual rates actually reduced the cost of credit origination effectively to below the DFR and well below the effective lower bound on the remuneration of retail deposits. Thus, banks that were exposed to TLTROs found it less necessary to explore the higher echelons of the risk spectrum of potential exposures in order to maintain or improve their profitability.

The recalibration of TLTROs on 12 March 2020 could have offered an alternative event for the study of TLTROs with dual rates, as described in Section 2.1. Nonetheless, three aspects polluted the reaction of bond yields around this event. The announcement came only one day after the declaration of COVID-19 as global pandemic by the World Health Organisation, so the aggregate evolution of bond yields on 12 March 2020 was opposite to what one would expect. Moreover, in the morning of 12 March 2020, ahead of the monetary policy decision published at 13:45 on 12 March 2020, there was the announcement of some capital relief measures by the Single Supervisory Mechanism of the ECB, so also the variation in the cross-section was affected by important simultaneous policy provisions. Lastly, the legal details of the recalibration were communicated to the public only at later stages, in two tranches on 16 March and on 30 April, so the only moment in which market participants reached a full understanding of the scope and functioning of the recalibration was, in fact, on 30 April 2020.

[11] See e.g. the January 2021 ECB Bank Lending Survey.

At the same time, the April 2020 TLTRO III recalibration coincided with the announcement by the ECB of seven operations under a new pandemic emergency longer-term refinancing operations (PELTROs) programme. However, unlike TLTROs, PELTROs were of a backstop nature, aimed ultimately to preserve the smooth functioning of money markets.[12] Consistent with this purpose, the pricing of PELTROs was considerably less attractive compared to TLTROs and, therefore, participation to PELTROs was limited and circumscribed to just a few banks.

4 Empirical evidence

4.1 The impact of TLTROs on credit growth

The main results of our specification are displayed in Table 3. The first panel (*Full sample*) reports our baseline result on the impact of the TLTRO shock on credit growth, using industry-location-size fixed effects to control for firm-level demand and saturating the model with bank- and firm-level controls. The exposure to the TLTRO shock in April 2020 is associated with a gradual increase in credit growth after the announcement. The impact is economically sizable. After six months, one standard deviation of TLTRO exposure corresponds to around 50% of the mean loan growth observed over the same period. The second panel (*Multiple relationships*) in Table 3 reports the same specifications as in the first panel, but for the sample of firms with multiple bank relationships. The number of observations drops to around 40% of the sample covered in the specification reported in the first panel, as indeed most firms primarily do business with one individual bank. For this restricted sample of multiple-lender firms, firm fixed effects can be included to control for firm-level demand, alongside bank-level controls. The estimated coefficients are similar across specifications, suggesting that the sub-sample of multiple-relationship firms is comparable to the baseline and that the estimates are robust to the fixed effects method used to control for loan demand.

Insert Table 3.

[12] See the press release for the PELTRO announcement.

As discussed in Section 3, several concomitant policy measures have been deployed in parallel to the TLTRO announcement, including fiscal, monetary and supervisory actions. These might have also had an impact on bank balance sheets and their intermediation capacity. We therefore include a battery of bank-level controls to account for exposure to these policy measures. We include the ratio of securities held to capture exposure to the Eurosystem asset purchase programmes, as banks with more securities holdings may have realised disproportionate capital gains out of the asset purchases that the Eurosystem conducted over that period. The deposit-to-asset ratio captures banks' exposure to the frictions associated with an inability to pass-through the negative rate policy to retail deposits. Moreover, given that bond yields reactions to the TLTRO shock may be correlated with bank health, vulnerability and business models, we include as controls the return-on-assets (ROA) and the capital ratio. Given that micro- and macro-prudential authorities adopted temporary decreases in capital requirements in March and April 2020 in response to the pandemic, we also check whether results are robust to the inclusion of banks' actual capital buffer above regulatory requirements by end-April 2020. We control also for firm age, which offers a dimension of firm characteristics potentially not captured by ILS fixed effects. Lastly, given that the lending performance in March and April 2020 correlates mildly with our treatment variable and at the same time could condition lending dynamics in the months after April 2020, we check whether its inclusion in the specification plays any role.

The impact of the TLTRO shock on credit growth at different horizons is robust to controlling for all these confounding factors. Interestingly, the coefficient on bank size is the only one that is statistically significant. In the right panel we control also for firm age, which offers a dimension of firm characteristics potentially not captured by the ILS fixed effects.The coefficients associated with bank and firm characteristics are reported in Table A1 in the Appendix. The only statistically significant coefficients relate to bank size and firm age, consistent with the idea that these controls convey sources of variation not fully captured by our system of fixed effects. We interpret the lack of significance in the coefficient associated with the March and April 2020 lending

performance as confirmation that, while being relevant for the reaction of bond yields in April 2020 as shown in Table 2, its cross-sectional variation is mainly due to demand factors which are absorbed by ILS fixed effects.

Figure 3 illustrates the horizons month by month for the benchmark specification in Table 3, panel (1). Table A2 in the Appendix instead casts the same specification in a panel setting, with bank fixed effects and dummies for every month interacted with the exposure to the TLTRO shock, showing the impact of each point over the whole investigation period. All results are consistent across specifications. Importantly, the coefficients on the TLTRO shock variable are not significant at the placebo horizons in the months prior to the recalibration of TLTROs, suggesting that the documented effect is not part of an already existing relationship and that it is indeed due to changes in bank lending behaviour attributable to the announcement of modifications in the design of the TLTRO. Further evidence on this is discussed in Section 4.2.

Insert Figure 3 and Table A2.

We investigate also the extensive margin of credit in the aftermath of the pandemic, that is, we check whether borrowers increase their lending by borrowing from new lenders rather than from pre-existing ones. This is of particular importance during a crisis such as the one generated by the COVID-19 pandemic, as firms with no existing outstanding loans might have faced sudden liquidity needs and therefore started relying on bank credit. To explore the impact of the TLTRO shock on the extensive margin of bank credit, the dependent variable is a dummy variable that takes the value of 1 if a new loan is granted to a firm which had zero credit outstanding vis-à-vis a given bank as of April 2020.[13] The aim is therefore to estimate the effect of the TLTRO shock on new lending by the treated banks. The results are displayed in Table 4. We find that a standard deviation in the funding cost relief from TLTROs is associated with a 2 percentage points higher chance that a firm that did not have any bank loans in April 2020 had some by October 2020. This finding speaks to the relevance of the programme

[13]See e.g. Acharya et al. 2021 for a similar exercise.

not only for the build-up of credit (intensive margin) but also for the formation of new relationships (extensive margin) at a time when firms were at their most vulnerable.

Insert Table 4.

Similarly, one possible concern is that the recorded increase in credit might stem from the substitution of lending to the same firm from one bank to another. This would imply that actually firms did not experience any effective increase in the supply of credit. We therefore consider credit at the firm level and investigate the change in loan volumes granted by all banks associated with each firm. The results are displayed in Table 5. We find that credit also expands at the firm level in response to the TLTRO shock, thus discarding the hypothesis that our main result could be driven by credit substitution across banks. The higher magnitude of the coefficients in Panel (1) of Table 3 compared to Panel (2), together with the significance of the coefficients at the firm level in Table 5, is consistent with the idea that the increase in credit spurred by TLTROs was particularly relevant for arguably smaller borrowers with fewer bank counterparts.

Insert Table 5.

4.2 Robustness of the main findings

In this section, we provide some robustness tests in support of our main results on the impact of the TLTRO shock on bank credit to firms. First, we control for the role of guarantees, as a substantial amount of loans granted in the aftermath of the pandemic were subject to government support through public guarantee schemes. Second, we run a series of placebo tests around the TLTRO announcement shock. Third, we explore the sensitivity of our main result to alternative definitions of credit and TLTRO exposure.

