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THE IMPACT OF THE ECB'S TARGETED LONG-TERM REFINANCING OPERATIONS ON BANKS' LENDING POLICIES: THE ROLE OF COMPETITION (*)

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Abstract

We assess the impact of the Eurosystem's Targeted Long-Term Refinancing Operations (TLTROs) on the lending policies of euro area banks. To guide our empirical research, we build a theoretical model in which banks compete à la Cournot in the credit and deposit markets. According to the model, we distinguish between direct and indirect effects. Direct effects take place because bidding banks expand their loan supply due to the lower marginal costs implied by the TLTROs. Indirect effects on non-bidders operate via changes in the competitive environment in banks' credit and deposit markets and are a priori ambiguous. We then test these theoretical predictions with a sample of 130 banks from 13 countries and the confidential answers to the ECB's Bank Lending Survey. Regarding direct effects on bidders, we find an easing impact on margins on loans to relatively safe borrowers, but no impact on credit standards. Regarding indirect effects, there is a positive impact on the loan supply on non-bidders but, contrary to the direct effects, the transmission of the TLTROs takes place through an easing of credit standards, and it is mainly concentrated in banks facing high competitive pressures. We also find evidence of positive funding externalities.

Keywords: unconventional monetary policy, TLTROs, lending policies, competition.

JEL Classification: G21, E52, E58.

Resumen

El presente artículo evalúa el impacto de las operaciones de refinanciación a largo plazo con objetivo específico (TLTRO, por sus siglas en inglés) en las políticas crediticias de los bancos del área del euro. Para guiar la investigación empírica, construimos un modelo teórico en el que los bancos compiten a la Cournot en los mercados de crédito y depósito. Distinguimos entre efectos directos y efectos indirectos. Los efectos directos ocurren porque los bancos que participan en las TLTRO expanden su oferta de crédito gracias a los menores costes marginales que conllevan estas operaciones. Los efectos indirectos en los bancos que no participan operan a través de cambios en la estructura competitiva de los mercados de crédito y depósito, y su efecto es ambiguo a priori. Tras este análisis, examinamos estas predicciones teóricas con una muestra de 130 bancos de 13 países y las respuestas confidenciales a la Encuesta de Préstamos Bancarios del Banco Central Europeo. Respecto a los efectos directos, encontramos que las TLTRO contribuyeron a reducir los márgenes sobre préstamos relativamente seguros, pero que no tuvieron impacto en los criterios de aprobación de préstamos. Respecto a los efectos indirectos, la transmisión de las TLTRO tuvo lugar a través de la relajación de los criterios de aprobación de préstamos, y estuvo concentrada principalmente en los bancos expuestos a altas presiones competitivas. También hallamos evidencia de externalidades positivas en los mercados de financiación.

Palabras clave: política monetaria no convencional, TLTRO, políticas crediticias, competencia.

Códigos JEL: G21, E52, E58.

1 Introduction

Since the 2008 global financial crisis, central banks around the world have undertaken numerous unconventional monetary policies to prevent a credit crunch, stimulate aggregate demand and boost inflation. In the euro area these included the provision of liquidity using fixed-rate full-allotment tenders, a lengthening of the maturity of central bank credit operations, a wider set of eligible collateral, large scale purchase programmes of public and private sector assets, negative interest rates and forward guidance.

The goal of this paper is to assess the impact of the Eurosystem's Targeted Long-Term Refinancing Operations (TLTROs) on the lending policies of euro area banks. The TLTROs are liquidity providing central bank operations with maturity of up to four years. They were announced in June 2014 in a context of slow economic growth, weak inflation outlook and subdued monetary and credit dynamics in the euro area. Unlike their predecessors (VLTROs[1]), the TLTROs explicitly targeted lending to the real economy and were designed to reduce the incentives to banks to use the liquidity for sovereign debt purchases. Our analysis aims to capture both the direct impact of the measure on the lending policies of banks which accessed the TLTROs and the indirect effects, as the remaining banks react strategically to the change in the behaviour of TLTRO bidders. Such indirect effects operate via changes in the competitive environment in banks' credit and funding markets. Their inclusion as object for analysis is a distinct feature of this study.

To guide our empirical research, we first present a simple extension of the Monti-Klein model of oligopolistic competition in the banking sector. For the sake of simplicity, we consider only two banks, a safe and a risky bank, which compete à la Cournot in the loan and deposit markets. The main departure from the standard model is the introduction of a funding impairment: one of the banks is perceived to be risky, resulting in higher funding costs. Importantly, it also leads to an asymmetric recourse to the TLTROs and allows us to study the direct impact of the measure on the risky bank, which borrows from the central bank, and the indirect impact on its competitor, the safe bank.

This asymmetric recourse arises as the TLTROs borrowing costs are higher than the deposit funding costs of the safe bank but attractive for its risky competitor. After the introduction of the measure the risky bank can fund part of its loan portfolio with the TLTROs rather than with more costly deposits. The introduction of the TLTROs has both direct effects on the bidding bank (the risky bank) and indirect effects on the non-bidder (the safe bank). Regarding direct effects, the funding cost relief due to the TLTROs leads to an expansion of the loan supply by the risky bank. With respect to indirect effects, we must differentiate between two opposite forces. On the one hand, competition in the credit market becomes stronger. The TLTROs, by reducing the risky bank's marginal funding costs, allow it to compete more aggressively in the loan market. As banks compete à la Cournot, loan quantities are strategic substitutes, implying that an expansion in the credit supply of the risky bank leads to a contraction in the credit supply of the safe bank. On the other hand, competition in the deposit market weakens because the risky bank substitutes some deposits with TLTRO funding. The lower demand for deposits leads to lower deposit rates, which translate into lower marginal

1 Longer-term refinancing operations with a three year maturity implemented in December 2011 and February 2012. The abbreviations "VLTROs" stands for very long-term refinancing operations.

costs also for the safe bank. Ceteris paribus, its loan supply expands. Hence, the overall indirect impact of the TLTROs is a priori ambiguous and must be assessed empirically.

The empirical analysis measures bank lending policies with credit standards (i.e., the internal guidelines or loan approval criteria of a bank) and loan margins (i.e., the agreed spread over the relevant reference rate), as reported by banks in the ECB's Bank Lending Survey (BLS). Several papers in the literature, such as Lown and Morgan (2006), and Ciccarelli et al. (2015), identify credit standards as reported in lending surveys as proxies for credit supply. We use the confidential answers by 130 banks from 13 euro area countries, matched with individual bank balance-sheet information and operations data.

The empirical identification of the causal impact of the TLTROs on bank lending policies needs to address two major issues. First, banks participated in the TLTROs on a voluntary basis and thus selection into treatment is non-random. To obtain consistent estimates we construct an instrumental variable for the TLTRO uptake. The proposed instrumental variable comes from the institutional setting of the TLTROs, as in Benetton and Fantino (2017). In particular, we exploit an allocation rule by the policy, according to which banks could borrow an amount equivalent to 7% of their eligible loans outstanding on 30 April 2014. Crucially, the stock of eligible loans was measured at a date prior to the announcement of the policy (June 2014). The initial allowance constitutes an exogenous component of the TLTRO uptakes, as it is based on exogenous parameters that are common across banks and on pre-determined bank balance sheet characteristics. The relevance of our instrument is ensured by the fact that in the first two TLTROs 80% of the participating banks borrowed at least 90% of their initial allowance (Figure 1).

Second, credit supply must be disentangled from credit demand.[2] For instance, banks with high TLTRO uptakes may face more dynamic demand conditions or deal with more creditworthy borrowers, which may induce them to ease credit standards or narrow margins. To control for demand factors, we include a large vector of control variables that measure the evolution of credit demand by firms and households in different segments (e.g. loans to SMEs), as well as the factors underlying those developments (e.g., consumer confidence), as reported by banks in the BLS.

Our results suggest strong indirect effects of the TLTROs on credit standards, but no significant impact on margins on safe loans. In the case of loans to non-financial corporations, a standard deviation increase in the TLTRO uptakes of a bank's competitors leads to a 5.3 pp increase in the probability that it eases overall credit standards. The impact on credit to large firms is even stronger, resulting in an 8.8 pp increase in the probability of easing credit standards. In the case of loans to households for house purchase, a standard deviation increase in the TLTRO uptakes of a bank's competitors implies an 8.8 pp increase in the probability that the bank eases its own credit standards. These effects are concentrated in banks with low market share that face high competitive pressures, suggesting that competition in the credit market plays a crucial role. By contrast, the TLTRO uptakes of a bank's competitors have no significant effect on margins on average loans in either segment. We also find some evidence that the TLTROs do not lead to excessive risk taking, as TLTRO uptakes

2 While the BLS aims to distinguish between supply (measured by credit standards and loan margins) and demand, note that some of the factors underlying the changes in credit standards and loan margins have a demand component. According to the survey, credit standards and loan margins are determined by cost of funds and balance sheet constraints, pressure from competition, bank's risk tolerance and perception of risk. The last factor comprises the sub-factors "general economic situation", "industry or firm-specific situation" and "risk related to the collateral demanded".

are negatively correlated with the probability of narrowing margins on riskier loans. All in all, the results suggest that the TLTROs generate positive funding externalities on non-bidders.

Regarding direct effects, the transmission of monetary policy takes place mainly through the adjustment of margins on loans to relatively safe borrowers. The effects are stronger in the subsample of bidding banks (i.e., the intensive margin of monetary policy pass-through) than in the comparison between bidders and non-bidders (i.e., the extensive margin). In particular, for the subsample of bidding banks, a standard deviation increase in a bank's TLTRO uptake increases the probability of narrowing margins on average loans to firms by 20 pp and raises the probability of narrowing margins on average loans to households for house purchase by 28.6 pp. With respect to the extensive margin, bidding banks are much more likely (62 pp) to narrow margins on average loans than non-bidders in the case of housing loans, while there are no significant differences between the two groups in the segment of corporate loans.

The rest of the paper is organised as follows. Section 2 reviews the most relevant literature on the subject and discusses our key contributions. Section 3 describes the institutional background of the TLTROs. Section 4 presents a simple theoretical model to guide our empirical analysis. Section 5 discusses the identification strategy in detail. Section 6 explains the data sources and the variables employed in the empirical analyses. Section 7 comments on the main results. Section 8 explains some robustness tests. Section 9 concludes.

2 Related Literature and contribution

Our paper belongs to the broad and by now mature literature on the effects of monetary policy on bank credit supply, the so-called bank lending channel. It belongs to the set of empirical studies focusing on the impact on unconventional monetary policies. The analysis is most closely related to the branch of the literature analysing the impact of large scale liquidity injections via central bank credit operations, as introduced for instance by the ECB and Fed in the course of the financial crisis.[3] Many of the papers using euro area data focus on the two longer-term refinancing operations with a 3 year maturity (often labelled 'VLTROs' or '3yLTROs') of 2011-2012, in which an unprecedented overall amount of around one trillion euros were allotted to banks in the euro area.

As regards analysis using aggregate data, Darracq-Paries and De Santis (2015) use information on credit supply conditions from the ECB's Bank Lending Survey (BLS) to identify the credit supply shock implied by the VLTROs in a panel-VAR for euro area countries. Their counterfactual experiments point to a relevant increase in bank loans to non-financial corporations and a moderate narrowing of lending rate spreads, together with a significant increase in the euro area real GDP. Casiraghi et al. (2016) use bank-level data and the individual answers of the Italian banks to the BLS, together with the Bank of Italy model of the Italian economy, to assess the effectiveness of the ECB's Securities Markets Programme (SMP), the VLTROs and the Outright Monetary Operations (OMT). They find that the VLTROs had a significant impact on credit supply, mainly through a sizeable reduction in the interest rates paid by Italian banks in the interbank market. They also find that the overall impact of the three policies on GDP growth, mainly via the credit channel, was a cumulative increase of 2.7 pp. over the period 2012–2013. A different approach consists of exploiting very granular data coming from credit registers to identify shifts in credit supply using the Khawja and Mian (2008) methodology. Andrade et al. (2015), in their study of the French banking system, find that the VLTROs had a positive and sizeable impact on the provision of credit to firms. The opportunity to replace outstanding short-term by longer-term central bank funding (as banks rolled over their existing borrowings from the Eurosystem into the VLTROs) enhanced this transmission. Similarly, Jasova et al. (2018), in their analysis of the Portuguese case, show that the extension of bank debt maturity caused by the VLTROs had a positive and sizeable impact on bank lending to the real economy thanks to the reduction in rollover risk. Garcia-Posada and Marchetti (2016), find that the VLTROs had a positive moderate-sized effect on the supply of bank credit to Spanish firms. The effect was greater for illiquid banks and that it was driven by credit to SMEs, as there was no impact on loans to large firms. Carpinelli and Crosignani (2017), for the case of Italy, show that banks that experienced a wholesale market dry-up before the intervention reduced their credit supply during the period of funding stress and restored their credit supply once the central bank injected liquidity into the system, partly due to a regulatory change that expanded eligible collateral.[4]

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3 Examples of injections of liquidity via central bank credit operations by the Eurosystem include the liquidity-providing longer-term refinancing operations with a one year maturity announced in May 2009, the longer-term refinancing operations with a 3 year maturity announced in December 2011 and the two series of TLTROs, announced in June 2014 and in March 2016. The liquidity providing credit operations introduced by the Fed include the Primary Dealer Credit Facility, the Term Auction Facility, Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility, the Commercial Paper Funding Facility, and the Term Asset-Backed Securities Loan Facility.

4 The Italian government offered banks the possibility to obtain a government guarantee on securities otherwise ineligible as collateral against a fee.

