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January 2022


**ECARES working paper 2022-01**

ECARES
ULB - CP 114/04
50, F.D. Roosevelt Ave., B-1050 Brussels BELGIUM
www.ecares.org

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**Abstract**

This paper investigates the impact of idiosyncratic shocks in bank lending standards on firm credit in Italy, using survey data from the Regional Bank Lending Survey to identify bank supply conditions. From 2009 to 2019, we document that a one-standard-deviation tightening in lending standards reduces firm credit growth by 0.21 percentage points and explains 4.3% of the total variation. This effect is driven mainly by liquidity provisions to firms for credit lines. Examining the extensive margin of the bank-firm relationship, we find that a negative shock significantly impacts the probability of accepting new loan applications and the likelihood of the bank-firm relationship breaking up. We also show firms cannot smooth individual bank shocks by borrowing more from other lenders. Changes to lending standards have sizable and persistent effects on aggregate credit and production, especially at times of high economic uncertainty.

*JEL Classifications*: E30, E32, E44, E51 .

*Keywords*: Credit Growth, Bank Lending Standards, Credit Lines

*We are very grateful to Oliver De Jonghe, Glenn Magerman, Francesco Manaresi, Andrea Nobili, Steven Ongena, Marco Pagano, Marco Pelosi, Daniel Paravisini, Andrea Passalacqua, Enrico Sette, Fernando Stipanicic Màrquez, Ludwig Straub, Jeff Wooldridge, and Andrei Zlate for their comments and suggestions. We wish to thank the participants at the Bank of Italy's Banking Research Network Conference 2017 in Rome, the ENTER Jamboree Conference in Toulouse, the 22nd International Conference on Macroeconomic Analysis and Finance in Crete, the ERMAS Conference 2018 in Iaşi and the seminar audience at the European Stability Mechanism, and Tilburg University. Correspondence should be addressed to Lorenzo Trimarchi, Department of Economics, Université de Namur. Address: Rempart de la Vierge 8, B-5000 Namur (Belgium). Email: lorenzo.trimarchi@unamur.be. Lorenzo Trimarchi gratefully acknowledges financial support by the Excellence of Science (EOS) Research project of FNRS O020918F. The views contained here are those of the authors only and do not necessarily reflect those of their institution.

# 1 Introduction

The world experienced a prolonged economic decline after the 2007-2008 sub-prime mortgage crisis, now referred to as the "Great Recession," and its financial origins led economists and policy-makers to devote attention to the role of banks in the economy (Brunnermeier, 2009; Gorton, 2009) because a sharp decline in credit to firms (Ivashina and Scharfstein, 2010; Chodorow-Reich, 2014) and real investments (Campello et al., 2010; Cingano et al., 2016) was observed parallel to the economic slowdown.

Two competing mechanisms explain why credit is pro-cyclical, based on the relationship between asset price changes and credit growth (Bernanke and Gertler, 1989; Holmström and Tirole, 1997; Kiyotaki and Moore, 1997). First, companies cannot pledge assets as collateral to borrow more during economic recessions because the crisis reduces demand for the firms' output, and that leads to lower credit demand, i.e., the *borrower balance-sheet channel*). Secondly, the higher cost of financing and the deteriorating quality of their portfolio make it harder for banks to meet regulatory capital requirements, and this turns into a decrease in credit supply, i.e., *bank balance-sheet channel* (Gambacorta and Mistrulli, 2004).

While previous studies have extensively analyzed the transmission of aggregate shocks to the banking sector (e.g., Khwaja and Mian, 2008; Jiménez et al., 2012, 2014), recent papers highlighted the importance of bank-level shocks in shaping the credit cycles (e.g., Amiti and Weinstein, 2018). Our work focuses on the effects of idiosyncratic shocks in lending standards on credit markets. In particular, we find that bank-level shocks decrease the amount of credit granted to firms and reduce the probability of acceptance of new loan applications while increasing the likelihood of bank-firm relationships breaking up.

The lending standards reflect the banks' internal guidelines or criteria governing their loan policy, defining, for any given level of borrower risk, whether the bank should grant the loan or not. Crucially, the applied lending standards have important consequences on the amount of credit granted to firms, especially during busts of the business cycle (Dell'Ariccia and Marquez, 2006; Rodano et al., 2018). Recent studies also show how important are lending standards to motivate the role of financial frictions in macroeconomic models to explain the Great Recession (Perri and Quadrini, 2018). Change in lending standards can lead to negative externalities, given that they are dynamic strategic complements among banks: when one bank tightens lending standards, it worsens the pool of future borrowers for all banks, escalating their incentives to stiffen their lending standards. This feedback loop, generated by tightening bank credit policy, can amplify and prolong recessions, affecting the loan amounts, credit spreads, and default rates (Fishman et al., 2020).

To study how idiosyncratic shifts in bank lending standards affect credit to firms, we construct a unique database exploiting information from the Bank of Italy's Credit Register (CR) while directly eliciting the bank lending standards from an original Bank of Italy's survey, the Regional Bank Lending Survey (RBLS). CR data helped in the study of different financial instruments and loan applications.[1] We first focus on the total credit granted to private non-financial firms in Italy, then move on to look at a specific type of loan, the revocable lines of credit (credit lines), because we are interested in investigating how shocks dampen the ability of banks to function as "liquidity providers." (Kashyap et al., 2002)[2]

We use half-yearly data to show how an idiosyncratic shock to lending standards affects the credit market between 2009 and 2019. We document that exposed firms fail to smooth these effects by using alternative sources of finance, with consequences on real economy outcomes such as sales and employment. Departing from other studies analyzing how firms use bank credit to smooth firm-level shocks (e.g., Greenwald et al., 2020), we focus on granted credit which is more apt to capture bank supply shocks rather than drawn credit that better identifies firm demand shocks.

The Italian economy has underperformed compared to euro area peers. Firms' financial constraints could be one of the major obstacles preventing Italy from reaching the pre-crisis income level. Several studies show that financial shocks can harm productivity growth (e.g., Midrigan and Xu, 2014). Given that Italian firms used bank credit as a primary financing source, the role of credit markets can be particularly important to them, with any credit

[1]The Italian Credit Register contains detailed information on three main loan facilities by firms: loans backed by account receivables, revocable lines of credit, term loans. The loan backed by receivables is a financial contract where the firm's receivables are used as collateral. In the transaction, the firm receives a reduced value of the unpaid invoices when it transfers the default risk associated with the accounts receivables to the lender. A revocable line of credit is a short-term source of financing that can be drawn at the borrower's discretion. However, the bank keeps the possibility of revoking a credit line under specific circumstances, such as a deterioration in the firm's financial condition. Term loans are a financial contract with a longer maturity usually used for investments.

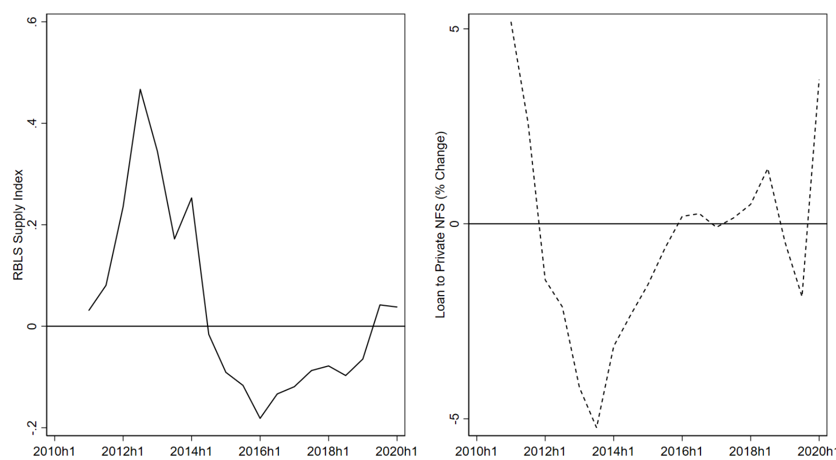
[2]Lins et al. (2010) document that credit lines represent about 17% of Italian firm's assets and 15% of firm's assets across 29 countries.

tightening imposing a negative impact on productivity and investment (Cingano et al., 2016; Manaresi and Pierri, 2018).[3]

During a crisis, a combination of demand and supply effects will reduce the equilibrium credit quantities, which raises an identification problem in our study. The challenge is to identify whether a move in lending to firms is induced by demand or supply factors. Following other influential studies that highlight the importance of idiosyncratic bank shocks to the economy (Amiti and Weinstein, 2018; Huber, 2018), we estimate the effects of idiosyncratic shifts in the bank lending policy using an identification strategy that combines the empirical methodologies proposed by Bassett et al. (2014) and Khwaja and Mian (2008).

