Information-driven Credit Line Runs: Evidence from the 2011 European Stress Test*

Jose E. Gutierrez† Luis Fernández Lafuerza‡
Banco de España Banco de España

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Abstract

Recent literature shows that banks are exposed to credit line runs. In such runs, firms draw down funds from their credit lines due to fear of future credit restrictions. We explore the occurrence and magnitude of these runs after the release of negative financial information about banks. Using the Spanish credit registry and the results from the 2011 European stress test supervised by the European Banking Authority (EBA), we show that, following the release of the results, firms drew down approximately 10 pp. more available funds from credit lines granted by banks with a worse performance in the stress test. The effect was reversed a few months later, supporting the interpretation that the additional drawdowns were driven by concerns about the worse-performing banks rather than by genuine immediate liquidity needs. Moreover, we find that extraordinary drawdowns were concentrated in credit lines of firms at risk of violating a financial covenant and on smaller and ex-ante less solvent banks.

Keywords: credit lines, bank runs, stress tests, liquidity risk.

JEL Codes: G01, G14, G21, G28.

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†E-mail: gutierrez.je@bde.es
‡E-mail: luisg.fernandez@bde.es

1. Introduction

The growing but still scarce empirical literature on credit lines highlights their importance as a key source of liquidity for firms. In a credit line, the lender (typically a bank) extends a promise to a borrower to provide funding on demand up to a set limit within a period of time at certain terms. Such access to funding helps firms to ease the impact of liquidity shocks, both idiosyncratic and deriving from adverse macroeconomic shocks.[1] This protection against liquidity shocks explains why they are widely used as a tool for firms' liquidity risk management.[2] However, access to credit lines is contingent on a firm's and its bank's financial health. On the one hand, credit lines incorporate financial covenants that protect the lender from an increase in the borrower's risk profile; hence, access to funds may be limited if a financial covenant is not complied by the borrower. On the other hand, banks with balance sheet problems, such as declines in liquidity or capital, may find it problematic to accommodate increases in liquidity demand, in which case they are less likely to waive a covenant violation (Acharya et al., 2020). Consequently, if firms anticipate that a bank might have trouble accommodating liquidity demand, they might precautionarily draw down the available funds, creating a form of bank run. In fact, after the failure of Lehman Brothers, Ivashina and Scharfstein (2010) document that firms in the U.S. drew down heavily on existing credit lines due to concerns about the soundness of the banking system. Similarly, Ippolito et al. (2016) find that after the dry-up of the European interbank market in August 2007, Italian firms drew down more from banks with high exposure to the interbank market, which they argue was in anticipation of future credit supply restrictions.

The aim of this paper is to explore whether precautionary drawdowns from credit lines

[1] For instance, after the COVID-19 outbreak, non-financial firms drew down significant amounts from their pre-existing credit lines following a sudden and sharp drop in their revenues (Greenwald et al., 2021; Kapan and Minoiu, 2020).

[2] For the U.S., Sufi (2009) and Demiroglu et al. (2009) report that 87% of public firms and 64% of large private firms have access to credit lines; in Spain, around 40% of firms' bank financing are credit lines, see Jiménez et al. (2009).

can occur as a result of purely informational shocks about individual banks' solvency. The arrival of such news can change clients' perception on the bank's ability to honor credit lines, which can result on firms precautionarily drawing down their available funds. To the best of our knowledge, this is the first paper that investigates whether negative informational content in stress tests about individual banks can lead to credit line runs. From a macroprudential point of view, understanding the possibility of credit line runs is important because bank capital and liquidity buffers can be depleted if banks are exposed to a sudden and large increase in drawdowns. Banks' capital position can deteriorate because capital requirements for undrawn but committed credit are small compared to drawn credit.[3] In addition, the undrawn portion of credit lines represents an important material exposure for banks.[4] Hence, a spike in drawdowns decreases bank capital buffers. Moreover, precautionary drawdowns can have distributional effects on firm credit. Liquidity pressures on the asset side due to credit line drawdowns can force banks to cut back on new credit origination (Acharya and Mora, 2015; Greenwald et al., 2021). This especially affects smaller firms that rely less on funding from credit lines due to stricter terms set by the lender (Chodorow-Reich et al., 2021).