While the above evidence suggests that the VLTROs were effective in preventing a credit crunch in the euro area, there is also ample evidence that banks used part of the liquidity to purchase high-yield government bonds and engage in carry trade strategies (Acharya and Steffen (2015), Carpinelli and Crosignani (2017), Crosignani et al (2017), Jasova et al. (2018)), which reinforced the sovereign-bank nexus. Consistent with these findings, Van der Kwaak (2017) builds a DSGE model in which the provision of central bank liquidity, for which commercial banks pledge collateral in the form of government bonds, induces banks to shift from private credit to government bonds, and finds that the cumulative effect on output is zero. Similarly, the model of Corbisiero (2018) shows that the sovereign-bank nexus can impair a proper monetary transmission mechanism in the euro area, because in times of high sovereign yields central bank liquidity injections can lead banks in stressed countries to increase their domestic sovereign holdings, rather than channelling funds to the real economy.

As a response to those criticisms, the TLTROs explicitly target lending to the real economy. The literature on the topic is still scarce. Balfoussia and Gibson (2016) analyse the potential impact of the TLTROs on the real economic activity of the euro area within a VAR framework. Their results suggest a significant impact of the TLTROs on economic growth via an easing of financial conditions. Andreeva (2018) studies the impact of the TLTROs on bank lending rates and volumes in a difference-in-differences framework. She finds that the TLTROs successfully boosted the supply of eligible bank loans with limited spillover effects on not targeted ones. Benetton and Fantino (2017) use the Italian credit register to analyse the pass-through of the TLTROs to the cost of credit to Italian firms. As in our paper, they use the initial borrowing allowance as an instrument for the endogenous take-up in the TLTROs in a diff-in-diff framework. They find that banks participating in the TLTROs decrease their rates by 20 basis points relative to non-participating banks. Crucially, the pass-through of the TLTROs depends on the competition in local credit markets, as proxied by the Herfindahl-Hirschman Index (HHI): a firm in a province with a standard deviation higher level of concentration experiences almost no decrease in the rates as a result of the liquidity injection.

Our paper, while sharing some similarities with Benetton and Fantino (2017), it possesses some distinctive features. First, we analyse both the direct and the indirect channel of the transmission of the TLTROs to the banking sector. Previous literature has focused on the direct channel (the direct impact of a bank's participation in the programme on its own credit supply) and has ignored the indirect channel (the impact of the participation of a bank's competitors on the bank's credit supply via changes in the competitive environment). Second, we analyse the impact of the TLTROs on both bank credit standards and margins. Confidential survey data allows us to study lending standards, a variable that is not directly observed in credit registers.[5] A related analysis using banks' individual responses in the BLS to assess the impact of the APP and negative interest rates can be found in Altavilla et al. (2018). Third, we analyse both loans to firms and households, while previous literature has exclusively studied the former. Finally, we analyse the transmission of unconventional monetary policy in 13 euro area countries, while the papers that rely on credit registers only study the effect on a single country.

5 This does not mean that the evolution of credit standards cannot be studied using hard data. See, for instance, Rodano et al. (2017).

3 Institutional framework

On the 5th of June 2014, the ECB decided to support bank lending to the euro area nonfinancial private sector through a first set of Targeted Longer-Term Refinancing Operations (TLTRO I).[6] This policy was implemented through eight auctions, one each quarter from September 2014 to June 2016, and participation was open to institutions that were eligible for the Eurosystem open market operations. In addition, a second series of four operations (TLTRO II) were announced on the 10th of March 2016[7] and conducted between June 2016 and March 2017 at a quarterly frequency. This paper focuses on the effect of TLTRO I on banks' lending policies, as measured via credit standards and margins.

All 8 TLTROs-I mature in September 2018, although early voluntary repayments can be done starting 24 months after each TLTRO. The interest rate on the TLTROs is fixed over the life of each operation at the rate on the Eurosystem's main refinancing operations (MROs) prevailing at the time of take-up, plus a fixed spread of 10 basis points in the case of the first two TLTROs. The spread was abolished in the subsequent TLTRO-I operations.

The borrowing limits were different for the first two operations in September and December 2014 (TLTROs against initial borrowing allowances/'stock TLTROs') and the last six operations between March 2015 and June 2016 (TLTROs against additional borrowing allowances/ 'flow TLTROs'). In the case of the stock TLTROs, banks' borrowing could not exceed an amount equivalent to 7% of their eligible loans outstanding on 30 April 2014. Eligible loans are loans to the euro area non-financial private sector, excluding loans to households for house purchase.[8] In the case of the flow TLTROs, the maximum amounts that could be borrowed depended on the evolution of banks' net eligible lending in excess of bank-specific benchmarks. More precisely, the additional borrowing allowance was limited to three times the difference between the net lending since 30 April 2014 and the benchmark at the time of each borrowing. The benchmark was computed as follows:

- for banks that exhibited positive eligible net lending[9] in the twelve-month period to 30 April 2014: the benchmark was always set at zero.
- for banks that exhibited negative eligible net lending in the year to 30 April 2014, different benchmarks applied. For the 12 months between 30 April 2014 and 30 April 2015, the average monthly net lending of each in the year to 30 April 2014 was extrapolated. For the 12 months between 30 April 2015 and 30 April 2016, the benchmark remained constant. Overall, its shape resembled a kinked line.

Banks that borrowed in the TLTROs and failed to achieve their benchmarks as at 30 April 2016 were required to pay back their borrowings in full in September 2016. Participation in the TLTRO-I was massive. Euro area banks borrowed around 212 billion euros in the two initial TLTROs (September and December 2014) and 220 billion euros in the six additional TLTROs (between March 2015 and June 2016).

6 Press release: https://www.ecb.europa.eu/press/pr/date/2014/html/pr140605_2.en.html
7 Press release: https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310_1.en.html
8 The eligible loans also exclude loans securitised or otherwise transferred without derecognition from the balance sheet.
9 Eligible net lending means gross lending in the form of eligible loans net of repayments of outstanding amounts of eligible loans during a specific period.

4 Theoretical framework

To illustrate the direct and indirect effects of the TLTROs on banks' credit supply we present a simple version of the Monti-Klein model with oligopolistic competition. In particular, consider a banking system with two banks, a safe bank S and a risky bank R, which compete à la Cournot. These banks face a downward-sloping demand for loans L and an upward-sloping supply for safe deposits D. The decision variables of bank $i = S, R$ are the quantity of loans L^i and the quantity of deposits D^i. For simplicity we abstract from funding sources other than deposits and assets other than loans. De facto our model captures by construction the most traditional form of banking and disregards banks' capital market/trading/asset management activities. When choosing the optimal amounts of loans each bank takes into account that a marginal increase in its supply of loans reduces equilibrium rates on loans, which in turn lowers the unit return on its own loan portfolio. The same logic applies to their demand for deposit funding.

For simplicity, let us assume that the inverse demand for loans $r_L(L^S + L^R)$ and the inverse supply of deposits $r_D(D^S + D^R)$ are characterised by the following linear functions:

$$r_L(L^S + L^R) = a - (L^S + L^R) \tag{1}$$

$$r_D(D^S + D^R) = c + (D^S + D^R) \tag{2}$$

In addition, the balance sheet identity needs to hold, which requires in our case that banks need to fund their loan portfolio with deposits:

$$L^i = D^i \text{ for } i = S, R \tag{3}$$

The market clearing condition in the model economy requires that:

$$L^* = L^S + L^R \text{ , where L* is the aggregate loan supply in the economy} \tag{4}$$

$$D^* = D^S + D^R \text{, where D* is the aggregate deposit funding} \tag{5}$$

$$L^* = D^* \tag{6}$$

Let us first consider the symmetric case in which bank S and bank R are identical. Bank S' profit maximization problem is the following:

$$max_{L^S, D^S} \;\; \pi^S = (a - (L^S + L^R))L^S - (c + (D^S + D^R))D^S \tag{7}$$

$$\text{s.t.: } L^S = D^S$$

The solution of the above maximisation program, combined with $L^R = D^R$, yields bank S's reaction function to bank R's loan supply decision $L^S(L^R)$:

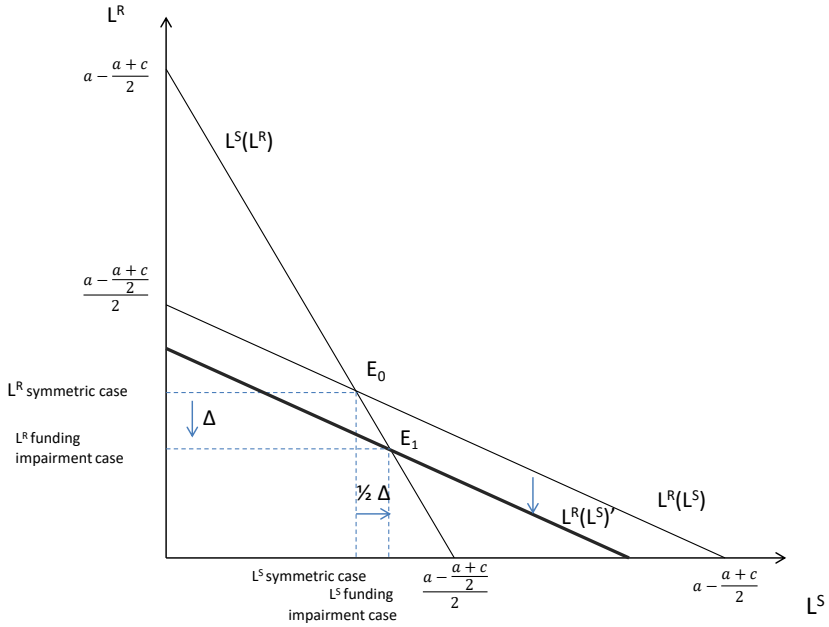
$$L^S = \frac{a - \frac{a+c}{2}}{2} - \frac{1}{2} L^R \tag{8}$$

Since the maximisation problem is fully symmetric for bank R, its reaction function $L^R(L^S)$ is the following:

$$L^R = \frac{a - \frac{a+c}{2}}{2} - \frac{1}{2} L^S \tag{9}$$

The standard reaction functions (8) and (9) are depicted by the thin lines in Chart 1. The intersection of those lines represents the Nash equilibrium E_0 in the symmetric case. Note that given the oligopolistic setting, the overall quantity of loans and deposits in the economy will be lower compared to perfect competition. By slightly reducing the quantity of loans and deposits banks S and R can keep the rates on bank loans higher while those on deposits lower than under perfect competition. This allows banks to extract some of the consumer surplus, a standard result in this type of model.

Chart 1: Loan supply reaction functions in the symmetric case and in the presence of funding impairments



We now turn to the asymmetric case. We assume that bank S is perceived to be safe, while bank R is perceived to be risky. As a result, depositors require an extra compensation of ρ to fund bank R. The premium ρ reflects the perceived probability of default of that bank. Bank R's profit maximization problem is the following:

$$\max_{L^R, D^R} \ \pi^R = (a - (L^S + L^R))L^R - (1+\rho)(c + (D^S + D^R))D^R \tag{10}$$

s.t.: $L^R = D^R$

The solution of the above maximisation program, combined with the balance sheet identity for the safe bank $L^S = D^S$, yields bank R's reaction function to bank S's loan supply decision $L^R(L^S)'$ in the case of a funding impairment:

$$L^R = \frac{a - \frac{a+c}{1 + \frac{1}{1+\rho}}}{2} - \frac{1}{2} L^S \tag{11}$$

The risk premium required by investors translates into higher marginal funding costs for bank R and as result its overall supply of loans declines irrespective of the volume of loans provided by its competitor S. This leads to a parallel downward shift in bank's R reaction

function, as depicted by the thick line in Chart 1. The intersection between the new reaction function of bank R, $L^R(L^S)'$, and the reaction function of bank S, $L^S(L^R)$, represents the new Nash equilibrium E_1. The comparison of the two equilibria E_0 and E_1 yields two main insights. First, the funding impairment of the risky bank leads to a decline in its supply of bank loans. Second, overall credit supply is also lower, as the supply of loans by the safe bank compensates for only half of the missing lending by its competitor (see equation 8).

We now turn to the impact of TLTROs on the equilibrium in the loan market. We will show that the introduction of the TLTROs affects the loan supply of both banks even if only one of them actually bids in the operation, as the TLTROs have both direct and indirect effects. In particular, assume that banks can fund up to a fraction β of their loan portfolio with TLTROs at an exogenous interest rate i. We assume that the central banks sets i equal to deposit rate paid by the safe bank. In addition, we assume that bidding in the TLTRO entails additional, small fixed administrative costs.[10] In this set-up, the safe bank will abstain from bidding since it does not benefit from a funding cost reduction and avoids the administrative costs. By contrast, given the price attractiveness of the TLTRO funding, the risky bank will exhaust its borrowing limit, so that $TLTRO = \beta L^R$. The balance sheet identity of the risky bank includes now TLTROs in addition to deposit funding: $L^R = D^R + TLTRO$. The combination of these two equations yields the new constraint, $(1-\beta)L^R = D^R$, which indicates that the risky bank only funds a proportion $1-\beta$ of their loan portfolio with deposits. The new maximisation problem of the risky bank is the following:

$$\max_{L^R,D^R}\ \pi^R = (a-(L^S+L^R))L^R - (1+\rho)\big(c+(D^S+D^R)\big)D^R - i\cdot TLTRO \qquad (12)$$

s.t.: $(1-\beta)L^R = D^R$ and $TLTRO = \beta L^R$.