Figure 1

Loans to Private NFS and RBLS Supply Index (2010-2020)




The figure plots two time series: the left panel shows the variation of the average index for the lending standard supply condition retrieved from the RBLS where positive values are associated with tighter supply policies, the right panel shows the percentage change in the loans to non-financial corporations (NFS). Source: authors' calculation based on the RBLS and the Bank of Italy's statistical data.

[3]The Italian corporate bond and stock markets are undersized relative to similar advanced economies. For instance, the number of listed companies per million of habitats in Italy is 4.73, while 7.78 for Germany, and 13.21 for the United States (Source: FRED St. Louis for the year 2013).

To identify changes in banks' lending standards, we use RBLS data on banks' actual and expected lending policies. Figure 1 shows the negative relationship between the one-year lagged measure of supply index and the credit granted to non-financial corporations. However, to address potential endogeneity concerns, we construct a supply shock measure that abstracts from factors correlated with firms' demand, notably loan officers' expectations, bank characteristics, and economic conditions. Also, bank-firm relationship information is considered to control for any unobservable characteristics of the borrower by applying firm-time fixed effects: the coefficient is identified by comparing banks that lend to the same firm but are exposed to different shocks.

We document that a firm borrowing from a bank experiencing a one-standard-deviation change in lending standards suffers an additional reduction in total credit growth of 0.27 percentage points with respect to borrowing from non-affected banks, representing 4.3% of its average growth rate between 2009 and 2019. Our data suggest this credit contraction is concentrated on the most flexible type of financial contract: the revocable credit lines. A tightening representing a one-standard-deviation change in lending standards decreases the growth rate of credit lines by 0.18 percentage points, explaining 8.7% of the average credit lines growth rate. In addition, the extensive margin of the bank-firm relationship seems to be affected: a tightening in the lending standards reduces the probability of acceptance of loan applications by 0.5 percentage points, a similar effect to the likelihood that banks provide new credit to firms that already borrow. We also show that tightening lending standards increases the probability of an interruption of the bank-firm relationship by 1.3 percentage points.

Understanding the effects of idiosyncratic changes to lending standards is crucial to assessing the effectiveness of the risk-taking transmission channel of the monetary policy. Expansionary monetary policies should induce banks to provide more liquidity to firms by easing their lending standards. For instance, Maddaloni and Peydró (2011) show that a loose monetary policy stimulated a softening in lending standards before the crisis and worsened economic performance afterward. However, Italian banks often applied excessive tightening to lending standards during the crisis, despite the easing of ECB's monetary policy. We show that this phenomenon can impact macroeconomic variables, such as GDP and unemployment, and trigger a sharp contraction in firm borrowing. We find that when banks appreciably overshoot their tightening of lending standards, they reduce the growth rate of credit lines for at least two years by about five percentage points. This result suggests that the bank assessments of corporate risk could partially offset the impact of monetary policy transmission through the banking sector.

Our results are relevant, given how many governments planned to support economies through the banking system during the global pandemic economic crisis, relying on conventional wisdom that perceives the banking sector as the principal source of liquidity in bad times (Holmström and Tirole, 1998; Kashyap et al., 2002; Gatev and Strahan, 2006). Studies examining the impact of the global pandemic on firms' financing decisions show how the bond market has become central in providing liquidity to US firms, despite Federal Reserve monetary policy easing (Darmouni and Siani, 2020). Our evidence suggests that the transmission of an expansionary monetary policy might be diluted if banks embark on an excessive tightening of lending standards.

The rest of the paper is organized as follows: Section 2 briefly discusses the related literature; Section 3 describes the data; Section 4 introduces the econometric strategy; Section 5 presents the empirical results. Finally, Section 6 concludes the paper.

## 2 Related Literature

This paper contributes to various strands of the banking literature. First, it relates to empirical studies aimed at quantifying the impact of the bank-lending channel using firm-bank transaction data, demonstrating how credit supply impacts firm credit (e.g., Amiti and Weinstein, 2011; Jiménez et al., 2012, 2014; Bonaccorsi di Patti and Sette, 2016; Bofondi et al., 2018). For instance, Khwaja and Mian (2008) use changes in bank liquidity induced by an unexpected nuclear test in Pakistan as an exogenous source of variation for banks' credit supply. They document the transmission of a bank shock in terms of actual credit granted to firms and the heterogeneous effects among different firm size classes, showing how large connected firms compensate for adverse financial shocks by using alternative financing sources. Recently a new strand of the literature highlighted the role of bank-level idiosyncratic shocks in determining changes in credit supply (e.g., Passalacqua et al., 2021; Alfaro et al., 2021). For instance, Amiti and Weinstein (2018) extended Khwaja and Mian's methodology to analyze the role of idiosyncratic granular bank-supply shocks, finding that the estimated shocks can explain about 30-40 percent of the aggregate loan and investment fluctuations. These studies suggest it is crucial to analyze the effects of supply conditions, and our paper contributes to this literature by considering the measure of changes in credit supply as retrieved from survey data. We then apply an econometric strategy similar to that of Khwaja and Mian (2008) to identify the causal effect on credit to firms.[4]

Our paper also relates to an extensive body of work on credit lines. While previous studies have highlighted how the pricing and availability of credit lines are a function of the risk exposure of both lenders and borrowers (e.g. Sufi, 2009; Campello et al., 2011; Acharya et al., 2014; Ippolito et al., 2016; Chodorow-Reich and Falato, 2022), we provide novel evidence of the importance of bank lending standards on the supply of credit lines. This credit type is found to be a key source of funding for firms in times of distress (e.g. Jiménez et al., 2009; Campello et al., 2010; Lins et al., 2010; Berg et al., 2016; Nikolov et al., 2019; Brown et al., 2021). Moreover, Greenwald et al. (2020) show that aggregate US bank lending to firms expands following several adverse macroeconomic shocks, and credit line draws drive this dynamic. Thus, they find that banks experiencing larger draw-downs during the COVID-19 crisis restrict term lending more, crowding out credit to smaller firms. We contribute to this literature showing that bank-level idiosyncratic shocks restrict credit lines granted to firms.

Our study contributes specifically to the literature that aims to understand the role of lending standards in credit cycle fluctuations. Studies on European economies usually employ European Central Bank's Bank Lending Survey (BLS) data to estimate the pass-through effects of a change in lending standards to businesses. Del Giovane et al. (2011) quantify the relative importance of credit supply and demand behind the slowdown in loans to non-financial corporations during the financial crisis of 2007-2009, estimating that supply factors induced a contraction between 2.3 and 3.1 percentage points in the annualized quarter-on-quarter rate of growth in bank loans to enterprises during the financial crisis. Ciccarelli et al. (2015) provide a test to determine how the bank lending channel acts as a transmission mechanism for a monetary policy shock, amplifying its effects on real activities. Altavilla et al. (2019) find that a tightening of credit standards leads to a protracted contrac-

[4] Other papers use different sets of fixed effects, such as industry-location-size-time, to control for credit demand shocks (e.g., Degryse et al., 2019; Acharya et al., 2019).

tion in credit volumes intermediated by banks and to higher lending margins, showing that this is often associated with an increase in the issue of debt securities and higher corporate bond spreads. In the case of Italy, Nobili and Orame (2015) find that the estimated effect of a supply restriction on the short-term dynamics of credit to firms, as captured by the BLS indicators, is characterized by an upward but slight bias and suggest that the RBLS can be a valuable tool in the assessment of supply conditions in the Italian market.

Further evidence about the role of lending standards for the US economy arises from the Senior Loan Officer (SLO) Survey conducted by the US Federal Reserve. Lown and Morgan (2006) and Bassett et al. (2014) show that a shock in lending standards induces a decline in output and the aggregate volume of credit to firms and households, which would trigger a monetary policy easing in response to the tighter lending conditions. Although our empirical methodology is built upon the empirical model of Bassett et al. (2014), our paper focuses on the micro-level behavior of banks. Using a unique dataset combining information from the BLS and the SLO surveys, Maddaloni and Peydró (2011) find that low short-term (monetary policy) rates soften lending standards rather than low long-term interest rates. This effect amplifies the consequences of monetary policy easing, and they provide evidence that expansionary monetary policy prolonged through time induced an excessive softening of lending standards and constituted a key factor leading to the financial crisis. A study by Vojtech et al. (2020) finds that a tightening in lending standards for mortgages increases the loans denial rate by one percentage point and a five percent decline in the loan issuance. Chen et al. (2021) estimate a quantitative macro model incorporating credit frictions to identify how shocks to the credit supply drive a tightening in the lending standards and explain about 40 percent of the short-run fluctuations in bank loans and aggregate output. Finally, they link their results to the heightened economic uncertainty that follows credit supply shocks and provide evidence to show that uncertainty is the primary driver of tightening.