We exploit as an informational shock the disclosure of the results of the stress test coordinated by the European Banking Authority (EBA) in 2011. Stress tests typically assess whether banks maintain adequate capital levels to withstand an adverse macroeconomic scenario, which helps supervisors to identify vulnerable banks and address them early on. The results of the 2011 EBA EU-wide stress test were published for each participating bank on July 15. They focused on the ratio of Core Tier 1 capital (equity and retained profits) to risk weighted assets (CT1R) that the banks were projected to have under an adverse scenario. The stress test provided relevant information to market participants.

[3] As part of the post-crisis regulatory reforms, the Basel Committee on Banking Supervision (BCBS) increased the *credit conversion factor* (CFF) from 0% to 10%, that is, 10% of unused balances of credit lines is treated as on-balance-sheet exposures for the calculation of capital requirements under the standardized approach for credit risk (BCBS, 2017)

[4] In the U.S., undrawn balances are more than 40% larger than the total used balances on bank credit lines and term loans combined, see Greenwald et al. (2021).

Petrella and Resti (2013) find that after the publication of the results banks with higher CT1R under the adverse scenario were rewarded with higher abnormal returns compared to banks with lower CT1R.

Our study centers on Spanish firms and banks. As opposed to other countries, all Spanish saving banks and almost all commercial banks, 25 banks accounting for nearly 93% of the assets of the Spanish banking sector, participated in the stress test.[5] Among these banks, 12 were *inadequately capitalized* according to the EBA, that is, their CT1R fell below 6% under the adverse scenario. Such results were broadly covered in the main Spanish newspapers.[6] Furthermore, we have access to the comprehensive Spanish Credit Register, maintained by Banco de España, that covers all the outstanding credit lines extended by different banking institutions to each firm, which allows us to carry out our analysis at the bank-firm level. Finally, it is important to remark that in Spain most firms are bank dependent; hence, having access to bank lending is crucial for them.

Our empirical exercise examines whether, after the announcement of the results, a credit line extended by bank b to firm f was used more intensively by firm f if bank b was identified as inadequately capitalized in the stress test, *as a result of the negative information released*. That is to say, whether firms precautionarily drew down out of concern about their banks' soundness. Answering that question requires us to control for firm liquidity demand, in order to address the potential problem that banks with worse performance in the exercise might have been sorted with firms that had higher liquidity needs. Thus, we employ a sample with the important feature that each firm has at least two credit lines from two different banks, which allows us to control for credit demand by adding firm fixed effects in our regressions, following Khwaja and Mian (2008). Using a difference-in-differences approach, we compare, for the same firm, its credit line usage rate before

[5]The EBA required that the largest banks of each country, covering at least 50% of the national banking sectors in each EU member state, participated in the stress test.

[6]The two main Spanish newspapers, *El País* and *El Mundo*, both published on their front pages of July 16, 2011, headlines about the performance of Spanish banks in the exercise. More related articles appeared in other Spanish newspapers and in the following days.

and after the release of the stress results, with banks more or less affected by the adverse scenario of the stress exercise. That is, we assess whether firms with credit lines from more than one bank preferentially drew down credit lines granted by inadequately capitalized banks. Moreover, we control for banks' fundamentals and credit line characteristics that could potentially explain firms' drawdown behavior.

We find evidence of precautionary drawdowns after the disclosure of the results, on July 15, of the 2011 EBA EU-wide stress test. Specifically, firms with at least two credit lines extended by different banks chose to use 9.5 pp. and 1.2 pp. more of undrawn and granted (drawn plus undrawn) funds, respectively, between June and July from lines extended by banks that, according to the stress test, were not adequately capitalized, compared to lines from adequately capitalized banks. These are sizable extraordinary drawdowns considering that under the standardized approach for credit risk a 10% of the undrawn balances of credit lines is assumed to be drawn for the computation of the exposure at default (EAD); whereas, our results suggest that almost an additional 10% could arise due to precautionary motives.