The solution of the above maximisation program, combined with the balance sheet identity of the safe bank $L^S = D^S$, yields bank R's reaction function in the case of funding impairments after the introduction of TLTROs $L^R(L^S)''$:

$$L^R = \frac{\xi}{2} - \left(\frac{1}{2} + \frac{1}{2}\frac{\beta(1-\beta)}{\frac{1}{1+\rho}+(1+\beta)^2}\right)L^S \qquad (13)$$

$$where\ \xi = a - i\beta - \frac{1-\beta}{\frac{1}{1+\rho}+(1-\beta)^2}(a+c) + \frac{\beta(1-\beta)}{\frac{1}{1+\rho}+(1-\beta)^2}(a+i(1-\beta))$$

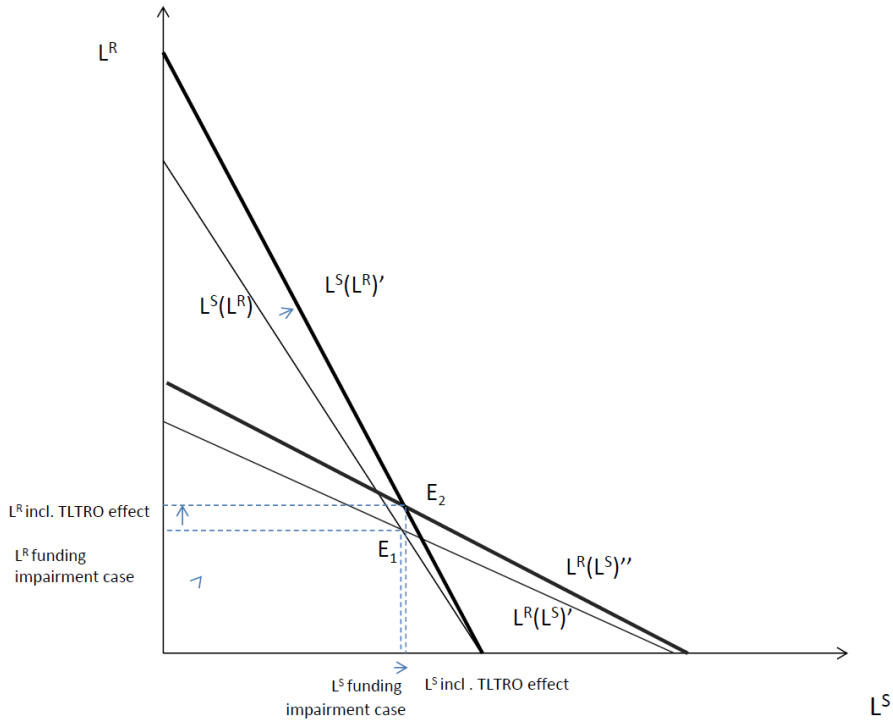
Finally, note that the maximisation problem of bank S remains unchanged after the introduction of TLTRO. However, the shadow price of extending an additional unit of loans – in our case the marginal costs of deposit funding – for the safe bank changes. Since the risky bank substitutes deposits with TLTROs the competition in the deposit market weakens, providing a boost to the supply of loans by bank S. Mechanically, this effect is taken into account by considering the new balance sheet identity of the risky bank ($(1-\beta)L^R = D^R$) when obtaining bank S' loan supply reaction function. The new reaction function of the safe bank is the following:

$$L^S = \frac{a-\frac{a+c}{2}}{2} - \left(\frac{1}{2}-\frac{1}{4}\beta\right)L^R \qquad (14)$$

10 These fixed administrative costs could be the reporting requirements and additional audit obligation that are a pre-requisite for the access to the TLTROs.

The comparison of equations (8) and (14) reveals that the safe bank's loan supply is now less sensitive to changes in the supply of loans by the risky bank. This is illustrated in Chart 2, which depicts the equilibria in the loan market before the introduction of the TLTROs (E_1) and following the implementation of the TLTROs (E_2). The reaction functions of both banks shift. The reaction function of the safe bank becomes steeper, while the intercept with the horizontal L^S axis remains unchanged. In the case of the risky bank, both the slope and the intercept change, as the reaction function steepens and shifts upwards: given that the risky bank receives a significant funding cost relief due to the TLTROs, its supply of loans increases for any given value of loans granted by the safe bank. The new Nash equilibrium is E_2, which in the example features higher loan supply by both banks. While lending by the risky bank always increases in equilibrium, for the safe bank it very much depends on the exact parameter values, in particular on the shape of the loan demand and deposit supply functions (a and c), the fraction of bank loans that can be funded with TLTROs (β) and the exact TLTRO rate (i).

Chart 2: Loan supply reaction functions in the presence of funding impairments before and after the introduction of a TLTRO



To put it differently, the impact on the loan supply by the safe bank is ambiguous because there are two opposite effects. On the one hand, the TLTROs reduce the marginal costs of its competitor, the risky bank, which expands its loan supply. Thereby the TLTROs promote stronger competition in the credit market. Since the banks compete à la Cournot, loan quantities are strategic substitutes, implying that an increase in the loan supply of the risky bank leads to a contraction in the loan supply of the safe bank. On the other hand, the TLTROs lead to weaker competition in the deposit market by the risky bank. As the risky bank substitutes deposits with TLTROs, competition in the deposit market weakens, which in turn implies lower marginal funding costs for the safe bank, which boosts its loan supply.

The upshot of the theoretical discussion is that the TLTROs may have important indirect effects on the credit supply of non-participating banks, as measured empirically by

credit standards and loan margins. In particular, the TLTROs may have important funding externalities on non-bidding banks, which are not necessarily restricted to retail funding. For instance, as the TLTROs allow participating banks to replace market-based bank funding with borrowing from the central bank, they can result in a reduction in the supply of bank bonds in the economy. The scarcity of bank bond issuance should translate into lower yields on bank bonds, including those issued by intermediaries not participating in the TLTROs. In addition, the TLTROs may foster competition in the credit market by reducing the marginal funding costs of participating banks, which allows them to expand their credit supply. Non-participating banks may react by contracting their loan supply or by expanding their loan supply depending on which effect dominates: a) the improved market position of competitors that borrow from the TLTROs, which benefit from a direct funding costs reduction and are therefore able to (re-) gain market shares at the expense of non-participants or (b) the indirect funding costs relief enjoyed by bidders and non-bidders alike, which supports the supply of bank loans of both. Hence, the overall impact of the TLTROs on non-participating banks is a priori ambiguous and must be assessed empirically.[11]

11 Note that demand for bank loans will increase as the lower funding costs of both bidders and non-bidders results in lower rates charged on bank loans.

5 Identification strategy

Our main goal is to estimate the impact of the TLTROs on banks' lending policies, as measured by bank credit standards and margins. There are two main channels. The first channel is direct: by participating in the TLTROs, a bank may reduce its funding costs and improve its overall liquidity position. This allows participating banks to relax credit standards, narrow margins and compete more aggressively. The second channel is indirect: TLTROs may influence on a bank's lending policies through the positive effect on the balance sheets of its competitors and the less tense competition in important funding markets due to bidders' recourse to long-term central bank funding.

We construct two variables to measure those effects. The direct effect is captured with $\text{bank TLTRO}_{\text{i}}$, which is computed as the ratio between the uptake in the initial TLTROs (September and December 2014) by bank i and its total assets.[12] The indirect effect is captured with $\text{country TLTRO}_{(\text{i})\text{c}}$, which is the ratio between the sum of the TLTRO uptakes of all the other banks in the country (i.e., excluding bank i) and the total assets of those banks. Formally:

$$\text{bank TLTRO}_{\text{i}} = \frac{\text{TLTRO}_{\text{i}}}{\text{total assets}_{\text{i}}} \tag{15}$$

$$\text{country TLTRO}_{(\text{i})\text{c}} = \frac{\sum_{\text{j}\neq\text{i}}^{\text{N}-1} \text{TLTRO}_{\text{j}}}{\sum_{\text{j}\neq\text{i}}^{\text{N}-1} \text{total assets}_{\text{j}}} \tag{16}$$

There are two main specifications. In the first one, we estimate the probability that lending policies ease (i.e., eased credit standards or narrower margins, $\text{Y}_{\text{it}} = 1$) as a function of $\text{bank TLTRO}_{\text{i}}$, $\text{country TLTRO}_{(\text{i})\text{c}}$ and a wide set of bank controls, demand controls and macro controls, plus time dummies. Formally:

$$\text{Y}_{\text{ict}} = \alpha \cdot \text{bank TLTRO}_{\text{i}} + \beta \cdot \text{country TLTRO}_{(\text{i})\text{c}} + \text{X}'_{\text{it}-1}\gamma + \text{W}'_{\text{it}-1}\delta + \text{X}'_{\text{ct}-1}\theta + \text{d}_{\text{t}} + u_{ct} + \varepsilon_{\text{ict}} \tag{17}$$

where i is bank, c is country, t is quarter, Y_{it} is the binary outcome variable (credit standards or margins), $\text{X}'_{\text{it}-1}$ is a vector of time-varying bank controls, $\text{W}'_{\text{it}-1}$ is a vector of demand controls (which also vary at the bank-quarter level), $\text{X}'_{\text{ct}-1}$ is a vector of time-varying macro controls, d_{t} are time fixed effects, u_{ct} is a country-quarter error component and ε_{ict} is an individual error term. The main coefficient of interest is β, which captures the indirect effect of the TLTROs on lending policies.

The second specification is quite similar to (17), but focuses instead on the direct effect of the TLTROs. To do so, we drop the variable $\text{country TLTRO}_{(\text{i})\text{c}}$ and the macro controls and saturate the regression with country-time fixed effects (d_{ct}). Formally:

$$\text{Y}_{\text{ict}} = \rho \cdot \text{bank TLTRO}_{\text{i}} + \text{X}'_{\text{it}-1}\gamma + \text{W}'_{\text{it}-1}\delta + \text{d}_{\text{ct}} + \varepsilon_{\text{ict}} \tag{18}$$

The main coefficient of interest is ρ, which captures the direct effect of the TLTROs on lending policies.

12 Using overall take-up instead of the take-up in only the first two TLTRO-I leads to overall very similar empirical findings but leads to a weaker instrument, in terms of the first-stage regressions.

We estimate (17) and (18) for the period 2014Q2-2017Q4. Hence, our empirical strategy implies a comparison of changes in credit standards/margins between treated and non-treated banks (e.g. high and low $\text{country TLTRO}_{(i)c}$) after the announcement of the TLTROs in June 2014.[13] We also perform placebo tests to make sure that any potential differences in the outcome variable across the two groups of banks were not present already before the TLTROs and thus can be attributed to the introduction of the measure.

Estimation of (17) and (18) by OLS may lead to biased and inconsistent estimates due to selection bias.[14] In particular, selection into treatment is non-random, as banks participated in the TLTROs on a voluntary basis. In particular, the evaluation of the policy may be biased upwards if the banks that borrowed (more) from the TLTRO had, on average, better lending opportunities. By contrast, the estimates may be biased downwards if the banks that borrowed (more) from the TLTRO had greater deleveraging needs.

In order to obtain consistent estimates of β and ρ we use two instrumental variables that come from the institutional setting of the TLTROs, as in Benetton and Fantino (2017). In particular, as explained in section 3, in the initial TLTROs (September and December 2014) banks could borrow an amount equivalent to 7% of their eligible loans outstanding on 30 April 2014. Crucially, notice that the stock of eligible loans was measured at a date prior to the announcement of the policy (June 2014). This initial allowance constitutes the exogenous component of the TLTRO uptakes, as it is based on exogenous parameters that are common across banks and on pre-determined banks' balance sheet characteristics. By contrast, we disregard the amounts borrowed in the additional TLTROs (between March 2015 and June 2016) because the additional borrowing allowances depended on the evolution of banks' eligible lending activities in excess of bank-specific benchmarks. Hence, both the additional TLTRO uptakes and their borrowing allowances are clearly endogenous variables.

Therefore, we construct two instrumental variables, bank allowance_i and $\text{country allowance}_{(i)c}$. The first one is computed as the ratio between the initial borrowing allowance of bank i and its total assets. The second one is constructed as the ratio between the sum of the initial allowance of all the other banks in the country (i.e., excluding bank i) and the total assets of those banks. Formally:

$$\text{bank allowance}_i = \frac{\text{initial allowance}_i}{\text{total assets}_i} \tag{19}$$

$$\text{country allowance}_{(i)c} = \frac{\sum_{j\neq i}^{N-1} \text{initial allowance}_j}{\sum_{j\neq i}^{N-1} \text{total assets}_j} \tag{20}$$

We then estimate (17) and (18) by 2SLS.[15] Note that equation (17) includes the individual TLTRO uptakes, $bank\ TLTRO_i$, although we are really only interested in the

13 Note that our dependent variables credit standards and, to a lower extent, loan margins, are quite sticky, i.e., they evolve very slowly over time. This means that we must also use the cross-section variation for identification, which renders the inclusion of bank fixed effects not feasible.

14 In addition to selection bias, the fact that one regressor, $\text{country TLTRO}_{(i)c}$, is the average of another, bank TLTRO_i, may complicate the interpretation of OLS estimates of equation (17). See Angrist and Pischke (2009), pages 193-195, for an explanation.

15 Notice that the estimation of (17) via OLS would entail in addition an omitted variables bias from the correlation between $\text{country TLTRO}_{(i)c}$ and other country-quarter effects embodied in the error component u_{ct}. For instance, the country's business cycle may affect the country's level of TLTRO uptakes because it determines banks' lending opportunities and firms' investment returns and it also affects credit standards and margins, which are usually anticyclical. This may generate a spurious correlation between the two. While the inclusion of time-varying macro controls (such as the industrial production index and the unemployment rate) mitigates this problem, a more complete solution is the approach we follow, IV estimation. By contrast, the estimation of (18) does not face this challenge, as the use of country-time fixed effects d_{ct} eliminates this source of variation.

aggregate effect of TLTROs –the effect of $country\ TLTRO_{(i)c}$- in that specification. The inclusion of $bank\ TLTRO_i$ is motivated by the fact that any instrument for $country\ TLTRO_{(i)c}$ must be also correlated with $bank\ TLTRO_i$. By including it in the regression (as a second endogenous variable) we avoid a violation of the exclusion restriction.[16]

Finally, an additional identification challenge is to disentangle shocks to credit supply from shocks to credit demand, as those shocks are often correlated and what we observe are equilibrium outcomes. For instance, banks with high TLTRO uptakes may face more dynamic demand conditions or deal with more creditworthy borrowers, which may induce them to ease credit standards or narrow margins. To control for demand factors, we include a large vector of control variables that measure the evolution of credit demand by firms and households in different segments (e.g. loans to SMEs), as well as the factors underlying those developments (e.g., consumer confidence) as reported by banks in the BLS.[17]

Regarding inference, standard errors are clustered at the bank level to allow for potential heteroscedasticity and serial correlation within groups in the error structure. Nevertheless, results are very similar when clustering at a higher level of aggregation such as country.[18]

16 See Acemoglu and Angrist (2000) for a similar identification strategy in the context of the social returns to schooling and human capital externalities.