We complement these studies by using the depth of our dataset to provide evidence on the micro-impact of lending standards on credit to firms, focusing on liquidity provision in bad times. Furthermore, we analyze the variation in the different credit facilities, on the extensive margin, and bad loans.

# 3 Data and Descriptive Statistics

For the empirical analysis, we retrieve half-yearly information between 2009-2019 from three databases collected by the Bank of Italy: the Regional Bank Lending Survey (RBLS), the Italian Credit Register (CR), and the Supervisory Reports.

As Bolton et al. (2016) highlighted, there can be several reasons to focus on Italy in studying credit supply during the Great Recession. First, the Italian economy is characterized by a significant fraction of small and medium-sized firms highly dependent on bank financing and, thus, exposed to bank-level shocks. Second, in our sample period, the crises have not compromised financial stability (Panetta et al., 2009). Third, multiple lending is a long-standing characteristic of bank-firm relationships in Italy (Detragiache et al., 2000). This feature is essential since Khawaja and Mian's methodology exploits the fact that a firm borrows from several banks. Finally, the data available at the bank-firm level allows us to identify better credit supply shocks (e.g., Kashyap and Stein, 2000).

## 3.1 The Regional Bank Lending Survey

To construct our bank lending standards measure, we use the Bank of Italy's Regional Bank Lending Survey, which mirrors the BLS structure to gather information about Italy's credit demand and supply. The purpose of this survey is similar to the Federal Reserve's Senior Loan Officer Opinion Survey used in other studies on lending standards in the United States. Questions are divided into two blocks: the first focuses on the latest economic trends; the second concerns structural characteristics of financial intermediaries.[5]

Our study employs the first block of the survey, where banks are asked to provide information on economic trends for credit supply and demand. The RBLS includes half-yearly information on banks' credit policies in the four Italian macro-regions, offering greater geographical depth than the BLS survey. Also, the RBLS captures information from 346 banks, a more significant number than the 141 in the BLS survey, capturing almost 90 percent of firm credit granted by banks operating in Italy.

[5] The analysis has no supervisory purposes because it is a statistical instrument at the disposal of the Bank of Italy's research department. Therefore, the incentives to misreport by the respondents are mitigated because loan officers do not need to hide information from the supervisory authority.

The RBLS provides information about bank lending standards for three credit categories: credit to firms (with details on their sector of activity: manufacturing, services and construction), consumer credit and family mortgages. The banks are asked each half-year to provide a qualitative measure of change in their credit demand ($\Delta D_{b,t}$) and in their supply policies ($\Delta S_{b,t}$). The intensity range for the supply indicator has five possible values: *tightened considerably*, *somewhat tightened*, *essentially unchanged*, *somewhat eased*, *eased considerably.* A similar range is used for the demand indicator: *increased considerably*, *somewhat increased*, *essentially unchanged*, *somewhat decreased*, *decreased considerably.* Employing these intensity ranges, the financial intermediaries also declare their expectations about credit demand ($E_{t-1}\left[\Delta D_{b,t}\right]$) and supply ($E_{t-1}\left[\Delta D_{b,t}\right]$) for the coming half-year. The answers are converted into numeric variables from -1 to 1. Positive values conventionally identify any credit supply tightening and negative numbers represent any easing; similarly, any projected demand increase is represented by positive values and shrinkage by negative values.

Table 1

Descriptive Statistics - RBLS

| | (1) Mean | (2) Median | (3) S.D. | (4) Observations |
|---|---|---|---|---|
| $\Delta S_{b,t}$ | 0.041 | 0 | 0.292 | 30,477 |
| $\Delta D_{b,t}$ | 0.014 | 0 | 0.426 | 30,477 |
| $E_{t-1}\left[\Delta S_{b,t}\right]$ | 0.002 | 0 | 0.242 | 30,477 |
| $E_{t-1}\left[\Delta D_{b,t}\right]$ | 0.135 | 0 | 0.625 | 30,477 |

Note. The table shows the descriptive statistics for the variables retrieved from the RBLS used in the paper: $\Delta S_{b,t}$ is the change in the supply condition for bank $b$ in the half-year $t$, $\Delta D_{b,t}$ is the change in the demand condition for bank $b$ in the half-year $t$, $E_{t-1}\left[\Delta S_{b,t}\right]$ and $E_{t-1}\left[\Delta D_{b,t}\right]$ are respectively the expectation of the demand and supply indexes for bank $b$ in the half-year $t-1$.

Table 1 displays the summarized statistics for these indexes for the period 2009-2019. Our sample starts in 2009 because the structure of the RBLS first appeared that year and has remained unchanged ever since. Average bank expectations indicate a degree of optimism compared to the actual indexes: supply is larger than its expected counterpart, meaning the credit market was tighter than what banks anticipated; demand was, on average, actually lower than expected.

## 3.2 The Central Credit Register

The second information source is the Italian Central Credit Register (CR), which details loans granted to non-financial borrowers above 30,000 euros. It includes data on loan applications that will be used to analyze the extensive margin of the firm-bank relationship. In addition, the CR includes both granted and drawn credit. Following Bofondi et al. (2018), among others, we focus on credit granted, called credit commitments, because the drawn credits are influenced by the borrower's decision to use available lines, often driven by demand factors.

Table 2 shows the descriptive statistics of our key variables from CR. To analyze the intensive margin of the bank-firm relationship we define the variable $\Delta L_{f,b,t}$ which is the change in the logarithm of bank credit to firms. The study focuses on two main aggregates: credit lines ($\Delta L^{CL}_{f,b,t}$) and total credit ($\Delta L^{TC}_{f,b,t}$).

We also study the extensive margin of the bank-firm relationship by retrieving information on the loan applications outcome from the credit register to analyze the probability that a firm receives new credit from a bank. Each time a new client submits a loan application to a bank, supervision requirements demand that the potential lender request information on the borrower through a CR record. For each application, we check whether the bank eventually granted any credit commitment to the applicant within the same or the following half-year of the application.[6] In our study we define the dummy variable Loan Granted$_{f,b,t}$ equal to one if a loan application of firm $i$ to bank $b$ at time $t$ is accepted, and zero otherwise.[7]

The analysis on the extensive margin is completed by other two variables: the dummy New Loans$_{f,b,t}$ equal to 1 if the bank $b$ increases the total amount lent to firm $f$ in CR, and a dummy Exit$_{f,b,t}$ equal to one if the bank-firm relationship disappears from CR in the following half-year. Finally, we collect information on the firm-bank relationship by including as control the following variables: the maturity measured as the number of half-years that the relationship is observed in CR; the share of credit granted to firm $i$ by bank $b$ over the firm $i$'s total bank credit; a dummy equal to one if the bank $b$ is firm $i$'s main lender; and the share of credit borrowed by firm $i$ from bank $b$ over bank $b$'s total credit.

[6] For example, if a loan application is submitted to a bank in September 2011, we classify it as accepted if we observe that the bank grants credit to that borrower either by 2011.II or by 2012.I.

[7] Information on the type of loans requested is not available in the loan application data.

Table 2
Descriptive Statistics

| | (1) Mean | (2) Median | (3) S.D. | (4) Observations |
|---|---|---|---|---|
| Total Loans$_{f,b,t}$ | 1058.022 | 212.083 | 16496.134 | 21,686,533 |
| Credit Lines$_{f,b,t}$ | 142.582 | 35 | 2459.206 | 18,184,488 |
| Term Loans$_{f,b,t}$ | 651.980 | 105 | 10754.286 | 12,659,079 |
| LBR$_{f,b,t}$ | 369.002 | 125 | 2540.081 | 12,027,771 |
| $\Delta$Total Loans$_{f,b,t}$ | -6.243 | 0 | 56.087 | 16,865,759 |
| $\Delta$Credit Lines$_{f,b,t}$ | -2.136 | 0 | 48.438 | 13,560,795 |
| $\Delta$Term Loans$_{f,b,t}$ | -12.228 | -12.479 | 79.692 | 8,823,443 |
| $\Delta$LBR$_{f,b,t}$ | -2.161 | 0 | 55.226 | 9,118,019 |
| Exit$_{f,b,t}$ | 0.067 | 0 | 0.250 | 20,871,819 |
| New Loans$_{f,b,t}$ | 0.237 | 0 | 0.425 | 20,002,695 |
| Loan Granted$_{f,b,t}$ | 0.347 | 0 | 0.476 | 21,686,533 |
| LS$_{b,t}$ | 0.005 | -0.001 | 0.305 | 21,686,533 |

Notes. The table shows the descriptive statistics for the variables retrieved from CR. Total Loans$_{f,b,t}$ is the value of the total loans in thousands borrowed by firm $f$ from bank $b$ in the half-year $t$, Credit Lines$_{f,b,t}$ is the value of credit lines granted by bank $b$ to firm $f$ in the half-year $t$, $\Delta$Total Loans$_{f,b,t}$ is the log-change of the value of the total loans in thousands borrowed by firm $f$ from bank $b$ in the half-year $t$, $\Delta$Credit Lines$_{f,b,t}$ is the log-change of the the value of credit lines granted by bank $b$ to firm $f$ in the half-year $t$, New Loans$_{f,b,t}$ is a dummy equal to 1 if the bank $b$ increases the total amount lent to firm $f$ in CR, Loan Granted$_{f,b,t}$ is a dummy equal to one if a loan application of firm $i$ to bank $b$ at time $t$ is accepted, Exit$_{f,b,t}$ is a dummy equal to one if the bank-firm relationship disappears from CR, and $\Delta$ LS$_{b,t-1}$ is the idiosyncratic shock to bank $b$ lending standards in the half-year $t-1$ as defined in equation (3).