Precautionary drawdowns were concentrated in credit lines of firms in higher risk of violating a financial covenant. To approximate the effect of complying with them, we divide our sample of firms into three different groups based on a capital (or an interest coverage) ratio: low, medium, and high capitalized (indebted) firms.[7] We find that firms with good financial ratios (highly capitalized and with low interest burden) did not react to the informational content of the stress exercise, whereas firms with worse financial prospects did react to the informational shock. These findings are consistent with the possibility that banks can withhold funds to financially distressed firms by not waiving a covenant violation. Additionally, we find that precautionary drawdowns were larger for ex-ante less solvent and smaller banks, as these banks might find it more difficult to access to external funds and sustain an increase in demand for drawdowns. Moreover, the size

[7] Acharya et al. (2020) find that the most common financial covenants are related with leverage restrictions, interest coverage limitations, and capitalization and collateral requirements.

of these extraordinary drawdowns was affected by certain characteristics of credit lines, such as their residual maturity, initial usage rate, size, and whether a downsizing had been experienced before. Overall, these findings suggest that precautionary drawdowns were driven by firms' fear that banks identified as inadequately capitalized may tighten their lending standards in a context where substituting bank lending was difficult.

A number of additional results support the interpretation that additional drawdowns were driven by news about banks' solvency. First, we find no evidence, prior to the disclosure of the results, that credit lines extended by inadequately capitalized banks were used more intensively than lines granted by adequately capitalized banks. Second, we find that firms that precautionarily drew down after the disclosure of the results decided to return the cash a few months later. That is, after the initial worries dissipated, liquidity came back to banks from firms that made extraordinary drawdowns. Finally, we show robustness to changes in the sample composition. Overall, evidence points to the direction that additional drawdowns were precautionary, driven by concerns about the worse performing banks, rather than by genuine immediate liquidity needs.

This paper contributes to two strands of literature. First, we add to the literature that shows that banks are exposed to credit line runs. Ivashina and Scharfstein (2010) show that, after the failure of Lehman Brothers, firms in the U.S. drew down their credit lines due to fear of losing access to funds at a time when banks' financial health was a concern. Similarly, Campello et al. (2010) and Berrospide and Meisenzahl (2015) provide evidence on precautionary drawdowns during the 2007-2009 financial crisis. By exploiting the dry-up of the European interbank market in August 2007 as an aggregate exogeneous liquidity shock to banks, Ippolito et al. (2016) find that Italian firms drew down preferentially from banks more exposed to the interbank market in anticipation to tighter lending conditions. In this paper, by using the release of the results of the stress test supervised by the EBA in 2011, we investigate whether credit line runs can also arise as a result of purely informational shocks about the solvency of particular banks.

The paper is also related to the literature that explores the reaction of financial markets and banks to the disclosure of regulatory stress tests. On the one hand, a strand of the literature studies the effect of the information content of stress tests on financial markets (Petrella and Resti, 2013; Morgan et al., 2014; Alves et al., 2015; Flannery et al., 2016; Borges et al., 2019; Fernandes et al., 2020). Specifically, by mostly using event studies techniques, it explores whether information disclosed in stress tests has an impact on prices (e.g., equity prices). Another strand of the literature investigates the effect of stress tests on participating banks' behavior, such as their effect on lending, bank capital, dividend payments, or lending to small businesses (Acharya et al., 2018; Gropp et al., 2018; Berrospide and Edge, 2019; Cornett et al., 2020; Nguyen et al., 2020; Cortés et al., 2020; Doerr, 2021). We contribute to this literature by investigating whether users of credit lines, in particular non-financial firms, react to the information disclosed in stress tests when credit in the economy is scarce.