17 In the case of non-financial corporations, demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. In the case of housing loans, demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects, consumer confidence, the general level of interest rates, debt refinancing and the regulatory and fiscal regime of housing markets.

18 While clustering at the country level may lead to standard errors that are biased downwards due to few clusters (Bertrand et al. 2004), inference using wild cluster bootstrap, a solution developed by Cameron et al. (2008), leads to qualitatively similar results.

6 Data and variables

The data employed in the baseline analyses come from four sources: the Individual Bank Lending Survey (iBLS), the Individual Balance Sheet Items (IBSI), the Individual MFI Interest Rate (IMIR) databases and proprietary information on banks' participation in central bank credit operations. The iBLS database contains confidential, non-anonymized replies to the ECB's Bank Lending Survey (BLS) for a subsample of banks participating in the BLS. The BLS is a quarterly survey through which euro area banks are asked about developments in their respective credit markets since 2003.[19] Currently the sample comprises more than 140 banks from 19 euro area countries and covers around 60% of the amount outstanding of loans to the private non-financial sector in the euro area. However, there are six countries that do not share the confidential, non-anonymized replies to the BLS so they do not participate in iBLS (see Table 1 for a view of the distribution of observations per country).[20]

The BLS is specifically designed to distinguish between supply and demand conditions in the euro area credit markets. Supply conditions are measured through credit standards (i.e., the internal guidelines or loan approval criteria of a bank) and credit terms and conditions (loan margins, loan size, loan maturity, etc).[21] The BLS also contains information on the evolution of credit demand by firms and households and the factors underlying these developments. In addition, several ad hoc questions have been added in the recent years to analyse the impact of the main non-standard monetary policy measures introduced by the ECB, such as the negative deposit facility rate (DFR) or the expanded asset purchase programme (APP), on several dimensions such as banks' balance sheets, credit standards and terms and conditions.

IBSI and IMIR contain balance-sheet and interest rate information of the 326 largest euro area banks,[22] which is individually transmitted on a monthly basis from the national central banks to the ECB since July 2007. We have matched both datasets with the iBLS and information on banks' participation in Eurosystem credit operations, including the TLTROs. We restrict the sample to the period spanning from 2014Q2 (i.e., announcement of TLTRO-I) to 2017Q4.[23] The resulting sample contains 1,784 observations corresponding to an unbalanced

19 For more detailed information about the survey see Köhler-Ulbrich, Hempell and Scopel (2016). Visit also https://www.ecb.europa.eu/stats/ecb_surveys/bank_lending_survey/html/index.en.html

20 Germany participates in the iBLS with a sub-sample of banks that have agreed to transmit their non-anonymized replies to the ECB.

21 According to the BLS, credit standards are the internal guidelines or loan approval criteria of a bank. They are established prior to the actual loan negotiation on the terms and conditions and the actual loan approval/rejection decision. They define the types of loan a bank considers desirable and undesirable, the designated sectoral or geographic priorities, the collateral deemed acceptable and unacceptable, etc. Credit standards specify the required borrower characteristics (e.g., balance sheet conditions, income situation, age, employment status) under which a loan can be obtained. On the other side, credit terms and conditions refer to the conditions of a loan that a bank is willing to grant, i.e., to the terms and conditions of the individual loan actually approved as laid down in the loan contract which was agreed between the bank and the borrower. They generally consist of the agreed spread over the relevant reference rate, the size of the loan, the access conditions and other terms and conditions in the form of non-interest rate charges (i.e., fees), collateral or guarantees which the respective borrower needs to provide (including compensating balances), loan covenants and the agreed loan maturity.

22 55 monthly time series are required on the asset side, which include data on holdings of cash, loans, debt securities, MMF shares/units, equity and non-MMF investment fund shares/units, non-financial assets and remaining assets. On the liability side, the time series cover information on deposits, included and not included in M3, issuance of debt securities, capital and reserves and remaining liabilities.

23 As most regressors are lagged one period, they are measured in the period spanning 2014Q1 to 2017Q2.

panel of 130 banks from 13 countries (see Table 1 for a view of the distribution of observations per country).[24] However, the estimation sample will be generally smaller due to missing values.

The definitions of the variables used in this study are displayed in Table 2. The dependent variables are changes in credit standards and margins in loans to enterprises and households for house purchase, as reported in the BLS. In particular, the BLS asks banks on a quarterly basis about the evolution of the credit standards applied to their new loans or credit lines to enterprises and households, as well as the margins charged on them. Banks must answer whether they have tightened credit standards, kept them basically unchanged or eased them over the past three months.[25] Regarding margins (defined as the spread over a relevant market reference rate), the BLS distinguishes between margins on average loans and margins on riskier loans. Banks must answer whether they have tightened them (wider margins), kept them basically unchanged or eased (narrower margins) over the past three months.

Descriptive statistics of the dependent variables can be found in Table 3. They are dummy variables that equal 1 in the case of easing and 0 otherwise. Credit standards are very stable over time. The proportion of banks that report an easing of credit standards ranges between 5% and 7%, depending on the segment. Margins on average loans ease more frequently, in about 25% of the observations, while margins on riskier loans are narrowed less often (about 5%). Therefore, while banks adapt their lending policies through the adjustment of both loan terms & conditions and credit standards, the former seem to be more flexible instruments than the latter. Regarding bank-level controls, we proxy bank size with the natural logarithm of the bank's total assets (size). Leverage is defined as the ratio of capital and reserves over total unweighted assets (capital ratio). Liquidity is measured with a liquidity ratio, expressed as the sum of cash, holdings of government securities and Eurosystem deposits over total assets (%). This variable may also capture the impact of the ECB's expanded asset purchase programme (APP) on banks' balance sheets, which was announced in January 2015. We also include a loan-to-deposit ratio, in logs.[26] The importance of deposits as a funding source is captured with the deposit ratio, the ratio between the deposits by households and non-financial corporations over total assets. Market share is the ratio between a bank's outstanding loans and the total loans of the country's banking sector (%). We also control for the bank's legal form (head institution, national subsidiary, foreign subsidiary, foreign branch). Finally, we need to control for the impact of negative interest rates on banks' lending policies because both the TLTRO I and the negative deposit facility rate (DFR) were announced in June 2014, as part of the ECB's credit easing package.[27] To do so we include the variable NDFR, a dummy variable that equals 1 if the bank reported that the ECB's negative DFR contributed to a decrease of the bank's net interest income in the past six months and 0 otherwise. This variable, which comes from Arce et al. (2018), is constructed using an ad-hoc question in the BLS that is asked on a semi-annual basis.[28] We also include a set of relevant macroeconomic controls: the 10-year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index.

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24 The level of consolidation of the banking group differs between BLS and IBSI. Consequently, we have 130 banks in IBSI but 112 banks in BLS, because sometimes the head of the group is the one that answers to the BLS but we have unconsolidated balance sheets of the head and its subsidiaries in IBSI.

25 While the BLS differentiates between "tightened considerably" and "tightened somewhat" and between "eased considerably" and "eased somewhat", we aggregate these categories into "tightened" and "eased", as done in the regular BLS reports prepared by the ECB.

26 To correct for right skewness and outliers.

27 The negative DFR was introduced on 11 June 2014, the TLTRO-I were announced on 5 June 2014.

28 The exact wording of the question is: "Given the ECB's negative deposit facility rate, did this measure, either directly or indirectly, contribute to a decrease / increase of your bank's net interest income over the past six months?".

Table 4 displays descriptive statistics of the bank characteristics, including the key regressors, the instrumental variables and the bank-level controls, as well as summary statistics of the macro controls. Table 5 presents the means of the bank characteristics for banks that participated in the TLTROs and banks that did not participate, together with the p-value associated with a two-sample t-test of equality of means, at the quarter of announcement of TLTRO-I (2014Q2). Out of the 116 banks in the sample at 2014Q2, 55 banks participated in the TLTRO.[29] The average participating bank borrowed an amount equivalent to 1.7% of its total assets (mean of $\text{bank TLTRO}_{\text{i}}$), close to its borrowing limit, 2% (mean of $\text{bank allowance}_{\text{i}}$). Regarding differences between bidders and non-bidders, the average TLTRO uptake of a bank's competitors (mean of $country\ TLTRO_{(i)c}$) is higher in the case of participating banks. This likely reflects that banks located in countries under intense financial market scrutiny during the sovereign crisis episode participated more widely and borrower larger amounts. This is not surprising since the funding cost benefit of accessing the TLTROs, instead of alternative funding, was on average higher for banks located in those countries. To some extent it may also reflect that the recourse to the operations are strategic complements: a bank is more likely to participate if its rivals borrow heavily in the operations. In addition, TLTRO bidders are significantly larger than non-bidders, probably due to the fixed costs associated with participation, and have a larger market share in the segment of loans to NFCs. With respect to risk, there are no significant differences in terms of capital and non-performing loan ratios, but bidders have higher CDS spreads than non-bidders, suggesting that they are riskier. However, this last result must be interpreted with caution, as we only have information on CDS spreads for 83 banks. Participating banks also have a substantially higher share of liquid assets, probably because some of those assets can be pledged as collateral in the TLTROs and the ECB's main refinancing operations. Bidders are also more likely to experience a decline in their net interest income due to negative interest rates (NDFR=1) than non-bidders.

In our empirical exercises we also use controls for firms' demand for credit. In particular, the BLS asks banks about perceived changes in the demand for loans or credit lines to enterprises and households. Banks must answer whether the demand for their loans has decreased, has remained basically unchanged or has increased over the past three months.[30] In the case of loans to non-financial corporations, we differentiate between demand for loans from SMEs and large firms and also between short-term loans and long-term loans. We also distinguish the evolution of credit demand according to the purpose of the loan (loans for fixed investment, for inventories and working capital, for mergers and acquisitions and for debt refinancing). In the case of loans to households for house purchase, we include dummy variables for changes in the demand of credit in that segment, as well as changes in the demand due to the factors "housing market prospects" and "consumer confidence".[31] Table 6 presents descriptive statistics of these variables. The demand indicators are also relatively stable, but they change more frequently than credit standards. In addition, demand is more likely to increase than to decrease, as expected in a period of economic recovery.

Descriptive analyses suggest a meaningful relationship between the dependent variables and the key regressors. For the segment of loans to NFCs, Figure 2 displays the averages of the dependent variables (i.e., the proportion of banks that eased credit

29 Note that we have an unbalanced panel. Out of 130 banks in the whole sample (2014Q2-2017Q4), 60 of them participated in the initial TLTROs.

30 As with the supply indicators, we merge "decreased considerably" and "decreased somewhat" into "decreased" and "increased considerably" and "increased somewhat" into "increased".

31 Similarly to the case of supply factors (e.g. competition), a demand factor may contribute to lower demand, to keeping demand unchanged and to higher demand. We exclude other BLS demand factors (general level of interest rates, debt refinancing/restructuring and regulatory and fiscal regime of housing markets) because there are only available since 2015Q1 due a change in the questionnaire.

standards/margins) for banks with high/low values of $country\ TLTRO_{(i)c}$ (above and below the median, respectively). According to Figure 2, banks that belong to the high country TLTRO group are more likely to ease credit standards and margins on average loans than banks that belong to the low country TLTRO. The differences are sizeable and statistically significant.[32] For instance, the proportion of banks that eased overall credit standards was 8% for the high country TLTRO group and only 3% for the low country TLTRO group. By contrast, banks whose national competitors borrowed heavily in the TLTROs (high country TLTRO group) were less likely to narrow margins on riskier loans than banks from the low country TLTRO group (5% and 8%, respectively). A similar analysis is displayed in Figure 3 for banks with high/low values of $\mathrm{bank\ TLTRO_i}$ (above and below the median).[33] According to Figure 3, banks with high TLTRO uptakes were more likely to ease credit standards and margins on average loans than banks with low uptakes. The differences are also statistically significant, although somewhat smaller than in Figure 2. By contrast, the proportion of banks that narrowed margins on riskier loans is very similar in both groups. All in all, the analysis of the two figures suggests potentially meaningful links between TLTRO uptakes at the bank and country level and changes in banks' lending policies. However, as these associations may be purely due to positive selection bias (e.g. banks with high TLTRO uptakes may have better lending opportunities) or confounding events (e.g. those banks may have been more affected by the negative DFR that was introduced in parallel), more formal analyses are required.

32 The statistical significance of those differences is assessed by performing two-sample tests on the equality of proportions.

33 As the median of $\mathrm{bank\ TLTRO_i}$ is 0, the two groups consist of participating and non-participating banks.

7 Empirical results

7.1 Baseline results

Let us start with the segment of loans to NFCs. As a benchmark, Table 7a and Table 7b display the estimation of (17) and (18) by OLS. Table 7a shows that there is a positive and significant correlation between the TLTRO uptakes of a bank's national competitors, as measured by $\text{country TLTRO}_{(i)c}$, and the probability that the bank eases overall credit standards (column (1)), credit standards to SMEs (column (2)) and credit standards to large firms (column (3)). This suggests a significant indirect effect of the TLTROs on bank credit standards. By contrast, there is no significant impact on bank margins (columns (4) and (5)). In addition, Table 7b shows no clear evidence of direct effects, as a bank's TLTRO uptake is not significantly correlated with the probability of easing credit standards or lowering margins. The only exception is column (5), which displays a negative sign: higher TLTRO uptakes are associated with a lower probability of narrowing margins on riskier loans. This observation may indicate that the TLTROs did not lead to excessive risk taking by banks.