As discussed in Section 3.2, one possible concern relates to the role of policy measures implemented in parallel with the TLTROs, in particular loan guarantee schemes

granted by governments.[14]

The fundamental challenge with trying to isolate the contribution of public guarantees is that the amount of guaranteed loans granted by a bank to its borrowers is potentially endogenous. First, it might be correlated with unobserved determinants of loan demand that are not captured by our ILS or firm-level fixed effects. Second, the decision to expand lending and to make use of the guarantee might be driven by the same common factors. Notwithstanding the potential endogeneity of guarantees, we can test the extent to which our measure of exposure to TLTRO is contaminated by the existence of these schemes and mitigate the concern that the expansion in lending associated with the TLTRO shock illustrated in our main result could be driven mainly by the extension of guaranteed credit. We therefore include a variable capturing whether a given bank-firm pair has experienced an increase in the share of guaranteed loans between April 2020 and October 2020 in our main specification. The results are displayed in Table 6.

Insert Table 6.

We first augment the model at the bank-firm level with a control for the increase in the share of government guaranteed loans (column (1)) and find that our main result is not altered. The coefficient on the TLTRO shock is still significant and similar in magnitude to what is obtained when controlling for firm fixed effects in Table 3. The coefficient is lower mainly on account of the substitution effect between guaranteed and non-guaranteed exposures across banks, as documented in Altavilla et al. 2021. This suggests that the most relevant dimension of loan demand that is not fully captured by ILS fixed effects and remains endogenous to our specification may indeed be related to guarantees.

In order to abstract from the substitution of guaranteed and non-guaranteed credit that occurs across banks, we look at results aggregated at the firm-level. We register qualitatively similar impacts when looking at the impact on credit growth at the firm-level. In column (2) the inclusion of controls for government guarantees reduces

[14]See Altavilla et al. 2021 for the impact of the public guarantee schemes on euro area bank lending conditions.

the coefficient associated with TLTROs by more than half compared to Table 5. This could signal that government guarantees indeed capture a relevant component of loan demand at the firm level not absorbed by ILS fixed effects, or that there is a complementarity between the increase in loan supply due to TLTRO and the increase in loan supply due to guarantees. In order to test this, we introduce an interaction between the firm-level TLTRO shock and our guarantee variables. In column (3) we observe how the coincidence of government guarantees and TLTRO exposure at the firm level generates sizable interaction effects on credit growth, as the coefficient on the interaction term between the firm-level TLTRO shock and the dummy for the increase in government guarantees features a positive sign and is significant. These results show that government guarantees alone, while fundamental in sustaining credit flows amidst the unprecedented level of uncertainty over borrower creditworthiness in the pandemic, were not sufficient to fully explain credit dynamics over this period, when the support from targeted monetary policy also played a key role.The evidence suggests that fiscal and monetary measures acted in unison in spurring loan origination, with the first alleviating the increase in the riskiness of the loan portfolio and therefore capital consumption from the increase in exposures, and the second creating the necessary leeway in terms of unit margins for the increase in lending to remain profitable.

As potential threat to identification could arise if banks affected by the TLTRO announcement already had the tendency to lend more to firms in the months prior to the outbreak of the pandemic. We address this concern in Table 7. We replicate our core specifications estimating the effect on credit growth of a change in bank bond yields at different points in time before and after the actual announcement shock of 30 April 2020. Columns (1) and (2) of Table 7 respectively report the result of the model with and without bank and firm level controls, while both columns include the ILS fixed effects.[15] The reaction of bank bond yields measured on days on which no TLTRO-related announcement was made is unrelated to the change in credit growth

[15]Coefficients are rescaled based on the standard deviation of each regressor to make them comparable in magnitude.

that occurred until October 2020.

Insert Table 7.

As an additional robustness test, we look at alternative measures of loan growth. Our main results consider drawn credit, i.e. loans outstanding on the balance sheet of banks, in order to capture the realised lending and borrowing decisions of banks and firms consistently with monetary aggregates. However, one might wonder what happens to a broader concept of credit encompassing both drawn and undrawn exposures. Table 8 shows that the main results do not change when using as dependent variable the total exposure rather than the outstanding amount of credit at the end of October 2020.

Insert Table 8.

Finally, we employ an alternative set of shocks to measure the reaction of bank bond yields around the TLTRO announcement. A 3-factor Fama-French model is fitted to euro area banks' changes in bond yields at a daily frequency to identify potentially abnormal returns around the TLTRO announcement of 30 April 2020. Returns are classified as abnormal to the extent that they deviate from the returns explained by the regularities captured via the Fama-French factors.[16] The results are reported in Table 9 and confirm that our main results in Table 3 are robust to an alternative definition of the TLTRO shock.

Insert Table 9.

4.3 Qualitative composition of credit

The design of TLTROs has been conceived to avoid that banks engage in unwarranted uses of the borrowed funds. In particular, the targeted nature of the programme provides banks with an incentive to use the borrowed funds towards lending to firms and households with the exclusion of mortgage lending, rather than to divert them to alter-

[16] See, as an example of a similar methodology, Borisov et al. 2016. For the exposition of the 3-factor Fama-French model, see Fama and French 1993.

native uses such as purchases of bonds or other assets. At the same time, the lending targets are calibrated with the purpose of avoiding predatory lending behavior and discouraging excessive risk-taking. Evidence from the past rounds of TLTROs (TLTRO I and TLTRO II) suggests that banks participating in the programme did not experience an increase in their risk-taking (see Andreeva and García-Posada 2021; Benetton and Fantino 2021) and that some even reduced risky lending (Flanagan 2019).

The large degree of uncertainty about the economic outlook and the severe disruptions in economic activity brought forth by the pandemic may have induced banks to adjust their risk tolerance or react differently to the deterioration in borrowers' credit risk in order to preserve their intermediation margins and keep up with their lending volumes. This might have translated into higher levels of risk-taking by banks exposed to TLTROs, thus posing a potential threat to the stability of the banking system as a whole. Moreover, during the observation period, the existence of other policy measures such as government guarantees and moratoria may have kept at bay the number of firm defaults, thus spurring an excessive amount of risk-taking that could translate into severe losses after the expiration of these temporary measures.

We therefore assess whether banks more affected by the TLTRO shock were more likely to lend to ex-ante riskier borrowers. We test also whether the large lending flows generated by TLTROs are associated with higher arrears ex-post (i.e., loans with delayed principal amount and/or delayed interest payments that are past due more than 90 days by October 2020). We cover both the intensive and the extensive margin of credit to understand the impact on credit supply. Moreover, in order to characterise whether any increase in volume towards riskier borrowers is excessive, we also look at how banks priced these increases in exposures to understand whether banks' underwriting criteria showed signs of increased mispricing of risk. We estimate the following model:

$$y_{b,f} = \alpha_{i,l,s} + \beta \text{TLTRO shock}_b + \gamma \text{Risk}_{b,f} + \delta \text{TLTRO shock}_b \times \text{Risk}_{b,f} + X_b + X_f + \epsilon_{b,f}, \quad (2)$$

where $y_{b,f}$ can be either Loan growth$_{b,f}$, i.e. the change of (log) loans granted by bank b to firm f occurred between April 2020 and October 2020, the probability of a new loan as of October 2020, or the change in the interest rate charged on loans between April 2020 and October 2020. *TLTRO shock*$_b$ is our treatment variable. *Risk* can be a measure of ex-ante borrower risk, i.e. the probability of default as of April 2020, or a measure of ex-post risk, i.e. the share of a given firm's arrears over total credit as of October 2020. X_b and X_f are bank and firm characteristics respectively, and $\alpha_{i,l,s}$ represents the ILS fixed effects. As in the previous section, since our treatment is at the bank level, we control for the spurious correlation in errors introduced in this way by clustering standard errors at the bank level.