## 3.3 The Supervisory Reports

Balance-sheet information collected through the Supervisory Reports, which financial intermediaries submit to the Bank of Italy each month, can act as a control for observable characteristics within our sample of banks. Given that the RBLS is collected on a non-consolidated basis, we use individual financial data rather than consolidated, group-level information. Thus, we add the following predetermined control variables: the bank size, measured as the natural logarithm of total assets; an interbank deposit variable, scaled by total assets; a liquidity ratio captured by the ratio between cash and total assets; a capital ratio given by book capital value over assets; and finally an indicator of non-performing loans scaled by total assets. We also control for the specialization of financial intermediaries by including the share of firm loans over the bank's total loans in our analysis.

# 4 Identifying Idiosyncratic Shocks in Bank Lending Standards

This section shows our strategy to identify changes in lending standards building on the methodology by Bassett et al. (2014).

First, we retrieve information about indicators charting the impact of supply and demand on bank lending standards using the RBLS. From the raw survey answers, about three client categories $k$ (firm credit, consumer credit, and family mortgages), we build composite bank indexes to measure the expected and observed changes in overall lending standards and credit demand. Those indexes are built as follows:

$$\Delta S_{b,t} = \sum_{k} \omega_{b,t-1}(k)\, I^{S}_{b,t}(k) \quad \text{and} \quad \Delta D_{b,t} = \sum_{k} \omega_{b,t-1}(k)\, I^{D}_{b,t}(k)\,, \tag{1}$$

where the weight $\omega_{b,t-1}(k)$ is the ratio of credit granted to $k$ at $t-1$ over the total outstanding credit of bank $b$, and $I^{S}_{b,t}(k)$ and $I^{D}_{b,t}(k)$ are respectively the supply and demand answers from the survey for category $k$. In particular, the supply indicator $I^{S}_{b,t}(k)$ is defined for bank $b$ in the half-year $t$ and the corresponding range spreads from $-1$ for a considerable easing to $+1$ for a considerable tightening respect to the client category $k$ (the demand indicator $I^{D}_{b,t}(k)$ follows a similar definition).

Our benchmark considers all three client categories and not just the firm index to account for spillover effects of a tightening in lending standards on credit markets. Furthermore, the RBLS provides information on the bank lending policies for firms disentangled by sectors and geographical areas. In our benchmark estimates, we always use the average value for firms but keep the geographical heterogeneity captured by the RBLS. Additionally, subsection 5.2.1 shows that our results are robust to different construction of the indexes shown in equation (1).

Using the survey data to describe credit cycles raises an endogeneity problem in that demand factors could influence the answer of loan officers about the credit supply. To identify the idiosyncratic shocks to bank supply, we want to measure a change in banks' lending standard orthogonal to demand factors. Therefore, we first estimate the following regression by ordinary least squares (OLS):

$$\begin{aligned}\Delta S_{b,t} = {} & \beta_0 + \beta_1 \Delta S_{b,t-1} + \beta_2 \Delta D_{b,t} + \beta_3 E_{t-1}\left[\Delta S_{b,t}\right] + \beta_3 E_{t-1}\left[\Delta D_{b,t}\right] + \\ & + \gamma X_{b,t} + \delta_b + \eta_t + \varepsilon_{b,t},\end{aligned} \tag{2}$$

where $\Delta S_{b,t}$ is the change in lending standard for the bank $b$ in year $t$; $\Delta D_{b,t}$ is the change in the demand condition for bank $b$ in year $t$; $E_{t-1}\left[\Delta S_{b,t}\right]$ is the expectation at the half-year $t-1$ of the change in lending conditions in the half-year $t$ for bank $b$; and $E_{t-1}\left[\Delta D_{b,t}\right]$ is the expectation at the half-year $t-1$ of the change in credit demand in the half-year $t$ for bank $b$. $X_{b,t}$ is a set of bank-level controls, $\delta_b$ is the bank fixed effects, $\eta_t$ is the time fixed effects and $\varepsilon_{b,t}$ is the error term.[8]

So we define our measure of idiosyncratic shocks to bank lending standards as follows:

$$\Delta \mathrm{LS}_{b,t} = \hat{\varepsilon}_{b,t}, \tag{3}$$

this is the residual of the regression defined in equation (2).[9] By construction, this is orthogonal to all the other variables included in the model, so it represents the variation in credit standards attributable to a bank supply shock and not to demand or other confounding factors; neglecting to include such factors in the analysis leads to the creation of an omitted variable bias. We remind that an increase in one of our supply indexes corresponds to a

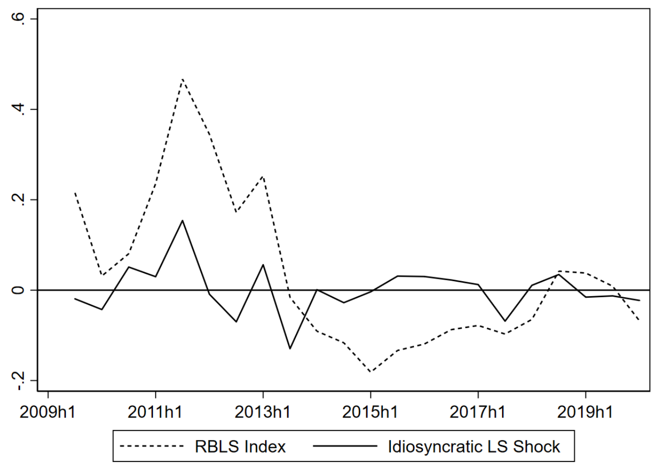
[8] In an alternative specification, we substitute the time fixed effects with macroeconomic variables, such as GDP and unemployment. We found no improvement in the goodness of fit, so we decided to adhere to the most conservative model in terms of residual magnitude.

[9] The identification assumption of our constructed credit shock is that the demand affects the supply contemporaneously and not vice-versa. The approach followed in this paper is inspired by the econometric literature on structural vector autoregressive analysis. For a recent literature review, see Kilian and Lütkepohl (2017).

tightening.

Figure 2

RBLS Supply Index and Idiosyncratic Shocks to Lending Standards (2009-2019)




The figure plots the average RBLS supply index and idiosyncratic shock to lending standards ($\Delta \mathrm{LS}_{b,t}$) for all the banks in our sample. Both indexes are constructed by weighting each bank by its total loans.

Table A1 of the Appendix shows the resulting coefficients from equation (2) estimation. The first specification reported in column 1 includes the lagged change in credit supply, the change in loan demand, and the lagged expected changes of both demand and supply indicators. In column 2, predetermined bank-level controls are added, such as total assets, inter-bank deposits, liquidity, capitalization, the share of non-performing loans, and the share of credit allocated to firms. In column 3, we include time fixed effects. Ultimately, our model always controls for bank fixed effects, while the standard errors are clustered at the bank level.

In all the specifications, the RBLS indicators show the expected signs: a tightening of credit standards in the previous half-year corresponds to a further tightening in the current half-year, with an increase in loan demand associated with an easing in credit standards in the same period. A similar path is retrieved from the coefficients for the expected changes in supply and demand in the previous half-year. The inclusion of bank-level controls and time fixed effects does not affect the magnitude or significance of the RBLS coefficients, except for the expected demand change, whose effect is absorbed by such controls. Using the estimation in column (3) as our favorite specification, we extract the residual and use this measure, $\hat{\varepsilon}_{b,t}$, as the change in lending standards induced by bank's supply shock. Figure 2 shows the average RBLS supply index dynamic and our measure of change in lending standards $\Delta\text{LS}_{b,t}$.