To make sure that our results are not biased by endogeneity we use the initial TLTRO-I allowance (at bank and country level respectively) as instrument variables and estimate (17) and (18) by 2SLS.[34] First we confirm that the instruments are not weak. Table 8 reports the first stage regressions corresponding to (17) (columns (1) and (2)) and the first stage regression that corresponds to (18) (column (3)). We observe positive and strong relationships between the instruments and the endogenous variables. In particular, a 1 pp increase in a bank's initial allowance leads to a 0.49 pp increase in a bank's TLTRO uptake (over total assets), and a 1 pp increase in a country's initial allowance leads to a 0.59 pp increase in a country's total TLTRO uptake (over the country's total assets). In columns (1) and (2), the multivariate F-statistics developed by Sanderson and Windmeijer (2016)[35] exceed Stock and Yogo (2005)'s critical values[36] and they are significantly greater than 10, the rule of thumb suggested by Staiger and Stock (1997). The same is true for a conventional first-stage F-statistic in column (3). Hence, we can conclude that our instruments are not weak.

The 2SLS estimates, which are presented in Table 9, are consistent with the previous OLS results. Regarding indirect effects (Table 9a), $\text{country TLTRO}_{(i)c}$ has a positive effect on overall credit standards, credit standards for SMEs and credit standards for large firms (columns (1), (2) and (3)). The effects are sizeable. For instance, a standard deviation increase in $\text{country TLTRO}_{(i)c}$ leads to a 5.3 pp increase in the probability that a bank eases overall credit standards and an 8.8 pp increase in the probability of easing credit standards to large firms. By contrast, the TLTRO uptakes of a bank's competitors have no significant effect on margins on average loans (column (4)) and riskier loans (column (5), coefficient only marginally significant). Finally, there is no clear evidence of direct effects (Table 9b), as the coefficient on bank TLTRO_{i} is insignificant in all specifications.

The analysis of loans to households for house purchase is presented in Table 10 (OLS) and Table 11 (2SLS). For the sake of brevity, let us focus on the IV estimates. With respect to

34 In the Supplement of this paper we report estimates of (17) by probit and IV probit. Results are broadly similar.

35 For multiple endogenous variables, inspection of the individual first-stage F-statistics is not sufficient. To see why, suppose there are two instruments for two endogenous variables and that the first instrument is strong and predicts both endogenous variables well, while the second instrument is weak. The first-stage F-statistics in each of the two first-stage equations are likely to be high, but the model is weakly identified, because one instrument is not enough to capture two causal effects. See Angrist and Pischke (2009).

36 For a Wald test with maximal size of 10%.

indirect effects (Table 11a), $\text{country TLTRO}_{(i)c}$ has a positive effect on credit standards (column 1). In particular, a standard deviation increase in the TLTRO uptakes of a bank's competitors implies an 8.8 pp increase in the probability that the bank eases its own credit standards. Regarding direct effects (Table 11b), there is no significant impact on credit standards (column 1). However, column (2) reports a positive effect of bank TLTRO_i on the probability of narrowing margins on average loans. The effect is strong, as a standard deviation increase in a bank's TLTRO uptake (relative to total assets) implies a 15.8 pp increase in the probability of lowering margins on average loans.

7.2 Analysis of the direct effects of the TLTROs: the intensive vs. extensive margin

The evidence presented so far suggests that direct effects are weak, except in the case of margins on loans for house purchase. However, notice that the regressor of interest, $bank\ TLTRO_i$, may hide some interesting heterogeneity. In particular, the variable takes the value 0 for about 50% of the observations (banks that did not borrow in the TLTROs) and it is continuously distributed between the values 0.1% and 5% for the other 50% of the observations (banks that borrowed in the TLTROs). Hence, we may distinguish the direct effect of TLTROs on bank lending policies in the extensive margin (participation vs. non-participation) and the intensive margin (amount of borrowed funds, conditional on participation). For the analysis of the extensive margin, we estimate (18) but replacing the variable $bank\ TLTRO_i$ with the variable $participation_i$, a dummy that equals 1 the bank borrowed any amount in the initial TLTROs (September and December 2014). We treat $participation_i$ as endogenous and instrument it with bank allowance_i. For the analysis of the intensive margin, we estimate (18) for the subsample of banks that participated in the initial TLTROs.

The analysis for the segment of loans to NFCs is presented in Table 12. Table 12a examines the intensive margin and Table 12b examines the extensive margin. According to Table 12a, there are no substantial differences in the lending policies of participating and non-participating banks, as the coefficient on $participation_i$ is always statistically insignificant. In other words, there is no "participation effect". By contrast, for the subsample of bidding banks (Table 12b), the coefficient on $bank\ TLTRO_i$ is positive and significant in columns (3) and (4), indicating that high TLTRO uptakes lead to a higher probability of easing credit standards on large firms and to a higher probability of narrowing margins on average loans. The effects are strong: a standard deviation increase in a bank's TLTRO uptake increases the probability of easing credit standards on large firms by 12.4 pp and it raises the probability of narrowing margins on average loans by 20 pp. This suggests that, for the subsample of bidding banks, the reduction in funding costs caused by the TLTROs is transmitted through easier lending policies to large safe firms.

The analysis for the segments of loans to households is presented in Table 13. Table 13a examines the intensive margin and Table 13b examines the extensive margin. According to Table 13a, bidding banks are much more likely (62 pp) to narrow margins on average loans than non-bidders, a strong "participation effect". The effect on those margins also takes place in the intensive margin (Table 13b): for the subsample of bidding banks, a standard deviation increase in a bank's TLTRO uptake raises the probability of narrowing margins on average loans by 28.6 pp. All in all, the picture that emerges from Tables 9, 11, 12 and 13 is that there are substantial direct effects of TLTROs on lending policies. The direct transmission of monetary policy takes place mainly through the adjustment of margins on loans to relatively safe borrowers.

7.3 Further analysis of indirect effects: the role of competition

The evidence presented so far suggests that the TLTROs have important indirect effects on banks' lending policies. Recall that, according to the above stylised model, large-scale recourse to the TLTROs has two simultaneous effects: (i) it fosters intense competition in the credit market and (ii) it eases competitive pressures in funding markets. While for bidders (i.e., the risky bank) these two effects go in the same direction,[37] for non-bidders (i.e., the safe bank) the effects are opposite. On the one hand their relative competitive position vis-à-vis bidders worsens, ceteris paribus contracting the loan supply of non-bidders. On the other hand, their access to market funding improves, supporting their supply of loans. The empirical results presented so far suggest that the overall indirect effect is positive, i.e. that the overall easier access to market funding for non-bidders more than compensates for their lost competitive position vis-à-vis bidders.

Against this background we try to isolate the positive indirect impact of the TLTROs on the loan supply of non-bidders via the positive funding externalities. We do this by controlling for the intensity of competition in credit markets, as reported by banks in the BLS. In particular, the BLS asks banks about the evolution of several factors that affect their credit standards and their terms and conditions. Specifically, a factor may contribute to a tightening of credit standards (terms & conditions), to keeping credit standards (terms & conditions) unchanged or to an easing of credit standards (terms & conditions). In this section we use the variable competition, which equals 1 if the factor "pressure from competition" contributed to an easing of terms and conditions, and 0 if it was unchanged or contributed to a tightening.[38]

The results of this exercise are presented in Table 14 and 15. Note that in this set-up the coefficient on $\text{country TLTRO}_{(i)c}$ only captures the positive funding externality of those operations. As expected, the respective coefficients are positive and significant when the dependent variables are credit standards (columns 1-3 of Table 14 and column 1 of Table 15). The effects are also sizeable. For instance, a standard deviation increase in $\text{country TLTRO}_{(i)c}$ leads to a 6.5 pp increase in the probability that a bank eases overall credit standards to NFCs and to a 7.3 pp increase in the probability of easing credit standards to households for house purchase. Therefore, the available evidence suggests that the TLTROs generate significant positive funding externalities, as non-bidders may benefit from weaker competition in the deposit and bond markets. Note that the coefficients on competition are positive and significant: an increase in competition leads to a higher probability of eased credit standards and narrow margins.

We also go on to test whether the overall indirect effects of the TLTROs are stronger in more competitive environments. Then we estimate equation (17) by 2SLS in subsamples of observations for which competition equals 1 and 0 (high and low competitive pressures, respectively). Results are displayed in Tables 16 (loans to NFCs) and 17 (housing loans). In the case of loans to NFCs (Table 16), the indirect effect of the TLTROs on credit standards is very strong for banks facing high competitive pressures (columns 1 to 3, Table 16a). For instance, a standard deviation increase in $\text{country TLTRO}_{(i)c}$ raises the probability of easing overall credit standards by 21 pp. In addition, an increase in the uptakes of a bank's competitors reduces the probability of narrowing margins on riskier loans, suggesting that the TLTROs did not

37 Access to the TLTROs levels the playing field from their perspective and results in an overall improved competitive position vis-à-vis non-bidders. And on top of that, the interest rates on deposits decline as a substitute for market funding is introduced.

38 Similar results are found when we use the variable *competition (credit standards),* which equals 1 if the factor "competition from other banks" contributed to an easing of credit standards and 0 if it was unchanged or contributed to a tightening.

translate into excessive risk taking (column 5, Table 16a). By contrast, those effects are virtually non-existent for banks facing low competitive pressures (Table 16b). In the segment of loans to households for house purchase (Table 17), the impact of $\text{country TLTRO}_{(i)c}$ on credit standards is significant in both subsamples, but much larger (7 times) in the case of high competitive pressures.

Alternatively, we test this hypothesis in Tables 18 and 19, which report 2SLS estimates of equation (17) in subsamples of banks with high and low market share (above and below the median, respectively). In Table 18 (loans to NFCs) we can observe that the impact of $\text{country TLTRO}_{(i)c}$ on credit standards is particularly high for banks with a low market share (Table 18a, columns 1to 3). For instance, a standard deviation increase in $\text{country TLTRO}_{(i)c}$ is associated with a 14.4 pp increase in the probability of easing overall credit standards. By contrast, in the sample of banks with high market share (Table 18b), the effect is only significant in the segment of large firms (column (3)), and even in this case it is substantially smaller. Similarly, in Table 19 (loans to households for house purchase) we observe a very strong effect in the case of banks with a low market share: a standard deviation increase in $\text{country TLTRO}_{(i)c}$ raises the probability of easing credit standards by 17.7 pp (column 1, Table 19a). However, the effect is much smaller, and only marginally significant, in the subsample of banks with high market share (column 1, Table 19b). In addition, an increase in the TLTRO uptakes of a bank's competitors leads to a lower probability of narrowing margins on riskier loans in the case of banks with low market shares (column 3, Table 19a). These findings suggest that the indirect effects of the TLTROs are particularly strong in the case of banks that face strong competition in the credit market, as proxied by low market shares.

8 Robustness tests

A standard concern in policy evaluation is the presence of pre-existing trends. If, for some reason, the evolution of treatment and control groups was not parallel before the implementation of the policy, the estimates may pick up such behaviour, rather than the causal impact of the policy. In our empirical implementation, our treatment groups, banks with high TLTRO uptakes and banks whose national competitors borrowed heavily in the TLTROs, could have started easing credit standards/margins well before the announcement of the TLTROs in June 2014.

In order to rule out such concerns, we carry out a falsification test. In particular, we estimate equations (14) and (15) by 2SLS for a placebo period spanning from 2010Q2-2014Q1. The placebo period is as long as the "true period" (2014Q2-2017Q4) and ends right before the announcement of the TLTROs. In other words, we assume that banks borrowed from the TLTROs in June 2010 and we observe their lending behaviour in the following 19 quarters.

Results of the falsification tests are presented in Tables 20 (loans to NFCs) and 21 (housing loans). Regarding the impact of $\text{country TLTRO}_{(i)c}$ on credit standards (Table 20a and 21a), the coefficients on the variable are no longer statistically significant or -in the case of credit standards on loans to SMEs- even negative and significant. With respect to the impact of bank TLTRO_{i}, the coefficients are generally insignificant (Table 20b and 21b). These results suggest that our main findings are not driven by pre-existing trends.

Another concern regarding the previous empirical analysis is that we may pick up the effect of the second series of targeted longer-term refinancing operations (TLTRO II) that were implemented between June 2016 and March 2017. In the case of TLTRO II (announced on March 2016[39]), banks were able to borrow a total amount of up to 30% of their eligible loans outstanding at 31 January 2016.[40] Incentives for banks to lend to the non-financial private sector were provided via reduction in the interest rate applied in the operations.[41] The uptakes in TLTRO-I and TLTRO-II are likely to be correlated, as participating banks used part of the funds to roll over expiring debts. To address this concern, we estimate (14) and (15) by 2SLS for the shorter period 2014Q2-2016Q1, i.e., before the implementation of TLTRO-II.

The results are presented in Tables 22 and 23. They are very similar to the baseline results (Tables 9 and 11). In the case of loans to NFCs, the indirect impact of TLTROs on credit standards becomes larger (Table 22a). For instance, a standard deviation increase in $\text{country TLTRO}_{(i)c}$ leads to a 6.8 pp increase in the probability that a bank eases overall credit standards and a 10.4 pp increase in the probability of easing credit standards to large firms. Interestingly, the negative impact of $\text{country TLTRO}_{(i)c}$ on the probability of narrowing margins on riskier loans also becomes stronger and more significant. In particular, a standard deviation increase in $\text{country TLTRO}_{(i)c}$ reduces by 8.7 pp the probability that the bank narrows margins on riskier loans. As before, the direct impact of TLTROs on credit standards and margins is not

39 Press release: https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310_1.en.html

40 In particular, 30% of their eligible loans less any amount which was previously borrowed and was still outstanding under the first two TLTRO operations conducted in 2014.