Table 10 presents the result of this specification. Columns (1) and (2) focus on the intensive margin of credit for the ex-ante and the ex-post measures of borrower risk, respectively. TLTROs keep explaining the intensive margin until October 2020 (column (1)), with impacts on lending being in line with those estimated in the previous section. On average, ex-ante riskier borrowers received less credit than ex-ante healthier borrowers, as suggested by the negative and significant coefficient on the *Ex-ante PD* measure. At the same time, the intensive margin of credit does not feature a significant interaction between TLTROs and the ex-ante riskiness of borrowers. The sign of this interaction is negative, suggesting that, if anything, exposure to TLTROs has been associated with less lending to ex-ante riskier borrowers. Similarly, borrowers in arrears by October 2020 pre-emptively received less credit than ex-post healthy borrowers. Moreover, in this case the interaction with the TLTRO shock is also significant, consistent with a prudent behavior by banks more affected by TLTROs (column (2)). The impact is also sizable, with an almost nil increase in loan volumes due to TLTROs for exposures in full arrears by October 2020 as opposed to exposures with no arrears. Overall, there are no signs that banks more exposed to TLTROs have extended more credit to riskier existing borrowers.

Insert Table 10.

In columns (3) and (4) of Table 10 we then run the same specification, replacing the dependent variable with a dummy that is equal to 1 if a new loan is granted to a firm which had zero credit outstanding as of April 2020 to assess the impact of TLTRO in its interaction with borrower risk on the extensive margin of credit. While a standard deviation of TLTRO exposure increases the chance of getting a loan by October 2020 that did not exist in April 2020 by around 2 percentage points (see Table 4), each standard deviation of additional probability of default in April 2020 shrinks that probability by one third.[17] The coefficient on the interaction term with the ex-post arrears in column (4) does not suggest a significant relationship between ex-post riskiness of borrowers and the probability of new lending relationships after the TLTRO shock, although the sign remains negative.

In the last two columns of Table 10 we report the impact on the lending rate charged by bank b to firm f between April 2020 and October 2020. Borrowers with a riskier profile were charged higher loan rates, with an increase of more than 4 percentage points for each standard deviation of riskiness, as opposed to an overall decrease in lending rates of 9 basis points over the same period. The interaction term between the ex-post arrears with the TLTRO shock is positive and significant. Banks more exposed to TLTROs, which have expanded their loan portfolios in general, did so also for those borrowers that would have turned out to be in arrears by October 2020, but only under the condition that they paid a substantially higher interest rate.

The combined evidence of Table 10 suggests that banks exposed to TLTROs have made an effective use of i) ex-ante observable probabilities of default to discriminate among new applicants and ii) additional private information on the likelihood of existing borrowers to miss on payments in the future to decide whether to extend or increase an outstanding exposure.

There are various factors that may have influenced banks' attitudes towards risk-taking. For example, banks' pricing policies over this period were closely monitored by microprudential supervisors, especially the banking supervision from the Single

[17] This calculation is based on the coefficient on the interaction term between the TLTRO shock and the ex-ante borrower risk measure in column (3) of Table 10.

Supervisory Mechanism (SSM), so that banks had additional incentives compared to the past in correctly pricing risk when granting credit.[18] Moreover, the part of exposures that resulted as risky even after the widespread adoption of public guarantees must have been perceived as very costly by banks, especially given that the capital charge coming from these exposures, in an environment characterised by high cost of equity and heightened market scrutiny, must have been considerably high. Yet, none of these factors explain a decrease in risk-taking for banks more exposed to TLTRO. So the mechanism at play could indeed be that the funding cost relief coming from exposure to TLTROs has created the necessary leeway to maintain net interest margins. This has provided incentives for exposed banks not to disengage from credit origination even when lending rates were compressed by the monetary accommodation coming from asset purchases and the explicit design of some public guarantee schemes that required banks to charge low lending rates. Hence, banks could profitably increase their credit supply without the need to explore higher echelons of the risk spectrum.[19]

4.4 The effectiveness of dual rates

In this section, we explore the mechanism through which TLTROs enabled a bank credit expansion without an increase in risk-taking. We have argued that the funding cost relief brought about by TLTROs allowed to preserve unit margins of intermediation while expanding credit volumes, so we should expect the impact of TLTROs to be larger for banks that lack ex-ante the leeway to compress their pre-existing margins to increase their credit supply.

Table 11 shows that the impact of the TLTRO shock on the intensive and extensive margin of credit and loan pricing was different across banks which displayed different

[18] See Altavilla et al. 2020b on the impact that the common supervision had on bank lending conditions in the euro area.

[19] A further validation of this interpretation comes from the ECB's bank lending survey, where most of the banks regularly report an improvement of profitability due to TLTROs. Moreover, they are also substantially more likely to report an easing of terms and conditions and an increase in loan volumes to firms due to TLTROs than they are to report an easing of credit standards, signalling a reduced tendency to increase their risk-taking as a result of the policy. See Barbiero et al. 2021.

levels of interest margins before the start of the pandemic.

Insert Table 11.

The left panel of Table 11, which is based on our baseline specification from (1), illustrates how the impact of the TLTRO shock on both the intensive and the extensive margin of credit differs across banks with above and below median interest margins. In particular, low margin banks substantially increased their credit volumes in response to the TLTRO shock, while high margin banks did not significantly do so. At the same time, both groups of banks were more likely to extend new loans in the aftermath of the TLTRO shock. Interestingly, high margin banks do not significantly reduce lending rates charged in response to the shock - although the sign is negative and consistent with the idea that the TLTRO benefit would be passed on to borrowers - while low margin banks do so. This result suggests that the relief provided by TLTRO benefited more banks that were already scrambling to maintain their margins before the start of the pandemic, while banks characterised by higher margins did not necessarily need the TLTRO relief to be able to reduce lending rates. This is supporting the idea that, by avoiding a compression of intermediation margins, central bank funding at rates below the level at which reserves are remunerated is able to afford a continued transmission of monetary policy even in presence of an effective lower bound on deposit rates.

In order to further investigate the differential impact of the TLTRO shock on banks with different interest margins, the right panel of Table 11 displays the specification outlined in (2) and differentiates between high and low interest margin banks. Low margin banks more affected by the TLTRO shock reduce credit to risky borrowers as measured by the ex-ante probability of default as of April 2020 (column (4)). The result is robust to different measures of riskiness such as the ex-post arrears status of borrowers (Table A3 in the appendix, columns (1)-(3)), to different measures of interest margins that include the whole non-financial private sector (columns (4)-(6)) and also to measuring borrowers' probability of default prior to the start of the pandemic instead of April 2020 (columns (7)-(9)).

The positive and significant coefficient on the probability of default by itself supports the hypothesis that low margin banks not affected by the TLTRO shock on average increased lending to riskier borrowers (most likely to support their margins), but the TLTRO effect reduced this incentive by providing funding relief, as the negative sign on the interaction term would suggest. High margin banks, instead, extended less credit to risky borrowers on average and the coefficient on the interaction term suggests that the TLTRO relief did not play a role for this group of banks.

Results on the extensive margin of credit (column (5)), i.e. the probability of extending a new loan after the TLTRO shock, are in line with those on the intensive margin, pointing to low margin banks being more likely to extend a new loan in response to the shock. As for the pricing of loans (column (6)), low margin banks decreased rates thanks to TLTRO, but the riskiness of the borrowers did not play a role, most likely also owing to the effect of public guarantees. High margin banks instead on average charged higher rates to riskier borrowers.

5 Conclusion

In this paper, we analyse the effectiveness of targeted monetary policy with dual rates in supporting bank credit provision in a low interest rate environment. We make use of granular data from AnaCredit - a novel and harmonised credit registry for the euro area. For identification, we exploit high frequency changes in bank bond yields prompted by an unexpected recalibration of the programme on 30 April 2020.