The rest of the paper is organized as follows. Section 2 describes the main features of credit line contracts, provides details about the 2011 EBA stress test, and presents the theoretical background and our main hypothesis. Section 3 describes the data. Section 4 explains the econometric model and the identification strategy. Section 5 discusses the main results, their implications, and robustness checks. In section 6, extensions of the main results are explored. Finally, section 7 summarizes the findings and concludes.

2. Background

2.1. Credit Line Contracts

A credit line is a commitment in which a borrower receives a promise from a lender to provide funding, within a period of time, up to a set amount and at pre-arranged terms. Due to advantages such as special monitoring abilities and synergies in lending and deposit taking, credit lines are mainly offered by banks (Kashyap et al., 2002; Gatev

and Strahan, 2006; Acharya et al., 2014). Moreover, these contracts incorporate financial covenants to protect the bank against a deterioration of the borrower's creditworthiness.[8] That is, the bank has the right to withhold funds if a covenant is not complied by the borrower.

Credit lines provide firms funding flexibility to address contingent liquidity needs. For instance, after a sudden and sharp drop in revenues due to the COVID-19 crisis, U.S. non-financial firms drew down significant amounts from their pre-existing credit lines (Greenwald et al., 2021; Kapan and Minoiu, 2020). This protection against liquidity shocks explains their widely used as a tool for firms' liquidity risk management. According to Sufi (2009) and Demiroglu et al. (2009), 87% of public firms and 64% of large private firms have access to credit lines in the U.S.

However, borrowing from credit lines might be difficult depending on the firm's credit quality as well as the bank's financial health. On the one hand, the no compliance of a financial covenant by the borrower allows the bank to restrict usage of credit lines by raising spreads, shortening maturities, tightening covenants, reducing the line size or even cancelling it. (Acharya et al., 2020). On the other hand, balance sheet problems, such as declines in liquidity or capital, may reduce banks' ability to accommodate firms' demand for liquidity trough credit lines, leading to tougher responses to covenant violations. Indeed, Huang (2010) and Acharya et al. (2020) find that distressed banks are less likely to waive the borrowers' current or future compliance with financial covenants. This possibility of losing access to funds may lead firms to precautionarily draw down available funds, creating a form of bank run (Ivashina and Scharfstein, 2010; Ippolito et al., 2016).

The aim of this paper is to determine whether firms react to news about their banks' financial soundness by drawing down their pre-existing credit lines. To such purpose, we use information available from the release of stress tests results.

[8]Coverage and debt-to-cash flow covenants are the most common financial covenants (Demiroglu and James, 2010). The former requires that a borrower's coverage ratio (e.g., EBITDA-to-interest expenses) remains above a minimum and the latter requires the debt-to-cash flow ratio to exceed a preset maximum.

2.2. Stress Testing

In the aftermath of the Global Financial Crisis, stress testing of banks has become an important element of the bank supervisory toolkit. Typically, stress tests assess whether banks maintain adequate capital levels to withstand a hypothetical adverse macroeconomic scenario. Banks whose capital ratios in the stressed scenario fall below a benchmark, set by the supervisor, are expected to adopt promptly remedial actions to strengthen their capital levels. As pointed out by Baudino et al. (2018), "the emphasis on stress tests to assess and replenish bank solvency was justified by the fact that capital is at the core of a bank's ability to absorb losses and continue to lend."

In the European Union (EU), the European Banking Authority (EBA) is in charge of coordinating the EU-wide stress test exercise. These exercises are conducted following a bottom-up approach and using consistent methodologies, scenarios and assumptions developed in cooperation with the European Systemic Risk Board (ESRB), the European Central Bank (ECB) and the European Commission (EC).