41 The interest rate applied to TLTRO II was fixed for each operation at the rate applied in the main refinancing operations (MROs) prevailing at the time of allotment. In addition, counterparties whose eligible net lending in the period between 1 February 2016 and 31 January 2018 exceeded their benchmark were charged a lower rate for the entire term of the operation. See ECB press release for details: https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310_1.en.html

significantly different from zero (Table 22b). Things also change little in the case of housing loans, as there is still a significant impact of $\text{country TLTRO}_{(i)c}$ on credit standards (Table 23a) and a significant impact of bank TLTRO_{i} on margins on average loans (Table 23b). Those effects are also larger than in the baseline estimations.

Note that the theoretical framework presented in Section 4 models credit supply in terms of loan quantities, while the empirical analysis proxies credit supply with credit standards and loan margins. While credit standards are a reliable proxy for credit supply according to previous literature (e.g. Lown and Morgan (2006) and Ciccarelli et al. (2015)), for robustness we replace them by credit growth rates[42] in equations (17) and (18). Results are presented in Table 24, which again distinguishes between indirect effects (Table 24a) and direct effects (Table 24b) for loans to NFCS (column 1) and loans to households for house purchase (column 2). The coefficient on $\text{country TLTRO}_{(i)c}$ is positive and statistically significant in both segments, indicating that a higher TLTRO uptake by a bank's national competitors leads to higher credit growth. In particular, a standard deviation increase in $\text{country TLTRO}_{(i)c}$ causes credit growth to increase by 0.8 percentage points in each segment. By contrast, there is no evidence of direct effects, as the coefficients on bank TLTRO_{i} are not statistically different from zero.

Finally, an implicit assumption of the whole analysis of indirect effects is that European credit and funding markets are segmented at the national level, probably due to a large array of regulatory, technological and cultural factors (e.g. different languages). In this context, each bank is influenced by the behaviour of its national competitors, as captured by the variable $\text{country TLTRO}_{(i)c}$. However, this may not be true in the case of very large well-diversified banks that simultaneously compete in many European markets. To ameliorate this concern, we take out from the sample those banks classified as globally systemic banks (G-SIB) by the Financial Stability Board. These banks have many similarities: they are very large, are all conglomerates, have an international geographical orientation and tend to be diversified (Altavilla et. al 2018). We then re-run regressions (17) and (18). The results, displayed in tables 25 and 26, are very similar to the baselines estimates: significant indirect effects on credit standards in both segments and significant direct effects on margins on average loans to households for house purchase.

42 Computed as quarterly changes in the natural log of the stock of loans. They are windsorised at 90% to reduce the impact of outliers.

9 Conclusions

This paper assesses the impact of the Eurosystem's Targeted Long-Term Refinancing Operations (TLTROs), announced in June 2014, on the lending policies of euro area banks. To guide our empirical research, we first present a simple model of oligopolistic competition in the banking sector in which two banks compete à la Cournot in the loan and deposit markets. One of the banks, with high funding costs, participates in the TLTROs, while the other one, with low funding costs, does not. The model helps us distinguish between the direct and the indirect effects of the TLTROs. Regarding direct effects, the TLTROs reduce the marginal costs of the participating bank, which expands its credit supply. There are two indirect effects. First, the TLTROs increase the competition in the credit market by levelling the playing field. Second, as the bidder replaces part of deposit funding with TLTRO funding, the competition in the deposit market weakens, which reduces deposit rates and the marginal costs of the non-bidder. The main predictions of the model are a positive direct impact of the TLTRO on the bidder's credit supply and an ambiguous indirect impact on the non-bidder's loan supply.

We then test those predictions with the confidential answers to the ECB's Bank Lending Survey (BLS) by 130 banks from 13 euro area countries, matched with individual bank balance-sheet information and operations data. We measure bank lending policies with credit standards (i.e., the internal guidelines or loan approval criteria of a bank) and loan margins (i.e., the agreed spread over the relevant reference rate), as reported by banks in the BLS. Regarding direct effects, our empirical analysis indicates that the transmission of monetary policy takes place mainly through the adjustment of margins on loans to relatively safe borrowers. In addition, our results suggest strong indirect effects of the TLTROs on credit standards, but no significant impact on margins on average loans. These effects are concentrated in banks with low market share that face high competitive pressures, suggesting that competition in the credit market plays a crucial role.

Finally, it is worth mentioning that we find significant effects of the TLTROs on a category of loans, housing loans, which was not targeted by the measure. This suggests important spillovers of the TLTROs, as banks search for yield in a profitable segment of the credit market. However, there is also some evidence that the TLTROs did not lead to excessive risk taking, as TLTRO uptakes are negatively correlated with the probability of narrowing margins on riskier loans.

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Table 1: Number of banks and number of observations by country

This table summarises the number of banks in our sample for each country and the number of observations corresponding to each country for the sample period 2014Q2-2017Q4.

	Number of banks		Number of observations	
Country	Freq.	Percent	Freq.	Percent
AT	8	6.15	117	6.56
BE	4	3.1	60	3.4
DE	28	21.5	417	23.4
EE	5	3.9	60	3.4
ES	10	7.7	150	8.4
FR	15	12	210	12
IE	7	5.38	105	5.89
IT	23	17.7	272	15.3
LT	5	3.9	48	2.7
LU	5	3.9	75	4.2
NL	10	7.7	120	6.7
PT	5	4	75	4
SK	5	3.85	75	4.2
Total	130	100	1,784	100

Table 2: Definition of variables

Dependent variables	
credit standards	Change in the credit standards applied to new loans or credit lines. It equals 1 if easing, 0 if unchanged or tightening.
average margins	Change in the bank's loan margin (i.e., the spread over a relevant market reference rate) on average loans. It equals 1 if easing, 0 if unchanged or tightening.
riskier margins	Change in the bank's loan margin (i.e., the spread over a relevant market reference rate) on riskier loans. It equals 1 if easing, 0 if unchanged or tightening.
Bank variables	
size	Logarithm of the bank's total assets.
capital ratio	Capital and reserves over total assets (%)
liquidity ratio	Cash + government securities + Eurosystem deposits over total assets (%)
log(loan-to-deposit ratio)	Loans to non-financial corporations and households over deposits by non-financial corporations and households. In logs.
deposit ratio	Deposits by households and non-financial corporations over total assets (%).
market share	Ratio between a bank's outstanding loans and the total outstanding loans of the country's banking sector (%).
legal form: foreign branch	Dummy that equals 1 if the bank is a branch of a foreign bank.
legal form: foreign subsidiary	Dummy that equals 1 if the bank is a subsidiary of a foreign bank.
legal form: head institution	Dummy that equals 1 if the bank is the head institution of the banking group.
legal form: national subsidiary	Dummy that equals 1 if the bank is a subsidiary of a domestic bank.
NDFR	Dummy that equals 1 if the negative deposit facility rate contributed to a decrease in the bank's net interest income.
competition (credit standards)	Change in the factor "competition from other banks", as contributing to easing/tightening of credit standards. It equals 1 if it contributes to easing, 0 if unchanged or it contributes to tightening.
competition (terms & conditions)	Change in the factor "pressure from competition", as contributing to easing/tightening of credit terms and conditions. It equals 1 if it contributes to easing, 0 if unchanged or it contributes to tightening.
Demand variables	
demand nfc	Change in the demand for loans or credit lines to non-financial corporations.
demand sme	Change in the demand for loans or credit lines to small and medium enterprises.
demand large	Change in the demand for loans or credit lines to large firms.
demand short term	Change in the demand for short-term loans or credit lines to enterprises.
demand long term	Change in the demand for long-term loans or credit lines to enterprises.
demand investment	Change in the demand for loans or credit lines to enterprises for fixed investment.
demand inventories	Change in the demand for loans or credit lines to enterprises for inventories and working capital.
demand mergers	Change in the demand for loans or credit lines to enterprises for mergers/acquisitions and corporate restructuring.
demand debt refinancing	Change in the demand for loans or credit lines to enterprises for debt refinancing/restructuring and renegotiation.
demand house purchase	Change in the demand for loans to households for house purchase.
demand housing market prospects	Change in the factor "housing market prospects", as contributing to lower/higher demand for loans to house purchase.
demand consumer confidence	Change in the factor "consumer confidence", as contributing to lower/higher demand for loans to house purchase.
Macro variables	
sovereign bond	10-year sovereign bond.
IPI	industrial production index.
unemployment rate	unemployment rate.
CPI	consumer price index.
HHI	Herfindahl-Hirschman Index. Computed with a sample of 323 banks from the euro area. Source: IBSI.

Table 3: Descriptive statistics of dependent variables

This table contains the descriptive statistics of the dependent variables referred to credit standards and loan margins for the sample period 2014Q2-2017Q4. Credit standards and margins are dummies that equal 1 if easing/narrowing and 0 if no change or tightening/widening.

Variable	Obs	Mean	Std. Dev.	Min	Max
Loans to NFCs					
credit standards overall	1,695	0.05	0.22	0	1
credit standards sme	1,627	0.06	0.23	0	1
credit standards large	1,628	0.07	0.25	0	1
average margins	1,688	0.29	0.45	0	1
riskier margins	1,680	0.06	0.25	0	1
Loans to households for house purchase					
credit standards	1,650	0.07	0.26	0	1
average margins	1,646	0.26	0.44	0	1
riskier margins	1,625	0.05	0.22	0	1

Table 4: Descriptive statistics of bank characteristics and macro controls

This table contains the descriptive statistics of the bank characteristics that are used as key regressors, instrumental variables and control variables for the sample period 2014Q2-2017Q4.

Variable	Obs	Mean	Std. Dev.	Min	Max
Bank variables					
bank TLTRO	1,775	0.80	1.08	0.00	4.96
country TLTRO	1,784	0.91	0.69	0.00	2.31
bank allowance	1,775	1.87	1.26	0.00	5.92
country allowance	1,784	1.46	0.67	0.00	3.00
size	1,776	10.68	1.54	2.77	13.88
capital ratio	1,772	10.68	5.98	0.25	100.00
liquidity ratio	1,776	8.36	6.41	0.00	34.24
log(loan-to-deposit ratio)	1,742	0.38	1.41	-1.60	10.00
deposit ratio	1,776	41.36	22.71	0.00	87.00
market share (loans to NFCs)	1,783	0.03	0.03	0.00	0.15
market share (loans for house purchase)	1,784	0.03	0.04	0.00	0.16
legal_form: foreign branch	1,784	0.04	0.19	0.00	1.00
legal_form: foreign subsidiary	1,784	0.21	0.41	0.00	1.00
legal_form: head institution	1,784	0.49	0.50	0.00	1.00
legal_form: national subsidiary	1,784	0.26	0.44	0.00	1.00
NDFR	1,784	0.72	0.45	0.00	1.00
competition (credit standards) NFCs	1,667	0.13	0.34	0	1
competition (credit standards) housing loans	1,635	0.10	0.30	0	1
competition (terms & conditions) NFCs	1,324	0.26	0.44	0	1
competition (terms & conditions) housing loans	1,293	0.16	0.37	0	1
Macro variables					
sovereign bond	1,649	1.06	0.78	-0.19	3.97
IPI	1,784	101.26	4.93	64.00	116.20
CPI	1,784	100.87	1.16	98.82	105.82
unemployment rate	1,784	8.86	4.55	3.56	24.45
HHI (loans to NFCs)	1,784	0.05	0.02	0.03	0.11
HHI (loans for house purchase)	1,784	0.06	0.02	0.03	0.11

Table 5: Descriptive statistics of bank characteristics for participating and non-participating banks

This table contains the number of observations and means of bank characteristics for participating and non-participating banks in the TLTROs at the quarter of announcement (2014Q2). It also includes the difference in means between the two groups and the p-value associated with a two-sample t-test of equality of means.

	Participating banks		Non-participating banks		Difference in means	
Variable	Obs	Mean	Obs	Mean	Diff	P-value
bank TLTRO	55	1.77	61	0	1.77	0.00
country TLTRO	55	1.06	61	0.82	0.24	0.06
bank allowance	55	2.04	61	1.90	0.14	0.56
country allowance	55	1.55	61	1.49	0.06	0.63
size	55	11.41	61	10.11	1.30	0.00
capital ratio	55	11.35	61	9.57	1.78	0.11
cds spread	49	99.08	34	81.22	17.86	0.04
npl ratio	49	9.76	58	7.18	2.58	0.16
liquidity ratio	55	8.94	61	5.59	3.35	0.00
log(loan-to-deposit ratio)	55	0.24	58	0.55	-0.31	0.19
deposit ratio	55	36.47	61	40.36	-3.88	0.35
market share (loans to NFCs)	55	0.04	61	0.01	0.02	0.00
market share (loans for house purchase)	55	0.03	61	0.02	0.01	0.13
legal form: foreign branch	55	0.02	61	0.05	-0.03	0.36
legal form: foreign subsidiary	55	0.29	61	0.13	0.16	0.03
legal form: head institution	55	0.56	61	0.44	0.12	0.19
legal form: national subsidiary	55	0.13	61	0.38	-0.25	0.00
NDFR	55	0.78	61	0.59	0.19	0.03

Table 6a: Descriptive statistics of demand variables (loans to NFCs)

This table contains the descriptive statistics of the demand variables that are used as control variables for the sample period 2014Q2-2017Q4.