We find that the recalibration of TLTROs had a strong, positive effect on the supply of bank credit, considering both the intensive and the extensive margin. Our baseline model shows that a standard deviation in the exposure to the funding cost relief coming from TLTROs translated into an impact on loan growth of around half of the actual lending registered over the six months after the announcement of the policy intervention. We carry out a battery of robustness checks to validate our results and to address identification challenges.

We also analyze the qualitative composition of the newly extended credit. When

looking at both the ex-ante and ex-post riskiness of borrowers, we find that the credit expansion spurred by exposure to the policy was not accompanied by an increase in risk-taking or in the mispricing of risk. Moreover, we find that results are mainly driven by banks with lower intermediation margins, that is, those that were poised to benefit the most from the leeway afforded to them by the TLTRO relief.

Our findings show that the funding cost relief brought forth by the TLTROs had a significant impact on credit provision, helping to sustain economic activity during the COVID-19 crisis. More importantly, they illustrate how a dual rate system, where banks can borrow from the central bank at a rate below the one at which reserves are remunerated, bears the potential to improve the bank-based transmission of monetary policy and contribute to the monetary accommodation without the increased risk appetite that a standard rate cut might spur under the same circumstances, especially if considered after a prolonged period of low interest rates.

References

Acharya, V. V., Eisert, T., Eufinger, C., and Hirsch, C. (2019). Whatever it takes: The real effects of unconventional monetary policy. *The Review of Financial Studies*, 32(9):3366–3411.

Acharya, V. V., Lenzu, S., and Wang, O. (2021). Zombie lending and policy traps. *Available at SSRN 3936064*.

Acharya, V. V. and Steffen, S. (2015). The "greatest" carry trade ever? understanding eurozone bank risks. *Journal of Financial Economics*, 115(2):215–236.

Altavilla, C., Barbiero, F., Boucinha, M., and Burlon, L. (2020a). The Great Lockdown: pandemic response policies and bank lending conditions. Discussion Paper DP15298, CEPR.

Altavilla, C., Boucinha, M., Peydró, J.-L., and Smets, F. (2020b). Banking supervision, monetary policy and risk-taking: Big data evidence from 15 credit registers. Working paper 2349, ECB.

Altavilla, C., Ellul, A., Pagano, M., Polo, A., and Vlassopoulos, T. (2021). Loan guarantees, bank lending and credit risk reallocation. Discussion Paper DP16727, CEPR.

Amiti, M. and Weinstein, D. E. (2018). How much do idiosyncratic bank shocks affect investment? evidence from matched bank-firm loan data. *Journal of Political Economy*, 126(2):525–587.

Andrade, P., Cahn, C., Fraisse, H., and Mésonnier, J.-S. (2018). Can the Provision of Long-Term Liquidity Help to Avoid a Credit Crunch? Evidence from the Eurosystem's LTRO. *Journal of the European Economic Association*, 17(4):1070–1106.

Andreeva, D. C. and García-Posada, M. (2021). The impact of the ecb's targeted long-term refinancing operations on banks' lending policies: The role of competition. *Journal of Banking & Finance*, 122:105992.

Barbiero, F., Boucinha, M., and Burlon, L. (2021). TLTRO III and bank lending conditions. *ECB Economic Bulletin*, Issue 6.

Benetton, M. and Fantino, D. (2021). Targeted monetary policy and bank lending behavior. *Journal of Financial Economics*.

Boeckx, J., de Sola Perea, M., and Peersman, G. (2020). The transmission mechanism of credit support policies in the euro area. *European Economic Review*, 124:103403.

Bordo, M. D. and Duca, J. V. (2020). How new fed corporate bond programs dampened the financial accelerator in the covid-19 recession. Technical report, National Bureau of Economic Research.

Borisov, A., Goldman, E., and Gupta, N. (2016). The corporate value of (corrupt) lobbying. *The Review of Financial Studies*, 29(4):1039–1071.

Carpinelli, L. and Crosignani, M. (2021). The design and transmission of central bank liquidity provisions. *Journal of Financial Economics*, 141(1):27–47.

Crosignani, M., Faria-e Castro, M., and Fonseca, L. (2020). The (Unintended?) consequences of the largest liquidity injection ever. *Journal of Monetary Economics*, 112(C):97–112.

Da Silva, E., Grossmann-Wirth, V., Nguyen, B., and Vari, M. (2021). Paying Banks to Lend? Evidence from the Eurosystem's TLTRO and the Euro Area Credit Registry. Working papers 848, Banque de France.

Darracq-Paries, M. and De Santis, R. A. (2015). A non-standard monetary policy shock: The ECB's 3-year LTROs and the shift in credit supply. *Journal of International Money and Finance*, 54(C):1–34.

Degryse, H., De Jonghe, O., Jakovljević, S., Mulier, K., and Schepens, G. (2019). Identifying credit supply shocks with bank-firm data: Methods and applications. *Journal of Financial Intermediation*, 40:100813.

Esposito, L., Fantino, D., and Sung, Y. (2020). The impact of TLTRO2 on the Italian credit market: some econometric evidence. *Temi di discussione (Economic working papers)*.

Fama, E. and French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1):3–56.

Flanagan, T. (2019). Stealth Recapitalization and Bank Risk Taking: Evidence from TLTROs. *Available at SSRN 3442284*.

Jasova, M., Mendicino, C., and Supera, D. (2021). Policy uncertainty, lender of last resort and the real economy. *Journal of Monetary Economics*, 118:381–398.

Jiménez, G., Ongena, S., Peydró, J.-L., and Saurina, J. (2014). Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? *Econometrica*, 82(2):463–505.

Khwaja, A. I. and Mian, A. (2008). Tracing the impact of bank liquidity shocks: Evidence from an emerging market. *American Economic Review*, 98(4):1413–42.

Lane, P. R. (2020). *The Monetary Policy Package: An Analytical Framework*, The ECB Blog, 13 March 2020.

Rebucci, A., Hartley, J. S., and Jiménez, D. (2020). An event study of covid-19 central bank quantitative easing in advanced and emerging economies. Technical report, National Bureau of Economic Research.

Rostagno, M., Altavilla, C., Carboni, G., Yiangou, J., et al. (2021). *Monetary Policy in Times of Crisis: A Tale of Two Decades of the European Central Bank*. Oxford University Press.

Schnabel, I. (2021). *Lessons from an unusual crisis*, speech on 1 October 2021.

Table 1: **Summary statistics**

	Units	Definition	Obs.	Mean	St.Dev.
Bank-level variables					
TLTRO shock	p.p.	Change in bank bond yields (with opposite sign) between the day before and the day of the TLTRO recalibration of 30 April 2020.	1,208,013	0.063	0.034
Assets	log	Log of main assets (total assets minus remaining assets), in €Mln.	1,208,013	12.33	1.04
ROA	%	Return on assets.	1,208,013	0.08	0.55
Capital	ratio	CET1 over risk-weighted assets.	1,208,013	0.131	0.025
Securities holdings	ratio	Holdings of securities over main assets.	1,208,013	0.086	0.051
Deposit ratio	ratio	Total deposits to NFC over main liabilities.	1,208,013	0.426	0.136
Bank-firm level variables					
Loan growth	$\Delta(log)$	Change in (log) loan volume from April 2020 to October 2020.	1,208,013	0.075	0.82
Probability of new loan	Prob.	Dummy equal to 1 if a new loan is granted to a firm which had zero credit outstanding as of April 2020	3,014,822	0.12	0.32
Loan interest rate	p.p.	Change in loan interest rate from April 2020 to October 2020.	1,127,296	-0.20	0.87
Guaranteed loans	Cat.	Dummy equal to 1 if the change in the share of guaranteed loans over total loans between April 2020 and October 2020 is positive.	1,208,013	0.24	0.43
Share of guaranteed loans	ratio	Share of guaranteed loans over total loans.	1,208,013	0.08	0.24
Firm-level variables					
Firm age	yrs	Number of years of activity of the firm.	1,208,013	19.21	15.53
Ex-ante PD	Prob.	Probability of default of the borrower in April 2020.	749,784	11.00	27.13
Ex-post risk	ratio	Ratio of exposures in arrears over total exposures in October 2020.	1,208,013	0.072	0.24

Notes: Observations are reported at the bank-firm level for April 2020 unless indicated otherwise. Our sample consists of a panel of 81 banks and 926,456 firms.