# 5 Results

## 5.1 Aggregate Impact of Idiosyncratic Shocks to Lending Standards

### 5.1.1 Impact on Macroeconomic Outcomes

We assess the dynamics of idiosyncratic shocks to lending standards on macroeconomic outcomes. Following Chen et al. (2021), we also analyze if our results depend on the level of uncertainty. Many studies use a class of vector autoregression models and identify the role of aggregate credit supply shocks by imposing sign restrictions or by using instrumental variables (Altavilla et al., 2019; Gambetti and Musso, 2017; Bijsterbosch and Falagiarda, 2015; Hristov et al., 2012). Given the limited dimension of our sample, we use the local projections method proposed by Jordà (2005) and the average shock to bank lending standard defined. This econometric model allows us to estimate impulse response functions robust to misspecification in the data generating process. In particular, it allows us to consider nonlinearities in the model that would be unfeasible using a vector autoregression model. These nonlinearities are estimated in a univariate framework, allowing higher degrees of freedom. Local projections are based on sequential regressions of the dependent variable moved forward:

$$\begin{aligned} y_{t+h} = \alpha^h &+ \beta^h_{1,1}\Delta\text{LS}_t + \beta^h_{2,1}\Delta\text{LS}_t \times \theta_{t-1} + \beta^h_{3,1}\theta_{t-1} + \\ &+ \cdots + \beta^h_{1,p}\Delta\text{LS}_{t-p} + \beta^h_{2,p}\Delta\text{LS}_{t-p} \times \theta_{t-p-1} + \beta^h_{3,p}\theta_{t-p-1} + \mu_{t+h}, \end{aligned} \tag{4}$$

where $y_{t+h}$ denotes real GDP growth or change in unemployment, $\mathrm{LS}_t$ is the average shock to bank lending standard in year $t$ weighted by banks' total loans, $\theta_t$ is our measure of economic uncertainty. We control for time trends and interest rates applied to firms in all our specifications.[10] We also use Newey-West standard errors due to the inherent serial correlation, and we define *high uncertainty* as corresponding to the value at the 90th percentile of the distribution of our uncertainty measure, while *low uncertainty* represents the 10th percentile.

Building upon the Global Economic Policy Uncertainty (GEPU) index constructed by Baker et al. (2016), we define a variable to measure uncertainty $\theta_t = -\lambda GEPU_t/(1 + \exp(-\lambda GEPU_t)$, with $\lambda > 0$ and $0 < \theta_t < 1$. Following Auerbach and Gorodnichenko (2012), we calibrate $\lambda$ to 1.5 to define the state of the business cycle when assessing the state-dependency of the fiscal stance. The effects of bank lending standards on $y_{t+h}$ at horizon $h$ are given by $\beta^h_{1,1} + \beta^h_{2,1}\theta_t$. $\beta^h_{2,1}$ captures the impact that depends on the level of uncertainty the period before the shock hits. A positive $\beta^h_{2,1}$ coefficient suggests that, on average, higher uncertainty in the period before the realization of the shock leads to a worsening in output.

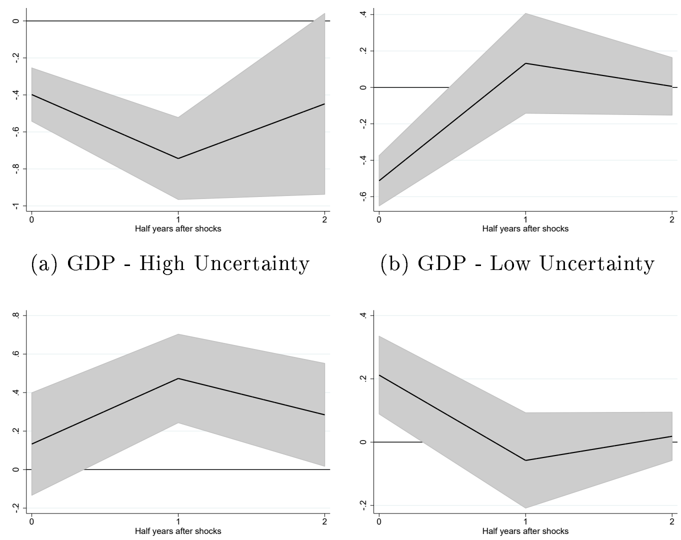
Figure 3 shows the estimated impulse response functions and the shaded areas represent the confidence interval defined at 90%. The top-left represents the output dynamics following the shock that materializes after a period of higher uncertainty, and the top-right panel shows the response with lower uncertainty. Similarly, the bottom-left and the bottom-right panels have the same structure but use the change in unemployment as the dependent variable.

Our results indicate that the output decline is prolonged following a period of higher uncertainty. A similar finding regards unemployment, for which the impulse response function shows a significant increase with a one-period lag. However, there is no significant effect following a low-uncertainty period for GDP and unemployment. Evidence in the high-uncertainty case is in line with the findings of Bassett et al. (2014) that the contraction of GDP after a negative shock on lending standards is around 0.7 percent change after a year - we find a similar magnitude after just one half-year. Moreover, when the level of uncertainty in the economy is high, banks respond by restricting the supply of funds to the real economy (Bratsiotis and Theodoridis, 2020).

[10] We also include as control one-period lagged variables in our estimation. We select the order by looking at different statistics, such as the Bayesian Information Criterion and Akaike's Information Criterion.

Figure 3

Empirical Response Functions to Change in Lending Standards




(a) GDP - High Uncertainty

(b) GDP - Low Uncertainty

(c) Unemployment - High Uncertainty

(d) Unemployment - Low Uncertainty

The figure plots the estimates the econometric model described in equation (4). The solid lines represent the estimated impulse responses to a change in lending standards, while the shaded areas contain the 90% confidence intervals based on Newey-West standards errors. High uncertainty corresponds to the 90th percentiles of our uncertainty measure, while low uncertainty corresponds to the 10th percentile.

### 5.1.2 Persistence of an Idiosyncratic Shock to Lending Standards

The previous subsection shows that idiosyncratic shocks to bank lending standards have sizable effects on the economy. However, the limited span of our period did not allow us to analyze the persistence of the estimated negative effect using the local projection. Thus we use an event-study approach to understand how persistent this shock is through time. This question is essential because a tightening in lending standards is, in theory, very persistent over time, with relevant consequences for the business cycle (Fishman et al., 2020).

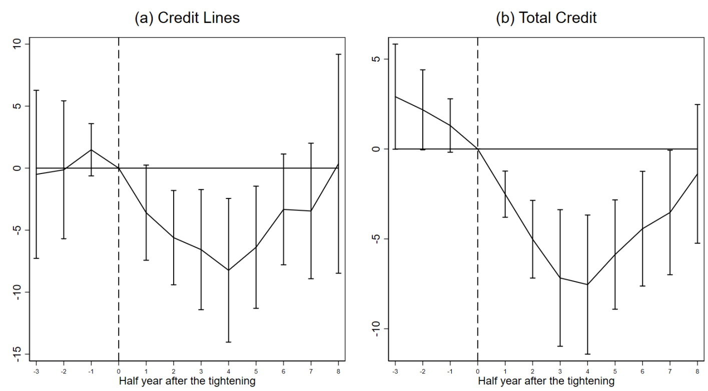
While in the rest of the paper, we use the entire distribution of the change in lending standards, in this section, we ask ourselves: what happens to bank lending when a more considerable shock hits banks, say, in the top 5% of its distribution? Data show this is more likely in periods of recession, as in the second half of 2011, as Figure 2 also depicts. The 95th percentile corresponds to an unforeseen change in lending standards of about 0.5. To this extent, building upon the methodology proposed by Passalacqua et al. (2021), we estimate the following non-parametric difference-in-differences (DiD) model:

$$\Delta L_{b,t,m} = \alpha_b + \alpha_t + \alpha_m + \sum_{\tau=-3}^{+8} \beta_\tau S_{b,t-1,m} \times \{1_{\tau=t}\} + \sum_{\tau=-3}^{+8} \gamma_\tau X_{b,t-1} \times \{1_{\tau=t}\} + \varepsilon_{b,t,m}, \quad (5)$$

where $b$, $t$, and $m$ stands for bank, half-year, and the geographical macro area. Each bank $b$ considered in this exercise is exposed at some point to a shock to their lending standards if $\Delta \text{LS}_{b,t}$ equal or greater than 0.5. While the treatment status is given by the actual exposure to the shock (the dummy variable $S_{b,t-1,m}$ is equal to 1), control banks are intermediaries that will be exposed to a similar shock in future periods. $S_{b,t-1,m} \times \{1_{\tau=t}\}$ are event time indicator variables interacted with a dummy variable for the treatment group. $X_{b,t-1}$ are the pretrend controls. $\alpha_b$, $\alpha_t$, $\alpha_m$ are bank, time, and macro-area fixed effects.