2.2.a. The 2011 EBA EU-Wide Stress Test

The first exercise coordinated by the EBA, and the only one before 2014, happened in 2011.[9] It was carried out in the midst of the European debt crisis, when concerns about bank solvency were heightened.[10] The results were published for each participating bank on Friday July 15, 2011, at the end of the day. They focused on the ratio of Core Tier 1 capital (equity and retained profits) to risk weighted assets (CT1R) under two hypothetical scenarios (baseline and adverse).[11] Before the release of the results, the EBA had announced that banks with a CT1R below 5% under the adverse scenario should take

[9]Previously, the Committee of European Banking Supervisors (CEBS) coordinated the 2009 and 2010 stress test exercises. On the one hand, only aggregate results were released for the former exercise. On the other hand, as opposed to the 2011 stress test, the 2010 exercise was poorly received, due to the relatively mild stressed scenario considered and other methodological concerns (Hardy and Hesse, 2013).

[10]In May 2010 Greece received an EU-IMF bailout; Ireland followed suit in November 2010, as did Portugal in May 2011; in March 2012 Greece received its second bailout; in June 2012 Spain received a rescue package aimed at recapitalizing its banking system.

[11]For a description of the main events of the stress exercise see Table A.1.

remedial measures to cover such shortfall. However, due to growing concerns about the European economy, on the publication date (July 15) the EBA strongly recommended that banks with a CT1R above but close to the 5% threshold in the adverse scenario should also strengthen their capital position. In particular, when the results were announced, the EBA highlighted the number of banks with a CT1R under the adverse scenario below 5% (8 banks) and between 5%-6% (16 banks) (EBA, 2011).

The main features of the exercise are follows.

(i) Assumptions: The exercise was carried out using financial data as of December 2010. In its implementation, a static balance sheet was assumed, that is, balance sheets as of end 2010 were frozen, which discouraged banks from claiming that risk would be mitigated by selling off risky assets or changing their business model. As in most stress testing practices, both scenarios, baseline and adverse, covered two years (2011 and 2012). Due to the uncertainty about a macroeconomic recovery of the EU, the adverse scenario considered a further aggravation of the EU sovereign debt crisis as of early 2011. Such adverse scenario affected differently each member country. For instance, under the adverse scenario, GDP in EU would shrink by 0.4% in the period of analysis (2011 and 2012); whereas, Spanish GDP would decrease by 2.2%. Moreover, concerns were also focused on banks' exposure to sovereign risk. As a consequence, sovereign exposures in the trading book were subject to valuations haircuts, which depend on maturity and issuing country, in the adverse scenario.[12] By using their internal models, banks were required to estimate the effect of each scenario on their balance sheet following the methodology stipulated by the EBA.

(ii) Scope: The largest banks of each country, covering at least 50% of the national banking sectors in each EU member state (measured as total consolidated assets as of end of 2010), were required to participate. However, national supervisors could add further banks to the sample. In total, 90 banks from 21 countries were part of the stress test exercise, which

[12] Additionally, banks were required to disclose their exposures to sovereigns broken down by country and duration bands, which allowed investors to simulate losses under tougher assumptions. For instance, it was revealed that the Franco-Belgian bank Dexia, a troubled bank that was later nationalized on October 2011, was holding a portfolio of risky sovereign bonds of almost a third of its balance sheet.

Table 1: Results for Spanish banks in the 2011 EBA EU-wide stress test

	Core Tier 1 capital ratio	
		Adverse Scenario
Bank	2010	2012
Santander	7.1	8.4
BBVA	8.0	9.2
Bankia	6.9	5.4
Caixa	6.8	6.4
Popular	7.1	5.3
Sabadell	6.2	5.7
Catalunyacaixa	6.4	4.8
NCG	5.2	5.3
Civica	8.0	5.6
CAM	3.8	3.0
BMN	8.3	6.1
Bankinter	6.2	5.3
Espiga	8.2	7.3