Table 2: **Balancing table**

	TLTRO shock above median		TLTRO shock below median		
	Mean	**St.dev**	**Mean**	**St. dev**	**t-test**
TLTRO Shock	0.08	0.04	0.03	0.06	0.05***
log(Main assets)	11.67	1.01	11.09	1.06	0.58**
ROA	0.30	0.49	0.17	0.48	0.13
CET 1 Ratio	14.78	3.89	17.88	12.63	-3.10
Securities holdings	7.78	5.11	8.02	6.78	-0.24
Deposits ratio	40.30	21.19	33.22	25.60	7.08
Firm age	6.80	12.03	12.65	23.51	-5.85
Probability of default of the borrower	3.64	10.44	6.39	8.56	-2.75
Share of loans in arrears (p.p.)	2.88	6.38	6.79	16.55	-3.91
Increase in share of guaranteed loans (1/0)	5.83	12.16	9.76	18.99	-3.93
Drawn/granted credit	5.38	10.86	9.59	17.12	-4.21
Mar-Apr performance	0.04	0.05	0.02	0.05	0.03**

Notes: The table presents t-tests for selected bank characteristics for banks with TLTRO shocks below and above the median. Bank-firm level variables are aggregated at the bank level using loan volumes as weights.

Table 3: **Impact of TLTRO shocks on bank credit provision**

	Dependent Variable: Loan growth					
	(1) *Full sample*			(2) *Multiple-relationship firms*		
	(-3M)	(3M)	(6M)	(-3M)	(3M)	(6M)
TLTRO Shock	-0.110	0.554**	0.737**	-0.0426	0.469**	0.559*
	(0.221)	(0.212)	(0.287)	(0.309)	(0.218)	(0.310)
Firm FE	No	No	No	Yes	Yes	Yes
ILS FE	Yes	Yes	Yes	No	No	No
Bank characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes	No	No	No
N	1,207,460	1,207,460	1,207,460	454,313	454,313	454,313
R^2	0.111	0.118	0.118	0.406	0.397	0.402

Notes: The table presents the results of our main specification. Each observation is a bank-firm pair. *TLTRO shock* is defined as a one-day change in bank bond yields at the TLTRO announcement on 30 April 2020. The reported coefficients β^k come for each horizon k from the following model: Loan growth$_{b,f,k} = \alpha^k_{i,l,s} + \beta^k \times$ TLTRO shock$_b + X_b + X_f + \epsilon_{b,f,k}$, k is -3 months, 3 months or 6 months from April 2020. Loan growth$_{b,f,k}$ is defined as the change in (log) loan volume from January to April 2020 for column *-3M*, from April to July 2020 for column *3M*, and from April to October 2020 for column *6M*. The results are split by the type of fixed effects used. Panel (1) presents the results including single-relationship firms by using industry-location-size (ILS) fixed effects. Panel (2) presents the results for firms with multiple banking relationships and employs firm fixed effects. Standard errors clustered at the bank level are reported in parentheses.

Table 4: **Extensive margin of credit**

	Dependent Variable: Probability of new loan		
	(1)	(2)	(3)
TLTRO Shock	0.399***	0.365**	0.370**
	(0.143)	(0.141)	(0.145)
ILS FE	Yes	Yes	Yes
Bank characteristics	No	Yes	Yes
Firm characteristics	No	No	Yes
N	2,488,661	2,416,194	2,410,721
R^2	0.210	0.211	0.214

Notes: The table presents results from a regression in which the dependent variable is the probability of a new loan. We obtain a balanced panel of bank-firm observations and define new lending relationships as occurrences in which there was no outstanding credit at the time of the shock in April 2020 but there was a positive amount in October 2020. The regression includes controls and fixed effects as described in Table 3. Standard errors clustered at the bank level are reported in parentheses.

Table 5: **Firm-level aggregation**

	Dependent Variable: Loan growth		
	(1)	(2)	(3)
Firm-level TLTRO Shock	0.580***	0.559***	0.566***
	(0.020)	(0.021)	(0.021)
ILS FE	Yes	Yes	Yes
Bank characteristics	No	Yes	Yes
Firm characteristics	No	No	Yes
N	1,030,418	1,003,697	1,003,684
R^2	0.151	0.151	0.151

Notes: The table presents the results from a regression in which the dependent variable (loan growth), the *TLTRO shock* and bank characteristics have been aggregated at the firm level. Firm level treatment is calculated by weighting bank level bond yield shocks by the amount of credit outstanding as of April 2020. Bank characteristics are also weighted by the same amount of credit. Standard errors are clustered at the firm level.

Table 6: **Controlling for government guarantees**

	Dependent Variable: Loan growth		
	Bank-firm level	Firm-level	
	(1)	(2)	(3)
TLTRO Shock	0.455*		
	(0.231)		
Firm-level TLTRO Shock		0.175***	0.201***
		(0.020)	(0.026)
Gov. Guarantee	0.554***	0.496***	0.495***
	(0.041)	(0.002)	(0.002)
Firm-level TLTRO shock × Gov. guarantee			0.153**
			(0.075)
ILS FE	Yes	Yes	Yes
Bank characteristics	Yes	Yes	Yes
Firm characteristics	Yes	Yes	Yes
N	1,207,460	1,003,684	1,003,684
R^2	0.219	0.241	0.241

Notes: The table presents a robustness test of our main results on loan growth controlling for government guarantees at the bank-firm level (columns 1) and at the aggregated firm level (columns 2 and 3). *Gov. Guarantee* is a dummy equal to 1 if the share of guaranteed loans has increased between April 2020 and October 2020, at the bank-firm (column 1) and at the aggregated firm level (columns 2 and 3). In column 3, the firm-level *TLTRO shock* and *Gov. Guarantee* variables are centered at the mean. The firm-level treatment is calculated by weighting bank level bond yield shocks by the amount of credit. Bank characteristics are also weighted by the amount of credit. Standard errors are clustered at the bank level.

Table 7: **Robustness on timing of the TLTRO shock**

	% change in loan volume	
	(1)	(2)
TLTRO Shock	0.0423***	0.0380**
	(0.0134)	(0.0148)
1 day before	-0.0169	-0.0080
	(0.0205)	(0.0157)
1 day after	0.0106	0.00184
	(0.0143)	(0.0149)
5 days before	0.0191	-0.00179
	(0.0337)	(0.0283)
5 days after	-0.00577	-0.0112
	(0.0136)	(0.0182)
10 days before	0.000938	0.00364
	(0.0257)	(0.0195)
10 days after	-0.0300	-0.0224
	(0.0270)	(0.0234)
15 days before	0.0428	0.0209
	(0.0358)	(0.0277)
15 days after	0.0114	0.0155
	(0.0174)	(0.0177)
Bank controls	No	Yes
Firm controls	No	Yes
ILS FE	Yes	Yes

Notes: This table presents the results of placebo tests in which we replace the *TLTRO shock* around the TLTRO III announcement of 30 April 2020 with changes in bank bonds at different points in time before and after the shock. Coefficients are re-scaled based on the standard deviation of bank bond changes. Standard errors clustered at the bank level are reported in parentheses.