Variable	Obs	Mean	Std. Dev.	Min	Max
demand nfc: decreased	1,693	0.11	0.31	0	1
demand nfc: unchanged	1,693	0.65	0.48	0	1
demand nfc: increased	1,693	0.24	0.43	0	1
demand sme: decreased	1,628	0.12	0.33	0	1
demand sme: unchanged	1,628	0.65	0.48	0	1
demand sme: increased	1,628	0.23	0.42	0	1
demand large: decreased	1,625	0.11	0.31	0	1
demand large: unchanged	1,625	0.68	0.47	0	1
demand large: increased	1,625	0.22	0.41	0	1
demand short term: decreased	1,693	0.10	0.31	0	1
demand short term: unchanged	1,693	0.71	0.45	0	1
demand short term: increased	1,693	0.19	0.39	0	1
demand long term: decreased	1,693	0.09	0.29	0	1
demand long term: unchanged	1,693	0.64	0.48	0	1
demand long term: increased	1,693	0.27	0.44	0	1
demand investment: decreased	1,692	0.11	0.31	0	1
demand investment: unchanged	1,692	0.69	0.46	0	1
demand investment: increased	1,692	0.20	0.40	0	1
demand inventories: decreased	1,670	0.06	0.24	0	1
demand inventories: unchanged	1,670	0.76	0.43	0	1
demand inventories: increased	1,670	0.18	0.39	0	1
demand mergers: decreased	1,674	0.03	0.17	0	1
demand mergers: unchanged	1,674	0.85	0.36	0	1
demand mergers: increased	1,674	0.12	0.32	0	1
demand debt refinancing: decreased	1,686	0.03	0.16	0	1
demand debt refinancing: unchanged	1,686	0.85	0.36	0	1
demand debt refinancing: increased	1,686	0.12	0.33	0	1

Table 6b: Descriptive statistics of demand variables (loans for house purchase)

This table contains the descriptive statistics of the demand variables that are used as control variables for the sample period 2014Q2-2017Q4.

Variable	Obs	Mean	Std. Dev.	Min	Max
demand house purchase: decreased	1,649	0.09	0.29	0	1
demand house purchase: unchanged	1,649	0.54	0.50	0	1
demand house purchase: increased	1,649	0.36	0.48	0	1
demand housing market prospects: decreased	1,642	0.02	0.15	0	1
demand housing market prospects: unchanged	1,642	0.70	0.46	0	1
demand housing market prospects: increased	1,642	0.28	0.45	0	1
demand consumer confidence: decreased	1,642	0.01	0.11	0	1
demand consumer confidence: unchanged	1,642	0.76	0.43	0	1
demand consumer confidence: increased	1,642	0.23	0.42	0	1

Table 7a: country TLTROs and loans to NFCs (OLS)

This table shows the coefficient of the variable country TLTRO, estimated by OLS. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.113***	0.076***	0.155***	0.082	0.013
	(0.029)	(0.029)	(0.032)	(0.061)	(0.033)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	1,346	1,341	1,344	1,342	1,340

Table 7b: bank TLTROs and loans to NFCs (OLS)

This table shows the coefficient of the variable bank TLTRO, estimated by OLS. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on bank TLTRO plus bank controls, demand controls and country-time dummies. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Bank TLTRO	0.011	0.019*	0.002	-0.009	-0.018**
	(0.012)	(0.012)	(0.012)	(0.020)	(0.009)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country-time dummies	YES	YES	YES	YES	YES
Observations	1,484	1,479	1,482	1,480	1,478

Table 8: first stage regressions

This table shows the coefficients on the instruments, bank allowance and country allowance, on first stage regressions. Equations (1) and (2) correspond to a regression with two endogenous variables, bank TLTRO and country TLTRO, and two instruments, bank allowance and country allowance. Equation (3) corresponds to a regression with one endogenous variable, bank TLTRO, and one instrument, bank allowance. The regressions include bank controls, demand controls, country controls, time fixed effects and country-time fixed effects as specified in the lower part of the table. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	Bank TLTRO	Country TLTRO	Bank TLTRO
Bank allowance	0.470***	0.007	0.469***
	(0.085)	(0.014)	(0.085)
Country allowance	0.100	0.577***	
	(0.170)	(0.042)	
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	NO
Time dummies	YES	YES	NO
Country-time dummies	NO	NO	YES
F-statistic	17.06	98.13	30.52
Sanderson-Windmeijer F-statistic	29.73	92.66	30.52
Stock-Yogo critical value (10% maximal IV size)	19.93	19.93	16.38
Observations	1,346	1,346	1,484

Table 9a: country TLTROs and loans to NFCs (2SLS)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.076***	0.066**	0.126***	0.046	-0.061*
	(0.029)	(0.028)	(0.030)	(0.075)	(0.034)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	1,346	1,341	1,344	1,342	1,340

Table 9b: bank TLTROs and loans to NFCs (2SLS)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. In addition, we use country-time fixed effects. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	riskier margins	average margins
Bank TLTRO	0.000	-0.001	0.002	0.003	-0.002
	(0.014)	(0.014)	(0.015)	(0.033)	(0.016)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country-time dummies	YES	YES	YES	YES	YES
Observations	1,484	1,479	1,482	1,480	1,478

Table 10a: country TLTRO and loans for house purchase (OLS)

This table shows the coefficient of the variable country TLTRO, estimated by OLS. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects, consumer confidence, the general level of interest rates, debt refinancing and the regulatory and fiscal regime of housing markets. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

DEPENDENT VARIABLE	(1) credit standards	(2) average margins	(3) riskier margins
Country TLTRO	0.085***	0.077	-0.034
	(0.029)	(0.052)	(0.027)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	1,176	1,173	1,156

Table 10b: bank TLTROs and loans for house purchase (OLS)

This table shows the coefficient of the variable bank TLTRO, estimated by OLS. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

DEPENDENT VARIABLE	(1) credit standards overall	(2) average margins	(3) riskier margins
Bank TLTRO	0.003	0.041*	0.016
	(0.014)	(0.021)	(0.011)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country-time dummies	YES	YES	YES
Observations	1,288	1,285	1,268

Table 11a: country TLTROs and loans for house purchase (2SLS)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance.The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.126***	0.155*	-0.026
	(0.035)	(0.094)	(0.036)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	1,176	1,173	1,156

Table 11b: bank TLTROs and loans for house purchase (2SLS)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on bank TLTRO plus bank controls, demand controls and country-time dummies. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Bank TLTRO	-0.026	0.146***	0.042*
	(0.018)	(0.055)	(0.022)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country-time dummies	YES	YES	YES
Observations	1,288	1,285	1,268

These tables show the coefficient of the variable participation (Table a) and bank TLTRO (Table b), estimated by 2SLS. The sample includes all banks in Table a) and banks that participated in the TLTROs in Table b). The instrumental variable is bank allowance. The dependent variables take the values 1 (easing) and 0 (remained unchanged or tightened) and are regressed on participation or bank TLTRO plus bank controls, demand controls and country-time fixed effects. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 12a: participation in the TLTROs and loans to NFCs (2SLS)

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Participation	0.001	-0.005	0.009	0.012	-0.010
	(0.059)	(0.060)	(0.064)	(0.142)	(0.067)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country-time dummies	YES	YES	YES	YES	YES
Observations	1,484	1,479	1,482	1,480	1,478

Sample: all banks.

Table 12b: bank TLTRO and loans to NFCs for participating banks (2SLS)

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Bank TLTRO	0.019	0.029	0.072**	0.116**	-0.004
	(0.026)	(0.026)	(0.033)	(0.047)	(0.014)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country-time dummies	YES	YES	YES	YES	YES
Observations	767	764	766	767	766

Sample: banks that participated in the TLTROs.

These tables show the coefficient of the variable participation (Table a) and bank TLTRO (Table b), estimated by 2SLS. The sample includes all banks in Table a) and banks that participated in the TLTROs in Table b). The instrumental variable is bank allowance. The dependent variables take the values 1 (easing) and 0 (remained unchanged or tightened) and are regressed on participation or bank TLTRO plus bank controls, demand controls and country-time fixed effects. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 13a: participation in the TLTROs and loans for house purchase (2SLS)

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Participation	-0.109	0.617**	0.177
	(0.084)	(0.299)	(0.114)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country-time dummies	YES	YES	YES
Observations	1,288	1,285	1,268

Sample: all banks.

Table 13b: bank TLTROs and loans for house purchase for participating banks (2SLS)

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Bank TLTRO	-0.033	0.166**	0.050*
	(0.028)	(0.067)	(0.028)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country-time dummies	YES	YES	YES
Observations	636	636	631

Sample: banks that participated in the TLTROs.

Table 14: country TLTROs, competition and loans to NFCs (2SLS)

This table shows the coefficients of the variable country TLTRO and competition, estimated by 2SLS. Competition is a dummy variable that equals 1 if the bank answers that competition contributed to an easing of terms and conditions in the past 3 months and 0 otherwise. The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the first quarter of 2015 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.094***	0.082***	0.131***	0.131*	-0.024
	(0.029)	(0.030)	(0.034)	(0.073)	(0.031)
Competition	0.086***	0.080***	0.088***	0.376***	0.095***
	(0.029)	(0.029)	(0.034)	(0.043)	(0.023)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	966	962	964	965	964

Table 15: country TLTROs, competition and loans for house purchase (2SLS)

This table shows the coefficients of the variables country TLTRO and competition, estimated by 2SLS. Competition is a dummy variable that equals 1 if the bank answers that competition contributed to an easing of terms and conditions in the past 3 months and 0 otherwise. The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the first quarter of 2015 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.106***	0.138*	-0.050
	(0.036)	(0.075)	(0.042)
Competition	0.168***	0.180***	0.061**
	(0.039)	(0.046)	(0.025)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	1,176	1,173	1,156

These tables show the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (easing) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the first quarter of 2015 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Panel A and B contain the observations for which the variable competition equals 1 and 0, respectively. Competition is a dummy variable that equals 1 if the bank answers that competition contributed to an easing of terms and conditions in the past 3 months and 0 otherwise.

Table 16a: country TLTROs and loans to NFCs (2SLS): high competitive pressures

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.304***	0.399***	0.539***	-0.152	-0.268**
	(0.098)	(0.116)	(0.141)	(0.103)	(0.136)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	267	266	266	267	267

Sample: observations for which the variable competition equals 1.

Table 16b: country TLTROs and loans to NFCs (2SLS): low competitive pressures

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	riskier margins	average margins
Country TLTRO	0.023	-0.005	0.044*	0.121*	-0.014
	(0.025)	(0.014)	(0.025)	(0.071)	(0.013)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	783	779	782	783	782

Sample: observations for which the variable competition equals 0.

These tables show the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance.The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the first quarter of 2015 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Panel A and B contain the observations for which the variable competition equals 1 and 0, respectively. Competition is a dummy variable that equals 1 if the bank answers that competition contributed to an easing of terms and conditions in the past 3 months and 0 otherwise.

Table 17a: country TLTROs and loans for house purchase (2SLS): high competitive pressures

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.520***	0.219	-0.215*
	(0.179)	(0.163)	(0.113)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	129	129	129

Sample: observations for which the variable competition equals 1.

Table 17b: country TLTROs and loans for house purchase (2SLS): low competitive pressures

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.075**	0.054	-0.035
	(0.035)	(0.074)	(0.038)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	739	737	731

Sample: observations for which the variable competition equals 0.

These tables show the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (easing) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 18a: country TLTROs and loans to NFCs (2SLS): banks with low market share

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.209***	0.201***	0.146**	-0.017	-0.122*
	(0.072)	(0.074)	(0.060)	(0.131)	(0.068)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	603	602	602	599	598

Sample: banks with market share below the median (1.1%).

Table 18b: country TLTROs and loans to NFCs (2SLS): banks with high market share

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	riskier margins	average margins
Country TLTRO	0.034	0.031	0.119***	0.101	-0.074
	(0.037)	(0.032)	(0.044)	(0.090)	(0.052)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	743	739	742	743	742

Sample: banks with market share above the median (1.1%).

These tables show the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance.The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 19a: country TLTROs and loans for house purchase (2SLS): banks with low market share

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.257***	0.186*	-0.127**
	(0.061)	(0.103)	(0.049)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	594	593	576

Sample: banks with market share below the median (1.3%).

Table 19b: country TLTROs and loans for house purchase (2SLS): banks with high market share

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.100*	0.059	-0.017
	(0.056)	(0.118)	(0.049)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	582	580	580

Sample: banks with market share above the median (1.3%).