In Figure 4, the results of our event study show the effects of a significant unforeseen change in lending standards on credit for the treated banks at time t compared to the banks belonging to the control group. In panel a, we focus on credit lines and find a significant shock in bank lending standards significantly reduces the growth rate of credit lines by about five percentage points, an effect that lasts for two years. In panel b, we analyze the impact on the treated banks' total lending capacity and find that total credit growth shrinks significantly after the shock. The vertical line in zero indicates the half-year in which bank $b$ shows a considerable shock to lending standards. Therefore, it is crucial to notice that our estimates are never significant before the half-year zero, suggesting our sample's lack of a pretrend. Our event-study approach shows that credit growth drops by more than five percentage points for the average bank in the treatment group, and this effect lasts for more than three years.

Figure 4
Persistence of a Large Shock to Lending Standards




The figure plots the estimates of equation (5). The panel (a) shows the estimates when we consider as dependent variable the the change in the total amount of credit lines granted by the bank $b$ in the half hear $t$, while panel (b) shows the results when we consider as dependent variable the change in the total amount of credit granted by bank $b$ in the half-year $t$. The vertical axis represents the months relative to the benchmark half-year, where the large shock to lending standard is realized. The Standard errors are two-way clustered at the bank and inspection plan level. We also include predefined bank-level controls: size (natural logarithm of lagged total assets), ROA, liquidity ratio, deposit ratio, capital and NPL ratios.

## 5.2 The Impact of Lending Standards on the Credit Market

The aim of our analysis is to identify the impact of an unforeseen shock to bank lending standards on the credit markets. To evaluate the impact on the bank-lending channel, we estimate the following equation:

$$\Delta L_{f,b,t} = \beta_0 + \beta_1 \Delta \mathrm{LS}_{b,t-1} + \gamma X_{f,b,t-1} + \eta_{i,t} + \delta_b + \varepsilon_{f,b,t}, \tag{6}$$

where our dependent variable is $\Delta L_{f,b,t}$ defined as the yearly log change in loans to firm $i$ by bank $b$ in period $t$. $\Delta \mathrm{LS}_{b,t-1}$ is half-yearly change in our measure of bank supply for bank

$b$ in period $t-1$,[11] and $\eta_{i,t}$ corresponds to the firm×time fixed effects. In all our estimates we include the bank-firm relationship and the bank-level controls as defined in section 3.3. In this model, our coefficient $\beta_1$ is interpreted as the effect on the growth rate of credit to firm $i$ of a tightening in credit supply of bank $b$ relative to another bank with an unchanged lending policy.

To identify the coefficient $\beta_1$, we introduce the firm×time fixed effects, which help rule out possible endogeneity from demand shocks at the firm level. Using the information on different credit types helps alleviate the concern that a firm's credit demand is loan-specific and that shocks to loan demand are correlated with bank lending standards.

Table 3

Effects of a Change in Lending Standards (Intensive Margin)

| | (1) $\Delta L^{CL}_{f,b,t}$ | (2) $\Delta L^{LBR}_{f,b,t}$ | (3) $\Delta L^{TL}_{f,b,t}$ | (4) $\Delta L^{TC}_{f,b,t}$ |
|---|---|---|---|---|
| $\Delta \mathrm{LS}_{b,t-1}$ | -0.609*** | -0.595 | -0.256 | -0.884*** |
| | (0.161) | (0.685) | (0.223) | (0.337) |
| $R^2$ | 0.351 | 0.377 | 0.346 | 0.380 |
| F-Statistic | 6.48 | 9.30 | 13.08 | 7.48 |
| Observations | 10,483,094 | 5,292,662 | 7,125,932 | 13,613,454 |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank × area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

Table 3 presents the main estimates for equation (6). In column 1, we find banks significantly decrease the credit lines volumes when lending standards are tighter: a one-standard-deviation increase in the unexpected tightness of lending standards is associated with a 0.18 percentage points reduction in the growth rate for credit lines ($\Delta L^{CL}_{f,b,t}$). So our model explains 8.7% of the average credit lines growth rate. In columns 2 and 3, we show that there is no significant evidence of the impact of shocks to lending standards to credit granted to firms in the form of loans backed by receivables ($\Delta L^{LBR}_{f,b,t}$) and term loans ($\Delta L^{TL}_{f,b,t}$), however, it is important to mention that the coefficient sign is negative as expected. In column 4,

[11] We test the shock dynamic with a maximum of four lags, and we find a significant effect only for one period lag in all specifications.

we show how a negative shock to bank lending standards also decreases the total supply of credit ($\Delta L^{TC}_{f,b,t}$): a one-standard-deviation change in $\Delta \mathrm{LS}_{b,t-1}$ decreases the total credit growth by 0.27 percentage points, which explains the 4.3% of its average growth rate. These results suggest that an idiosyncratic shock to lending standards has a negative and significant impact on credit granted to firms, and this effect is mainly explained by a more pronounced contraction in credit lines.

In the section on the empirical strategy, we introduced the endogeneity problem linked to the estimation of a change in lending standards on credit markets using survey data. We investigate the direction and size of this bias by analyzing how the results change if $\Delta \mathrm{LS}_{b,t-1}$ is replaced by the RBLS supply index in equation (6). We estimate the following equation:

$$\Delta L_{f,b,t} = \beta_0 + \beta_1 \Delta S_{b,t-1} + \gamma X_{b,t-1} + \eta_{i,t} + \delta_b + \varepsilon_{f,b,t}, \tag{7}$$

The results are in Table 4 in columns 1 and 3, showing how the coefficients for credit lines and total credit remain significant but lower magnitude. As mentioned in Section 4, the procedure of partialling out demand, expectations, and other confounding factors is necessary to avoid underestimating the supply effect caused by an omitted variable problem. However, if we directly control for these factors in equation (7), the coefficients of $\Delta S_{b,t}$ and of $\Delta \mathrm{LS}_{b,t-1}$ do coincide, as shown in columns 2 and 4. This result also confirms that our results are robust to the issue of a potential generated regressor problem. Indeed, the OLS partialling out allows us to obtain the same coefficient of our two-step procedure. Columns 2 and 4 show that our results do not suffer from the generated regressor problem as the estimated coefficients are always significant, at least at 5%.[12]

[12] We also verified that our benchmark results hold if we bootstrap standard errors with 1000 repetitions in an additional robustness check. We run this robustness check using firm time and bank fixed effects for computational reasons, and we find that our estimates are robust. Results are available upon request.

Table 4

Effects of a Change in Lending Standards (Omitted Variable Bias)

| | (1) $\Delta L^{CL}_{f,b,t}$ | (2) $\Delta L^{CL}_{f,b,t}$ | (3) $\Delta L^{TC}_{f,b,t}$ | (4) $\Delta L^{TC}_{f,b,t}$ |
|---|---|---|---|---|
| $\Delta\text{Supply}_{b,t-1}$ | -0.412** | -0.595*** | -0.836** | -0.882*** |
| | (0.180) | (0.157) | (0.326) | (0.336) |
| Survey Controls | No | Yes | No | Yes |
| $R^2$ | 0.351 | 0.351 | 0.380 | 0.380 |
| F-Statistic | 6.25 | 5.75 | 7.55 | 6.14 |
| Observations | 10,483,094 | 10,483,094 | 13,613,454 | 13,613,454 |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank× area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

Previous studies highlight the importance of loan applications in analyzing credit supply conditions (e.g., Jiménez et al., 2012; Sette and Gobbi, 2015; Albertazzi et al., 2017; Galardo et al., 2019; Peydró et al., 2021). For this reason, we move our interest to the analysis on the extensive margin of the bank-firm relationship thanks to the richness of our data.

To identify the presence of a loan application, we use the fact that banks, as a general practice, lodge an inquiry to the Credit Register to obtain information on the current credit position of a potential borrower (*Servizio di prima informazione*, preliminary information request). These inquiries map one-to-one into actual applications because they can be placed only when the intermediary formally receives a credit request. Note that a bank resorts to such a service only when a "new" applicant puts forward the request for financing, i.e., one not currently borrowing from the bank, as the Credit Register regularly updates banks with information on the overall credit position of their existing borrowers. Thus, our data cover the applications placed to banks with which the borrower has no ongoing relations and those advanced to any bank by firms that enter the credit market for the first time.