Table 8: **Alternative measure of credit**

	Intensive margin	Extensive margin
	(1)	(2)
TLTRO Shock	0.649***	0.348**
	(0.207)	(0.150)
Bank controls	Yes	Yes
Firm controls	Yes	Yes
ILS FE	Yes	Yes
N	1,370,321	2,410,721
R^2	0.112	0.214

Notes: The table presents the results for an alternative measure of credit, i.e. term exposures, both drawn and undrawn, to firms. *Intensive margin* is defined as the growth of drawn and undrawn term credit between April 2020 and October 2020. *Extensive margin* is measured as the probability of a new term lending exposure in October 2020. Each observation is a bank-firm pair. The regression includes controls and fixed effects as described in Table 3. Standard errors clustered at the bank level are reported in parentheses.

Table 9: **Alternative TLTRO shock**

	Dep. Var.: Loan growth				
	(1)	(2)	(3)	(4)	(5)
FF TLTRO Shock	0.712***	0.579**	0.579**	0.883***	0.571**
	(0.189)	(0.276)	(0.277)	(0.264)	(0.228)
ILS FE	Yes	Yes	Yes	No	No
Firm FE	No	No	No	Yes	Yes
Bank characteristics	No	Yes	Yes	No	Yes
Firm characteristics	No	No	Yes	No	No
N	1,100,710	1,100,710	1,100,710	383,261	383,261
R^2	0.124	0.126	0.126	0.410	0.415

Notes: The table presents the results for an alternative measure of *TLTRO shock* (*FF TLTRO Shock*) which is calculated as the abnormal one-day change in bank bond returns on 30 April 2020, extracted using a standard Fama-French (FF) factor model. Each observation is a bank-firm pair. The regression includes controls and fixed effects as described in Table 3. Standard errors clustered at the bank level are reported in parentheses.

Table 10: **Qualitative composition of credit**

	Loan growth		Prob. of a new loan		Lending rate	
	(1)	(2)	(3)	(4)	(5)	(6)
TLTRO Shock	0.917**	0.809**	0.276*	0.354**	-0.306	-0.258
	(0.397)	(0.307)	(0.152)	(0.147)	(0.341)	(0.307)
Ex-ante PD	-0.124**		-0.094***		0.179**	
	(0.052)		(0.020)		(0.083)	
TLTRO Shock × Ex-ante PD	-0.497		-0.367*		0.698	
	(0.581)		(0.212)		(0.656)	
Ex-post risk		-0.112**		-0.151***		0.196***
		(0.043)		(0.025)		(0.056)
TLTRO Shock × Ex-post risk		-0.738**		-0.095		0.887**
		(0.344)		(0.298)		(0.395)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
ILS FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1,094,520	1,207,460	2,047,553	2,416,546	1,020,849	1,126,124
R^2	0.123	0.121	0.221	0.222	0.178	0.174

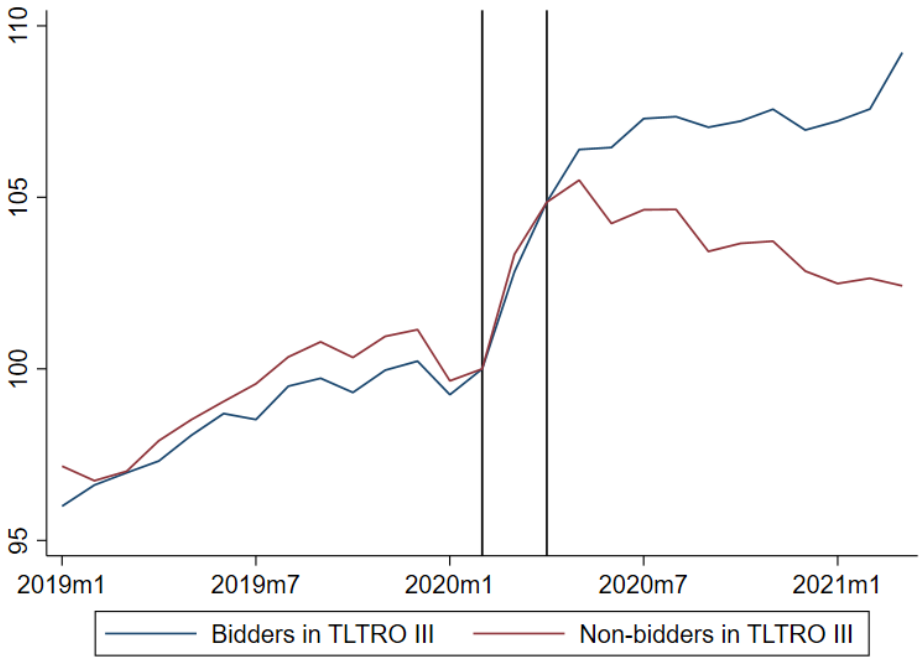
Notes: The table displays the results of the empirical specification described in Model (2), where the dependent variable is the change in loan volume (Columns (1)-(2)), the probability of a new loan (Columns (3)-(4)), or the change in loan rates (Columns (5)-(6)) between April 2020 and October 2020. Variables are described in Table 1. The regressions include controls and fixed effects as described in Table 3. Standard errors clustered at the bank level are reported in parentheses.

Table 11: **Impact on bank lending conditions by level of intermediation margins**

	Impact on bank lending conditions			Impact on composition of bank lending		
	Loan growth (1)	Prob. of new loan (2)	Lending rate (3)	Loan growth (4)	Prob. of new loan (5)	Lending rate (6)
Banks with high intermediation margins						
TLTRO shock	0.379	0.362***	-0.0677	0.452	0.224*	-0.042
	(0.428)	(0.110)	(0.242)	(0.588)	(0.119)	(0.348)
Ex ante PD				-0.217***	-0.122***	0.285***
				(0.066)	(0.013)	(0.096)
TLTRO shock × Ex ante PD				0.258	-0.234	0.076
				(0.775)	(0.173)	(0.962)
Banks with low intermediation margins						
TLTRO shock	2.408**	3.007***	-1.075**	3.148***	3.383***	-1.013*
	(1.019)	(1.069)	(0.454)	(1.145)	(1.190)	(0.577)
Ex ante PD				0.277***	0.097	0.049
				(0.086)	(0.067)	(0.045)
TLTRO shock × Ex ante PD				-5.342***	-2.758**	-0.195
				(1.389)	(1.277)	(0.757)
F-test						
TLTRO shock: High = Low	3.38*	6.07**	0.385*			
TLTRO shock × PD: High = Low				12.47***	3.86*	0.05*