Table 20a: country TLTROs and loans to NFCs (placebo period)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2010 to the first quarter of 2014. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	-0.017	-0.043***	-0.003	-0.059*	-0.039*
	(0.011)	(0.014)	(0.014)	(0.031)	(0.024)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	1,242	1,239	1,238	1,240	1,229

Table 20b: bank TLTROs and loans to NFCs (placebo period)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. In addition, we use country-time fixed effects. The sample period spans from the second quarter of 2010 to the first quarter of 2014. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	riskier margins	average margins
Bank TLTRO	-0.017*	-0.009	-0.013	-0.023	-0.008
	(0.009)	(0.008)	(0.010)	(0.022)	(0.015)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country-time dummies	YES	YES	YES	YES	YES
Observations	1,390	1,387	1,386	1,388	1,377

Table 21a: country TLTROs and loans for house purchase (placebo period)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance.The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the second quarter of 2010 to the first quarter of 2014. Robust standard errors in parentheses are clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.023	-0.085***	-0.026
	(0.018)	(0.031)	(0.017)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	1,027	1,026	1,014

Table 21b: bank TLTROs and loans for house purchase (placebo period)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on bank TLTRO plus bank controls, demand controls and country-time dummies. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2010 to the first quarter of 2014. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Bank TLTRO	0.029	0.022	-0.014
	(0.023)	(0.028)	(0.026)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country-time dummies	YES	YES	YES
Observations	1,138	1,137	1,125

Table 22a: country TLTROs and loans to NFCs (shorter period)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the first quarter of 2016. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.098**	0.097**	0.150***	-0.069	-0.124**
	(0.042)	(0.044)	(0.045)	(0.087)	(0.049)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	714	712	714	710	708

Table 22b: bank TLTROs and loans to NFCs (shorter period)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. In addition, we use country-time fixed effects. The sample period spans from the second quarter of 2014 to the first quarter of 2016. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	riskier margins	average margins
Bank TLTRO	-0.009	-0.013	-0.026	-0.008	0.003
	(0.020)	(0.019)	(0.022)	(0.034)	(0.022)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country-time dummies	YES	YES	YES	YES	YES
Observations	791	789	791	787	785

Table 23a: country TLTROs and loans for house purchase (shorter period)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance.The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the second quarter of 2014 to the first quarter of 2016. Robust standard errors in parentheses are clustered at the country level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.157***	0.169	-0.011
	(0.057)	(0.131)	(0.048)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	580	579	571

Table 23b: bank TLTROs and loans for house purchase (shorter period)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on bank TLTRO plus bank controls, demand controls and country-time dummies. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2014 to the first quarter of 2016. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Bank TLTRO	-0.021	0.182***	0.022
	(0.025)	(0.066)	(0.025)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country-time dummies	YES	YES	YES
Observations	639	638	630

Table 24a: country TLTROs and credit growth (shorter period)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance. The dependent variables are the quarterly growth rates of loans to NFCs (column 1) and loans for house purchase (column 2). They are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. In the case of loans to NFCs, demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. In the case of loans for house purchase, demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2014 to the first quarter of 2016. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

DEPENDENT VARIABLE	(1) credit growth (loans to NFCs)	(2) credit growth (loans for house purchase)
Country TLTRO	1.157**	1.205***
	(0.476)	(0.426)
Bank Controls	YES	YES
Demand Controls	YES	YES
Country Controls	YES	YES
Time dummies	YES	YES
Observations	710	774

Table 24b: bank TLTROs and credit growth (shorter period)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables are the quarterly growth rates of loans to NFCs (column 1) and loans for house purchase (column 2). They are regressed on bank TLTRO plus bank controls, demand controls and country-time dummies. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. In the case of loans to NFCs, demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. In the case of loans for house purchase, demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2014 to the first quarter of 2016. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

DEPENDENT VARIABLE	(1) credit growth (loans to NFCs)	(2) credit growth (loans for house purchase)
Bank TLTRO	-0.276	-0.398
	(0.298)	(0.279)
Bank Controls	YES	YES
Demand Controls	YES	YES
Country-time dummies	YES	YES
Observations	787	851

Table 25a: country TLTROs and loans to NFCs (sample without G-SIBs)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.085***	0.079***	0.138***	0.064	-0.055*
	(0.030)	(0.029)	(0.032)	(0.077)	(0.034)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	1,245	1,240	1,243	1,241	1,239

Table 25b: bank TLTROs and loans to NFCs (sample without G-SIBs)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on bank TLTRO plus bank controls, demand controls and country-time dummies. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Bank TLTRO	-0.004	-0.008	-0.005	-0.017	-0.012
	(0.014)	(0.015)	(0.015)	(0.034)	(0.018)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country-time dummies	YES	YES	YES	YES	YES
Observations	1,383	1,378	1,381	1,379	1,377

Table 26a: country TLTROs and loans for house purchase (sample without G-SIBs)

This table shows the coefficient of the variable country TLTRO, estimated by 2SLS. The instrumental variables are bank allowance and country allowance.The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

DEPENDENT VARIABLE	(1) credit standards	(2) average margins	(3) riskier margins
Country TLTRO	0.139***	0.163*	-0.031
	(0.035)	(0.098)	(0.039)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	1,093	1,090	1,073

Table 26b: bank TLTROs and loans for house purchase (sample without G-SIBs)

This table shows the coefficient of the variable bank TLTRO, estimated by 2SLS. The instrumental variable is bank allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on bank TLTRO plus bank controls, demand controls and country-time dummies. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

DEPENDENT VARIABLE	(1) credit standards	(2) average margins	(3) riskier margins
Bank TLTRO	-0.040*	0.126**	0.040
	(0.023)	(0.057)	(0.027)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country-time dummies	YES	YES	YES
Observations	1,205	1,202	1,185

Figure 1: distribution of TLTRO uptake over borrowing allowance (%) for banks participating in the initial TLROs

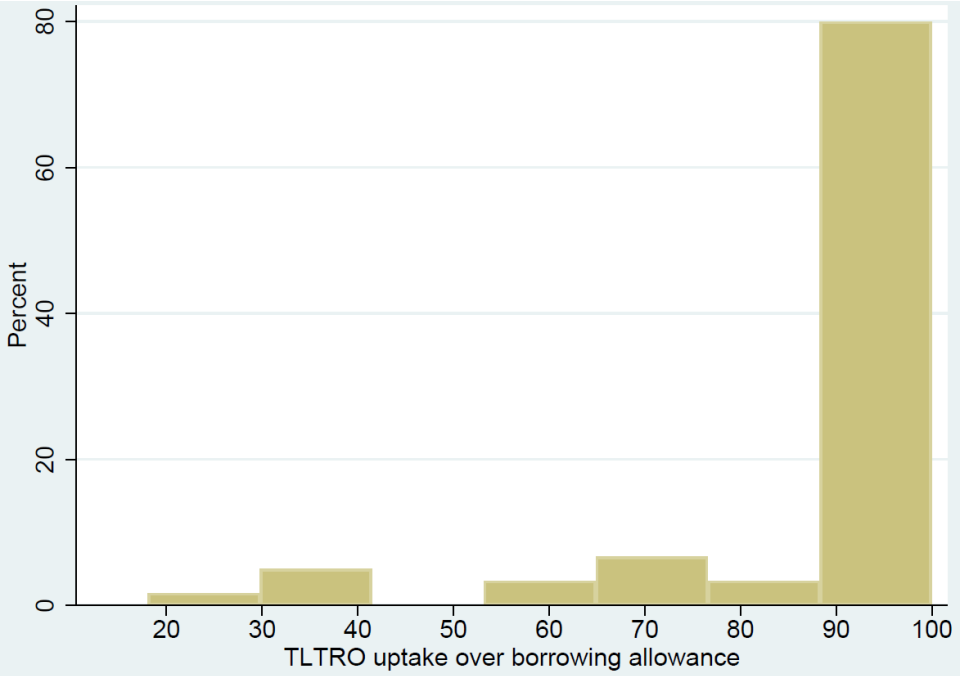
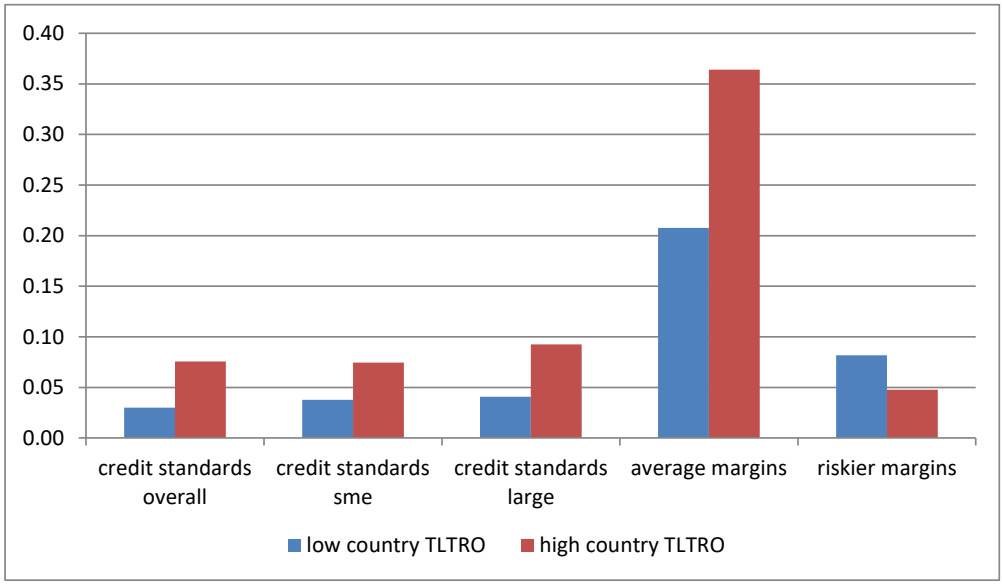
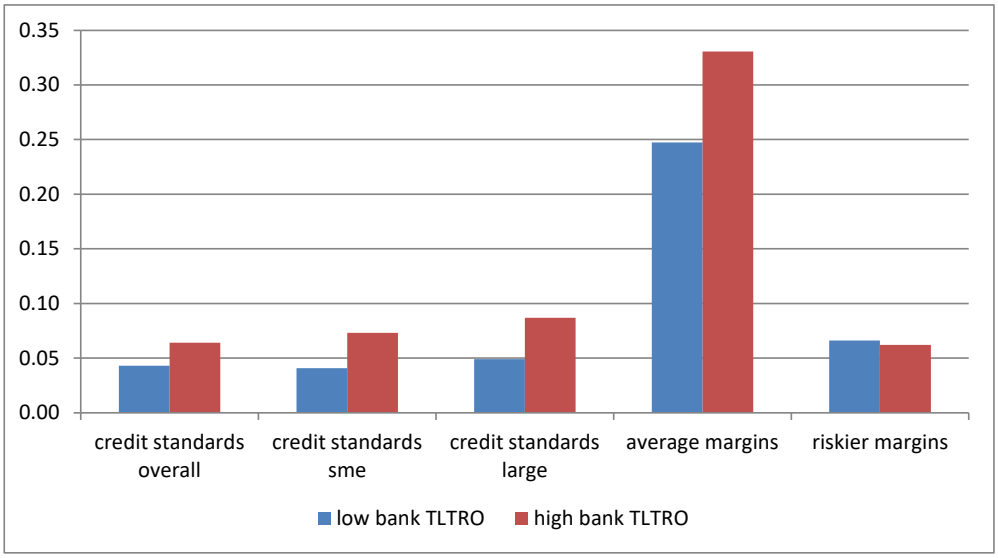


Figure 2: proportion of banks that eased credit standards/margins for high and low values of country TLTRO (loans to NFCs)



The figure displays the mean of the dependent variables (loans to NFCs) for two groups. A bank belongs to the group "high country TLTRO" if the value of the variable $\text{country TLTRO}_{(i)c}$ is higher than the median (0.75); otherwise it belongs to the group "low country TLTRO".

Figure 3: proportion of banks that eased credit standards/margins for high and low values of bank TLTRO (loans to NFCs)



The figure displays the mean of the dependent variables (loans to NFCs) for two groups. A bank belongs to the group "high bank TLTRO" if the value of the variable bank TLTRO_i is higher than the median (0); otherwise it belongs to the group "low bank TLTRO".

SUPPLEMENT: ESTIMATES OF INDIRECT EFFECTS WITH PROBIT AND IV PROBIT

Table A1: country TLTROs and loans to NFCs (Probit)

These tables show the average marginal effect of the variable country TLTRO, estimated by probit (table A1) and IV probit (table A2). The instrumental variables are bank allowance and country allowance. The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by non-financial corporations in the following segments: all firms, SMEs and large firms, short-term loans and long-term loans, loans for fixed investment, loans for inventories, loans for mergers and acquisitions and loans for debt refinancing/restructuring. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.113***	0.072***	0.157***	0.065	-0.002
	(0.026)	(0.025)	(0.030)	(0.057)	(0.026)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	1,137	1,134	1,315	1,342	1,340

Table A2: country TLTROs and loans to NFCs (IV Probit)

	(1)	(2)	(3)	(4)	(5)
DEPENDENT VARIABLE	credit standards overall	credit standards sme	credit standards large	average margins	riskier margins
Country TLTRO	0.196***	0.097***	0.160***	0.061	0.053*
	(0.036)	(0.034)	(0.040)	(0.078)	(0.027)
Bank Controls	YES	YES	YES	YES	YES
Demand Controls	YES	YES	YES	YES	YES
Country Controls	YES	YES	YES	YES	YES
Time dummies	YES	YES	YES	YES	YES
Observations	1,137	1,134	1,315	1,342	1,340

Table A3: country TLTROs and loans for house purchase (Probit)

This table shows the coefficient of the variable country TLTRO, estimated by probit (table A1) and IV probit (table A2). The instrumental variables are bank allowance and country allowance.The dependent variables take the values 1 (eased) and 0 (remained unchanged or tightened) and are regressed on country TLTRO and bank TLTRO plus macro controls, bank controls, demand controls and time fixed effects. Macro controls are the 10 year sovereign bond, the industrial production index, the unemployment rate, the consumer price index and the Herfindahl-Hirschman Index. Bank controls are size, capital ratio, liquidity ratio, loan-to-deposit ratio, deposit ratio, market share, legal form and NDFR. Demand controls are dummy variables for changes (decrease, unchanged, increase) in the demand of credit by households for house purchase and changes in the demand due to housing market prospects and consumer confidence. In addition, we use time fixed effects. The sample period spans from the second quarter of 2014 to the fourth quarter of 2017. Robust standard errors in parentheses are clustered at the bank level. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.095***	0.063	-0.039
	(0.028)	(0.054)	(0.027)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	1,158	1,173	1,156

Table A4: country TLTROs and loans for house purchase (IV Probit)

	(1)	(2)	(3)
DEPENDENT VARIABLE	credit standards	average margins	riskier margins
Country TLTRO	0.024	-0.117	-0.068**
	(0.038)	(0.097)	(0.033)
Bank Controls	YES	YES	YES
Demand Controls	YES	YES	YES
Country Controls	YES	YES	YES
Time dummies	YES	YES	YES
Observations	1,158	1,173	1,156

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