In our analysis on the extensive margin, we consider as the main dependent variable the dummy Loan $\text{Granted}_{f,b,t}$ which takes value one if the loan application placed by firm $f$ to bank $b$ in period $t$ is approved, and 0 otherwise. Following Jiménez et al. (2012), to assess whether a loan application has been approved, we inspected the Credit Register to detect if the lender reported any new credit granted to that particular borrower in the year following the application. If so, we infer that the loan application was approved and assign value 1 to the dummy Loan Granted$_{f,b,t}$. Also, in these estimates the presence of multiple loan requests by a given firm in a given period allows us to disentangle credit demand and risk from credit supply by including time-varying firm fixed-effects in the spirit of Khwaja and Mian (2008).

Three variables complement our analysis on the extensive margin. The variable Exit$_{f,b,t}$ equal to one if the bank-firm relationship does not exist anymore in the following half-year and the dummy New Loans$_{f,b,t}$ that it is equal to one if the amount granted by bank $b$ to firm $f$ at time $t$ increases.[13] These results complement those on loan applications that focus only on new bank-firm relationships.

Table 5

Effects of a Change in Lending Standards (Extensive Margin)

| | (1) Loan Granted$_{f,b,t}$ | (2) Exit$_{f,b,t}$ | (3) New Loans$_{f,b,t}$ |
|---|---|---|---|
| $\Delta LS_{b,t-1}$ | -0.005** | 0.013* | -0.005* |
| | (0.002) | (0.007) | (0.003) |
| $R^2$ | 0.543 | 0.518 | 0.422 |
| F-Statistic | 48.33 | 4.96 | 4.25 |
| Observations | 2,103,463 | 15,355,842 | 15,914,401 |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank × area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

The results of the analysis on the extensive margin are available in Table 5. In column 1, we estimate with a linear probability model the likelihood of a new loan application acceptance by firm $i$ to bank $b$. We find that a restriction in bank credit supply significantly decreases the probability of bank approval. In column 2, we find a negative and significant relationship between lending standard and the likelihood that a bank-firm relationship will end. In column 3, we find a negative and significant impact of $\Delta LS_{b,t-1}$ on the probability of raising granted credit in an existing bank-firm relationship. Although the magnitude of these

[13]In an unreported robustness check, we verify that our results are not driven by episodes of merger and acquisitions.

results is relatively small - for instance, one-standard-deviation change in $\Delta LS_{b,t-1}$ reduces the probability of acceptance by only 0.1 percentage points - its economic and statistical significance should still be taken into account in assessing the overall impact of a change in lending standards on credit dynamics.

### 5.2.1 Robustness Checks

Our first robustness check seeks to identify differences across geographical areas, with the results in Table A2 of the Appendix. This check is motivated by previous studies showing how the heterogeneity in local credit markets is key to explaining differences in income across Italian provinces (Guiso et al., 2004). However, it is interesting that the North-South economic divide does not drive our results: we find they are mainly associated with a contraction in credit to firms in the North of Italy, especially in the North-East.

Following several studies highlighting how industry heterogeneity affects the economy (e.g., Long and Plosser, 1987; MacKay and Phillips, 2005), we next investigate whether any differences arise in how credit supply shocks affect different sectors. In this robustness check, we use the sector-level RBLS Supply indexes directly, with the results in A3 of the Appendix showing that the estimated effect is more pronounced in credit lines for the services sector and total credit for the construction sector.

We check that specific characteristics of firms, such as riskiness and size, are not driving the results, as shown in the Appendix Tables A4 and A5. To test the presence of these heterogeneous effects, we first interact $\Delta LS_{b,t-1}$ with a measure of firm riskiness. We define the firm riskiness according to the rating provided by the CERVED database that rank firm risk in a range from one to 10. We define $Risk_{i,t}$ as a dummy equal to one if the firm $i$ has risk above seven. We also interact $\Delta LS_{b,t-1}$ with the variable $Small_{i,t}$ equal to one if the firm $i$ is defined to be small employing the definition used by the Bank of Italy for its statistical publications. Our estimates suggest the firm riskiness has no significant impact on the effect of a change in lending standards, while the firm size does have a significant impact amplifying the effect of a tightening on total credit.

Lastly, we verify if our benchmark results are robust using the checks shown in Table A6 of the Appendix. As mentioned in Section 4, to estimate $\Delta LS_{b,t-1}$, we construct indicators of bank credit supply and demand using RBLS answers, about firm credit, consumer credit and family mortgages, thereby accounting for any potential spillover effects among different market niches. We try to perform our analysis using the information on firm credit only, weighting the RBLS answers by the share of firm loans on banks' total loans: the results are qualitatively in line with the baseline model. Even though the survey asks banks to provide both overall firm indicators and detailed information for each sector, in the baseline estimation, we use overall firm credit demand and supply indexes to account for possible spillovers among sectors. As in the previous check, we consider a firm-only indicator that exploits the sector-level data and find that the results are qualitatively similar to the baseline model again. We also look to see if outliers drive our results: the estimates are robust to winsorizing at the one percent level of the dependent variables. Finally, our results are robust to excluding firms with more than 14 bank relationships (top one percentile of the bank-firm distribution) from the sample. This check is motivated by the presence of firms with a high number of lending relationships that do not necessarily reflect genuine credit relationships (Bottero et al., 2020).

### 5.3 The Impact of Lending Standards on the Firm-Level Outcomes

In this subsection, we analyze the firm-level impact of a shock in bank lending standard on firm outcomes. We do so by aggregating the idiosyncratic lending standards shocks $\Delta LS_{b,t-1}$ at the firm level using the formula:

$$\Delta\mathrm{LS}_{i,t} = \sum_{b \in B_i} \theta_{b,t} \times \Delta\mathrm{LS}_{b,t}, \tag{8}$$

where $B_i$ is the set of banks granting credit to firm $i$ and $\theta_{b,t}$ indicates the share of bank $b$ over total firm credit. Thus, we estimate the following equation:

$$y_{i,t} = \beta_0 + \beta_1 \Delta\mathrm{LS}_{i,t-1} + \gamma X_{i,t-1} + \eta_i + \phi_t + \varepsilon_{i,t}, \tag{9}$$

where $y_{i,t}$ is the firm outcome we consider in our analysis, $\gamma X_{i,t-1}$ are bank controls properly weighted at the firm level, $\eta_i$ and $\phi_t$ are respectively the firm and the time fixed effects. In estimating equation (9), we cannot include firm×time fixed effects to control for demand shocks at the firm level because of the firm-time panel dimension.

Table 6

The Borrowing Channel

| | (1) $\Delta L_{f,t}^{CL}$ | (2) $\Delta L_{f,t}^{CL}$ | (3) $\Delta L_{f,t}^{TC}$ | (4) $\Delta L_{f,t}^{TC}$ |
|---|---|---|---|---|
| $\Delta \text{LS}_{i,t-1}$ | -0.519*** | -0.877*** | -1.203*** | -1.428*** |
| | (0.054) | (0.084) | (0.049) | (0.093) |
| $\hat{\eta_{i,t}}$ | | 0.756*** | | 0.836*** |
| | | (0.003) | | (0.002) |
| $R^2$ | 0.153 | 0.434 | 0.184 | 0.520 |
| F-Statistic | 4,194.13 | 6,498.14 | 11,573.43 | 20,348.42 |
| Observations | 13,311,123 | 3,704,984 | 17,761,470 | 4,672,041 |

Notes. The standard errors, in parentheses, are clustered at the firm level. All models include bank-firm relationship and bank-level controls, firm and time fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

The first question to analyze is whether firms can substitute the loans from a bank with a negative shock to the credit supply with loans borrowed from other banks. To this extent, we consider as a dependent variable the log-change in the total amount borrowed by a firm $i$ in year $t$ ($\Delta L_{f,t}$). In Table 6, we present the estimates of equation (9) that test the existence of the firm-borrowing channel, and we find evidence that firms cannot compensate for the negative effect of tightening in bank lending standards. In column 1, we find a negative and significant impact of an average tightening in the lending standards of the banks borrowing to firm $i$ on the total credit lines granted to this firm. The result is also robust for total credit as shown in column 3. Unlike the previous paragraph, we could no longer use the firm×time fixed effects since it would saturate the data variability. To overcome this issue, we follow the methodology proposed by Cingano et al. (2016), exploiting the fixed effects estimates derived from equation (6) as a proxy for the idiosyncratic demand shock ($\widehat{\eta_{i,t}}$) at the firm-level. In columns 2 and 4, we show that our results are robust to the inclusion of $\widehat{\eta_{i,t}}$ as a control variable.