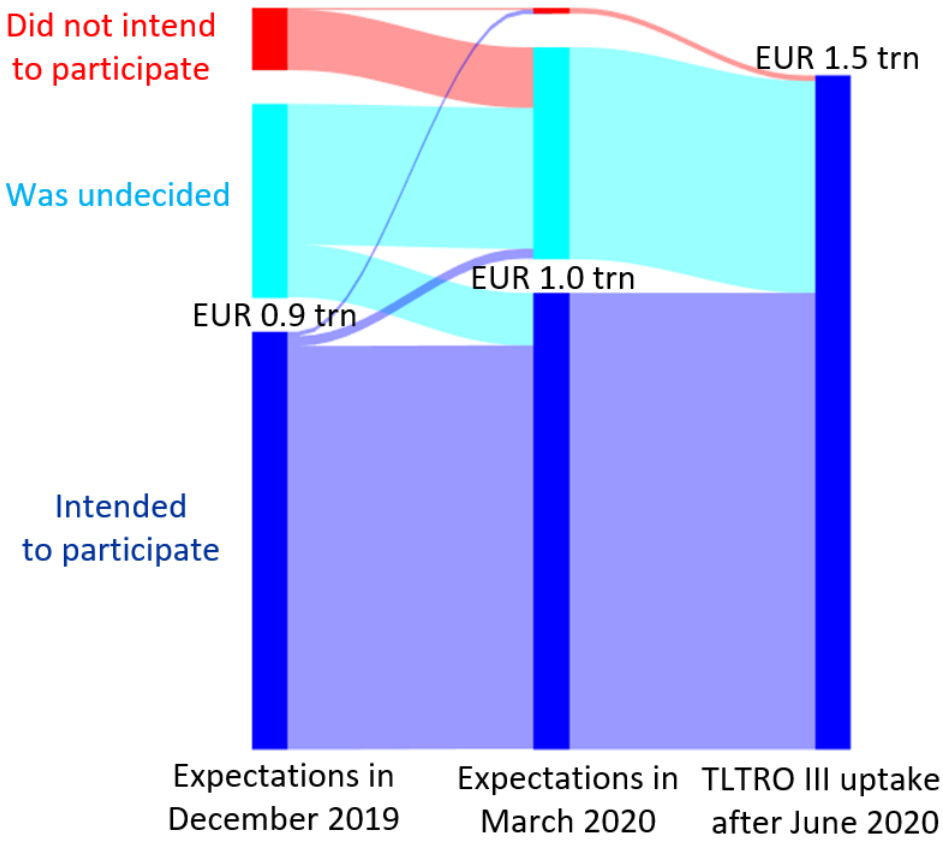
Notes: The table displays the results of the empirical specifications described in Model (1) (Columns (1)-(3)) and in Model (2) (Columns (4)-(6)) , where the dependent variable is either the percentage change in loan volume (Columns (1) and (4)), the probability of a new loan (Columns (2) and (5)), or the change in loan rates (Columns (3) and (6)) between April 2020 and October 2020. The sample is split according to banks' interest margins on firm loans and deposits as of end-2019. Variables are described in Table 1. The regressions include controls and fixed effects as described in Table 3. Standard errors clustered at the bank level are reported in parentheses.

Figure 1: Loans to firms



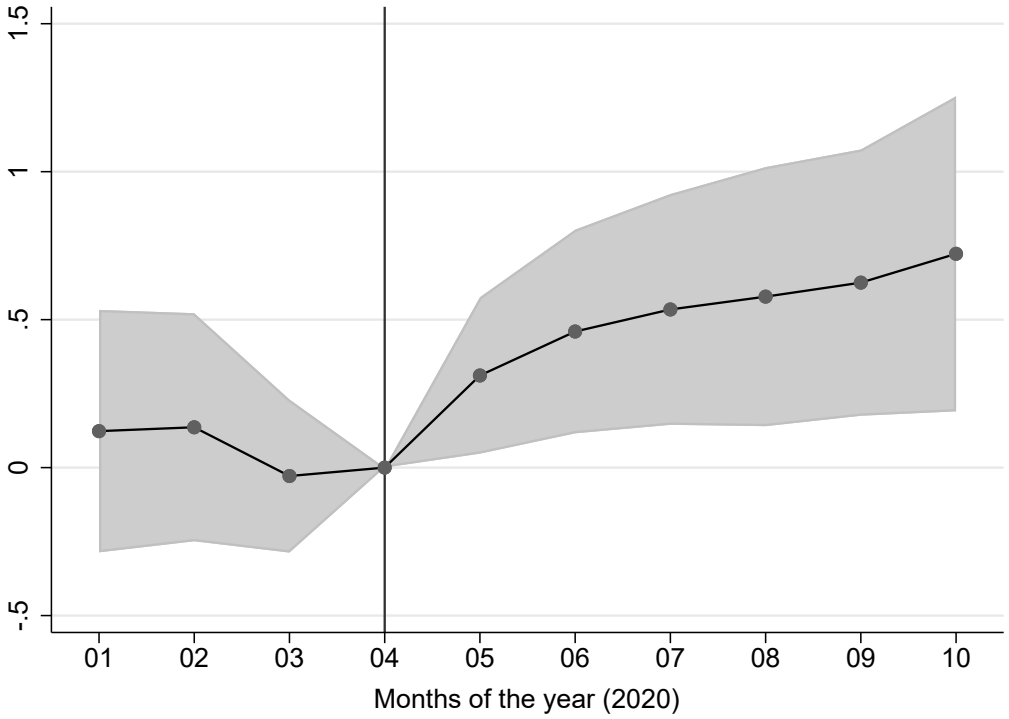
Notes: This figure displays the evolution of loans for banks participating (blue line) and banks not participating (red line) in TLTRO III. Notional stocks, February 2020 = 100. Vertical lines represent February and April 2020.

Figure 2: Evolution of intentions to participate in TLTROs as of June 2020



Notes: Authors' calculations based on the ECB Bank Lending Survey. The blue bar on the right column measures the EUR 1.5 trillion of participation after the June TLTRO operation. The three bars on the left column measure the eventual participation in the June operation by banks that, in December 2019 (January 2020 BLS), reported that they intended to participate (blue bar), were undecided (cyan bar) or did not intend to participate (red bar). The three bars on the central column measure the same participation in the June operation but based on responses given in March 2020 (April 2020 BLS). The shaded areas between the left and central columns measure transitions from one response to the other between survey waves. Share of respondents weighted by volume of TLTRO III uptake in June 2020.

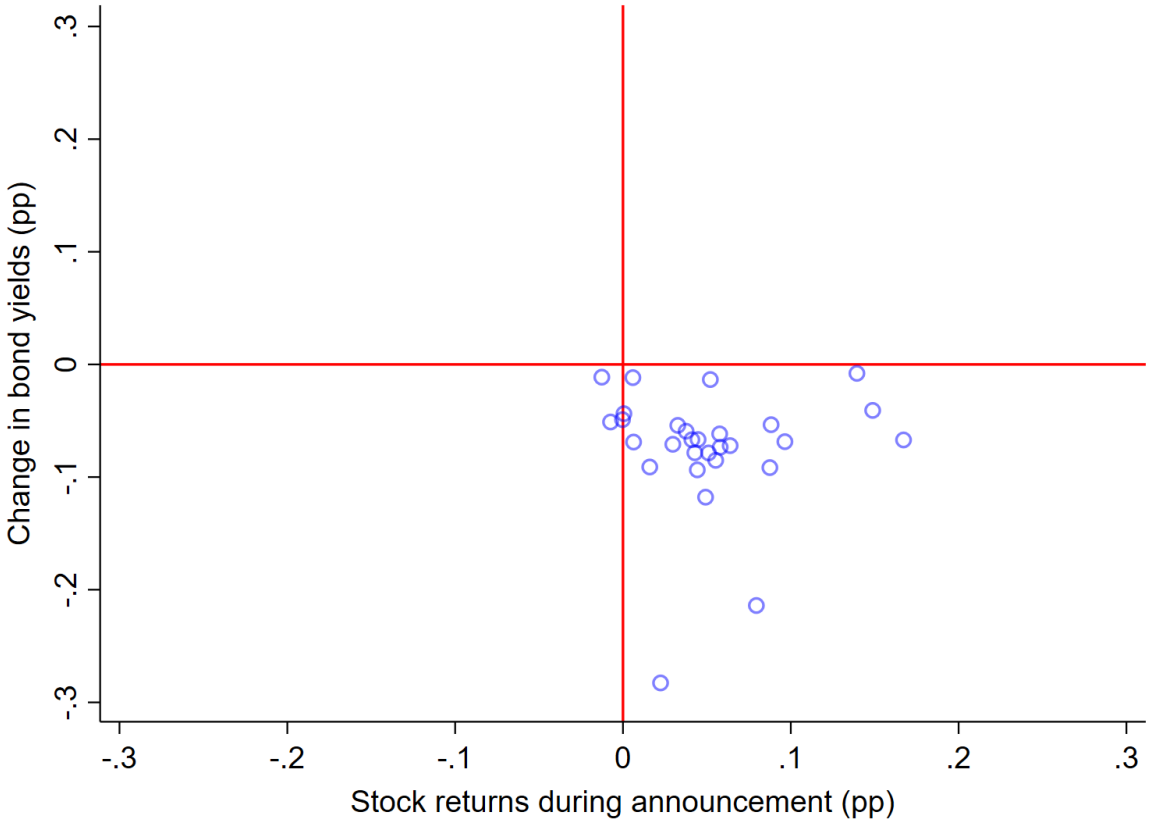
Figure 3: Credit growth after TLTRO shock