Table 7 analyzes whether our measure of an idiosyncratic shock to lending standard affects the real economy. In this subsection, we retrieve firm-level data from the CERVED database, and we analyze the impact of a change in a lending standard on the real economy focusing on three main variables: the return on equity ($\text{ROE}_{i,t}$), the logarithm of sales ($\text{Sales}_{i,t}$), and the logarithm of firm employment ($\text{Emp}_{i,t}$). Columns 1 and 2 show that negative shocks to lending policy harms firm profitability measured with the return on equity and sales. Column 3 shows that a tightening in lending standards has a negative and significant impact on the logarithm of the number of workers employed by firm in year $t$. These findings align with the macroeconomic evidence provided in subsection 5.1, confirming that a negative shock to lending standards generates a contraction in the real economy.

Table 7

Other Firm-Level Outcomes

| | (1)<br>$\text{ROE}_{i,t}$ | (2)<br>$\text{Sales}_{i,t}$ | (3)<br>$\text{Emp}_{i,t}$ |
|---|---|---|---|
| $\Delta\text{LS}_{i,t-1}$ | -7.363* | -0.006*** | -0.003* |
| | (3.888) | (0.002) | (0.001) |
| $R^2$ | 0.315 | 0.896 | 0.930 |
| F-Statistic | 0.91 | 508.85 | 189.76 |
| Observations | 3,139,142 | 3,030,378 | 2,333,448 |

Notes. The standard errors, in parentheses, are clustered at the firm. All models include bank-firm relationship and bank-level controls, firm and time fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

# 6 Conclusions

Much of the finance literature has tried to estimate the contribution of supply in credit markets. Our approach innovates on previous studies by combining survey data with granular information on the bank-firm relationship. One strength of this strategy is that it can be used by any other research using similar survey data, helping to shed new light on the credit crunch that hit most countries during the Great Recession and anticipate future disruptions in the credit market. It also provides reliable estimates in the absence of an external exogenous shock to credit supply or, as in the case of the COVID-19 crisis, when it is challenging to disentangle demand and supply shocks.

We find that an idiosyncratic tightening in lending standards induces a contraction in bank-intermediated credit to firms, an effect especially relevant to liquidity provisions in the form of credit lines. Also, when examining the extensive margin of the bank-firm relationship, we find a negative shock has a significant impact on the probability of accepting new loan applications and the likelihood of the bank-firm relationship breaking up. Finally, we also show that firms cannot smooth the individual bank shocks by borrowing more from other lenders.

Lending standards have sizable and persistent effects on credit supply, reinforced in a period of high economic uncertainty. Our findings parallel earlier studies that show how a slow recovery follows financial shocks due to economic uncertainty (Straub and Ulbricht, 2018). Our paper also highlights the role of bank lending policies in determining business cycle fluctuations.

During the last ten years in Italy, bank shocks might have caused two aggregate adverse effects. The first, by stifling existing businesses, with a credit crunch likely contributing to liquidity shortages within firms' earlier-granted credit. The second, by inducing a misallocation of resources in the economy as banks cut the new (extensive margin) or the already existing (intensive margin) and potentially productive projects. Our evidence also suggests that lending standards might affect macroeconomic variables, with large shocks possibly impacting bank lending over more than one period.

These findings are particularly relevant to the COVID-19 crisis, which caused an extensive liquidity shortage across large sections of the Italian economy (O'Hara and Zhou, 2021). Our results on the propagation of banks shocks on the supply of credit lines are even more critical given that empirical evidence suggests that firms primarily relied on this financial instrument to smooth the COVID-19 crisis (Acharya and Steffen, 2020). Available data show that during the first 12 months of the pandemic, the European System of Central Banks and the national authorities were able to mitigate the effect of the crisis on the financial sector and, ultimately, they granted the successful flow of liquidity provision to the affected firms. However, our paper warns regulators against the risks entailed in removing liquidity and credit access support measures too soon. If intermediaries overshoot in the tightening of their lending standards, the effects could be sizable and persistent, especially on credit lines, and possibly hampering the functioning of the bank-lending channel of monetary policy transmission.

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# Appendix A Additional Results and Robustness Checks

Table A1

Estimation of Equation (2)

| | (1) $\Delta Supply_{b,t}$ | (2) $\Delta Supply_{b,t}$ | (3) $\Delta Supply_{b,t}$ |
|---|---|---|---|
| $\Delta D_{b,t}$ | -0.153*** | -0.148*** | -0.138*** |
| | (0.011) | (0.012) | (0.012) |
| $\Delta S_{b,t-1}$ | 0.200*** | 0.187*** | 0.180*** |
| | (0.017) | (0.016) | (0.016) |
| $E_{t-1}[\Delta D_{b,t}]$ | -0.015* | -0.010 | -0.010 |
| | (0.006) | (0.006) | (0.006) |
| $E_{t-1}[\Delta S_{b,t}]$ | 0.255*** | 0.248*** | 0.236*** |
| | (0.021) | (0.021) | (0.023) |
| Bank-level controls | No | Yes | Yes |
| Time fixed effects | No | No | Yes |
| Bank-area fixed effects | Yes | Yes | Yes |
| $R^2$ | 0.384 | 0.394 | 0.408 |
| F-Statistic | 269.75 | 135.14 | 52.89 |
| Observations | 35,687 | 34,286 | 34,286 |

Notes. The standard errors, in parentheses, are clustered at the bank level. Significance levels: *: 10%; **: 5%; ***: 1%.

## Table A2

Effects of a Change in Lending Standards by Geographical Area

| | (1) $\Delta L^{CL}_{f,b,t}$ | (2) $\Delta L^{TC}_{f,b,t}$ |
|---|---|---|
| North East | -0.745** | -1.086** |
| | (0.321) | (0.417) |
| North West | -0.769** | -0.787** |
| | (0.308) | (0.351) |
| Center | -0.520** | -1.010* |
| | (0.256) | (0.519) |
| South | 0.091 | -0.153 |
| | (0.812) | (0.496) |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank × area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

## Table A3

Effects of a Change in Lending Standards by Sectors

| | (1) $\Delta L^{CL}_{f,b,t}$ | (2) $\Delta L^{TC}_{f,b,t}$ |
|---|---|---|
| Manufacturing | -0.375 | -0.447 |
| | (0.306) | (0.431) |
| Services | -1.062*** | -0.674* |
| | (0.280) | (0.399) |
| Construction | -0.351 | -1.038** |
| | (0.230) | (0.420) |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank × area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

## Table A4

Heterogenous Effects (Firm Riskiness)

| | (1) $\Delta L^{CL}_{f,b,t}$ | (2) $\Delta L^{TC}_{f,b,t}$ |
|---|---|---|
| $\Delta \text{LS}_{b,t-1}$ | -0.897*** | -0.805* |
| | (0.304) | (0.414) |
| $\text{Risk}_{i,t} \times \Delta \text{LS}_{b,t-1}$ | 0.404 | 0.133 |
| | (0.283) | (0.343) |
| $R^2$ | 0.322 | 0.357 |
| F-Statistic | 6.03 | 6.70 |
| Observations | 6,698,508 | 8,397,538 |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank × area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

## Table A5

Heterogenous Effects (Firm Size)

| | (1) $\Delta L^{CL}_{f,b,t}$ | (2) $\Delta L^{TC}_{f,b,t}$ |
|---|---|---|
| $\Delta \text{LS}_{b,t-1}$ | -0.653*** | -0.740** |
| | (0.198) | (0.376) |
| $\text{Small}_{i,t} \times \Delta \text{LS}_{b,t-1}$ | 0.165 | -0.529** |
| | (0.199) | (0.227) |
| $R^2$ | 0.351 | 0.380 |
| F-Statistic | 7.34 | 10.41 |
| Observations | 10483094 | 13613454 |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank × area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.

## Table A6
Additional Robustness Checks

| | (1) $\Delta L^{CL}_{f,b,t}$ | (2) $\Delta L^{TC}_{f,b,t}$ |
|---|---|---|
| Firm-specific indicators | -0.587*** | -1.066*** |
| | (0.177) | (0.395) |
| Sector-specific indicators | -0.627*** | -0.815** |
| | (0.180) | (0.356) |
| Winsorize (1%) | -0.458*** | -0.775*** |
| | (0.123) | (0.297) |
| Bank-Firm Relationships (1%) | -0.601*** | -0.891*** |
| | (0.149) | (0.331) |

Notes. The standard errors, in parentheses, are double clustered at the firm and at the bank level. All models include bank-firm relationship and bank-level controls, firm× time fixed effects and bank × area fixed effects. Significance levels: *: 10%; **: 5%; ***: 1%.