Notes: The figure reports the coefficients resulting from regressions of credit growth on *TLTRO shock*. *TLTRO shock* is defined as a one-day change in volume-weighted bank bond yields around the TLTRO III recalibration announcement of 30 April 2020. The reported coefficients represent the effect at different horizons and come from the following model: $\text{Loan growth}_{b,f,k} = \alpha^{k}_{i,l,s} + \beta^{k} \times \text{TLTRO shock}_{b} + X_{f} + X_{b} + \epsilon_{b,f,k}$, where k refers to the months from January 2020 to October 2020. $\text{Loan growth}_{b,f,k}$ is defined as the difference in (log) loan volume between month k and April 2020 (for months before April 2020, this implies an opposite sign to the results reported in column (-3M) in Table 3. Grey-shaded areas report 95% confidence intervals with standard errors clustered at the bank level.

APPENDIX

Figure A1: Intradaily stock returns during announcement and daily changes in bond yields on 30 April 2020 for selected euro area banks



Notes: The horizontal axis reports the percentage change between each bank's average stock price over 14:15-14:30 and the respective average stock price over 15:30-15:45 on 30 April 2020, that is, during the press conference where the TLTRO recalibration was announced. Changes over the duration of the press conference (1 hour) are re-scaled to the duration of a business day (8 hours). The vertical axis reports the change in bond yields registered between 29 April cob and 30 April cob for the sample of banks that have registered fluctuations in stock prices during the announcement.

Table A1: **Controlling for concomitant measures and balance sheet characteristics**

	Dependent Variable: Loan growth				
	(1)	(2)	(3)	(4)	(5)
TLTRO Shock	0.821***	0.730**	0.737**	0.720**	0.696**
	(0.259)	(0.288)	(0.287)	(0.285)	(0.276)
log(Main assets)		0.044***	0.044***	0.044***	0.038**
		(0.015)	(0.015)	(0.015)	(0.018)
ROA		-2.702	-2.611	-2.234	-3.196
		(4.577)	(4.601)	(4.669)	(4.463)
CET 1 Ratio		0.091	0.092		0.181
		(0.270)	(0.270)		(0.278)
Securities holdings		0.300	0.305	0.340	0.147
		(0.275)	(0.271)	(0.261)	(0.327)
Deposits ratio		-0.053	-0.066	-0.073	-0.022
		(0.114)	(0.118)	(0.114)	(0.101)
Firm age			-0.001*	-0.001*	-0.001*
			(0.000)	(0.000)	(0.000)
Capital buffer				-0.003	
				(0.005)	
Mar-Apr performance					0.338
					(0.284)
ILS FE	Yes	Yes	Yes	Yes	Yes
N	1,207,460	1,207,460	1,207,460	1,207,460	1,207,460
R^2	0.114	0.117	0.118	0.118	0.118

Notes: This table displays the full set of controls included in our main result (Table 3 at the 6 months horizon). Each observation is a bank-firm pair. *TLTRO Shock* is defined as a one-day change in volume-weighted bank bond yields at the TLTRO III announcement on 30 April 2020. Controls in Columns (2)-(3) are described in Table 1. Column (4) displays the results for our main model after additionally controlling for capital buffers, which are measured as the difference between each bank's CET1 ratio and its capital requirement. Column (5) additionally controls for the lending performance of March and April 2020 (measured as the logarithm of firm loan growth). The model is gradually saturated with bank and firm controls. Standard errors clustered at the bank level are reported in parentheses.

Table A2: **Panel specification**

	% change in loan volume
TLTRO shock × 202001	-0.195
	(0.119)
TLTRO shock × 202002	-0.167
	(0.140)
TLTRO shock × 202003	-0.163
	(0.125)
TLTRO shock × 202005	0.399***
	(0.100)
TLTRO shock × 202006	0.558***
	(0.142)
TLTRO shock × 202007	0.620***
	(0.152)
TLTRO shock × 202008	0.647***
	(0.157)
TLTRO shock × 202009	0.711***
	(0.171)
TLTRO shock × 202010	0.798***
	(0.195)
Bank FE	Yes
ILS × Month FE	Yes
Bank characteristics	Yes
Firm characteristics	Yes
N	12,036,631
R^2	0.119

Notes: This table displays the panel version of our main specification (Table 3 where the *TLTRO shock* variable is interacted with monthly dummy variables that are equal to one for the various months before and after April 2020. Each observation is at the bank-firm-month level. *TLTRO shock* is defined as a one-day change in volume-weighted bank bond yields at the TLTRO III announcement on 30 April 2020. Controls are described in Table 1. The model is gradually saturated with bank and firm characteristics. Bank and industry-size-location-month fixed effects are included. Standard errors with double clustering at the bank and month level are reported in parentheses.

Table A3: **Impact on bank lending conditions by level of intermediation margin: Robustness**

	Borrower risk: Oct. 2020 arrears			Borrower risk: Apr. 2020 PD			Borrower risk: Jan. 2020 PD		
	Split by NFC margins			Split by NFPS margins			Split by NFC margins		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Banks with high intermediation margins									
TLTRO Shock	0.415		0.418	-1.171***		-1.434***	0.549		0.547
	(0.447)		(0.432)	(0.168)		(0.341)	(0.629)		(0.623)
Borrower risk	-0.168***		-0.168***	-0.330***		-0.340***	-0.226***		-0.244***
	(0.041)		(0.039)	(0.0936)		(0.094)	(0.067)		(0.066)
TLTRO shock × Borrower risk	-0.485		-0.468	1.884*		1.988*	0.258		0.236
	(0.439)		(0.424)	(1.001)		(1.033)	(0.840)		(0.818)
Banks with low intermediation margins									
TLTRO Shock		2.843**	3.829***		0.069	0.655*		3.614***	3.453***
		(1.121)	(0.966)		(0.246)	(0.362)		(1.254)	(1.115)
Borrower risk		0.391***	0.384***		0.006	0.002		0.231***	0.279***
		(0.121)	(0.122)		(0.033)	(0.033)		(0.072)	(0.080)
TLTRO shock × Borrower risk		-8.006***	-7.896***		-0.780*	-0.778*		-4.354***	-5.225***
		(2.148)	(2.142)		(0.437)	(0.409)		(1.133)	(1.351)
ILS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	594,100	599,995	1,206,625	624,368	454,100	1,094,088	483,355	238,794	733,306
R^2	0.148	0.102	0.128	0.139	0.122	0.131	0.157	0.230	0.167

Notes: The table displays the results of the empirical specification described in Model (2), where the dependent variable is the change in loan volume between April 2020 and October 2020. Borrower risk is either the ex-post arrears share of loans (columns (1)-(3)), the ex-ante PD as of April 2020 (columns (4)-(6)), or the pre-pandemic PD (columns (7)-(9)). The sample is split according to banks' interest margins on firm (NFC) loans and deposits (columns (1)-(3) and columns (7)-(9)) or interest margins on non-financial private sector (NFPS) loans and deposits (columns (4)-(6)), both measured at the end of 2019. Variables are described in Table 1. The regressions include controls and fixed effects as described in Table 3. Standard errors clustered at the bank level are reported in parentheses.

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