	Core Tier 1 capital ratio	
		Adverse Scenario
Bank	2010	2012
Ibercaja	9.7	6.7
Unicaja	12.5	9.4
Effibank	8.3	6.8
Pastor	7.6	3.3
BBK	10.2	8.8
Unnim	6.3	4.5
Kutxa	13.2	10.1
Caja3	8.6	4.0
March	22.2	23.5
Vital	12.5	8.7
Ontinyent	8.9	5.6
Pollensa	11.2	6.2

This table contains the CT1R as of December 2010 and the CT1R under the adverse scenario of the 2011 EBA EU-wide stress test for each of the 25 Spanish banks that were part of the exercise.

represented more than 65% of the total assets in the EU banking system. Contrary to other countries, Spain included almost all commercial banks and all saving banks in the exercise (25 banks in total), which represented nearly 93% of the Spanish banking sector by assets. According to the EBA's requirement, only the four largest Spanish banks, which represented more than half of the Spanish banking assets, were required to participate.

(iii) Results: The results for the 25 Spanish banks that participated in the stress test exercise are presented in Table 1. On the one hand, five banks failed the stress test exercise, that is, their CT1R under the stress scenario fell below the 5% benchmark: one commercial bank and four saving banks. On the other hand, seven banks had a CT1R between 5% and 6%: three commercial banks and four saving banks. Thus, based on the EBA's announcement of July 15, 2011, such institutions were expected to strengthen their capital position.

(iv) Informational Content: Stress test exercises provide valuable information to market participants that help them distinguishing between sound and fragile banking institutions. The 2011 EU-wide stress test was not an exception. Indeed, by using an event study analysis, Petrella and Resti (2013) find that the release of the stress test results affected

Table 2: Effect of the 2011 EBA EU-wide Stress Test on Bank Stock Prices

	Cumulative Abnormal Returns (CAR)	
	Before Release Date	After Release Date
	(1)	(2)
Inadequately Capitalized	0.007	-0.024***
$\mathbb{1}$(CT1R < 6%)	(0.008)	(0.009)
No of Banks	46	46
R^2	0.019	0.146

This table shows the Weighted Least Square (WLS) regressions of Cumulative Abnormal Returns (CAR) on the Inadequately Capitalized dummy. The sample contains 46 European banks with stock price information that participated in the 2011 EBA EU-wide stress test, 8 of them are Spanish. Appendix B provides further details on how CARs are computed. The Inadequately Capitalized dummy takes value 1 if the bank's CT1R under the adverse scenario is below 6% and 0 otherwise. In the first column, CARs are computed over the window Jul. 14 − Jul. 15, 2011, before the results were announced. In the second column, CARs are computed over the window Jul. 18 − Jul. 20, 2011, after the results were public (note that the stress tests results were released on Friday July 15, after markets closed). The weights are calculated as the inverse of the root MSE from the one-factor model estimation stage, see Appendix B for further details. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

stock prices of participating banks differently. In particular, after the publication of the results, the authors show that banks with a higher CT1R under the adverse scenario were rewarded with higher abnormal returns compared to banks with a lower CT1R. Moreover, such difference in abnormal returns between banks with lower and higher CT1R was not significant before the announcement of the results, which is consistent with bank opaqueness prior to the disclosure of the results.

Table 2 shows the effect, before and after the results were public, on cumulative abnormal returns (CAR) of having a CT1R below 6% under the adverse scenario. Following Petrella and Resti (2013), CARs are computed for 46 publicly traded European banks, 8 of them Spanish, that participated in the stress exercise. Further details on how CARs are computed can be found in Appendix B. As it can be seen, only after the announcement of the stress test results, bank with a worse performance in the exercise (CT1R < 6%) were penalized with 2.4 pp lower CARs compared to banks that performed better (CT1R ≥ 6%). Overall, market returns indicate that the 2011 EBA EU-wide stress test provided valuable

information to sophisticated investors, who were not able to anticipate such results.

2.3. Theoretical Implications

The empirical literature shows that banks in need of recapitalization tend to increase their capital ratios, particularly in the short term, by partially reducing lending to their borrowers. For instance, Gropp et al. (2018) find that, to reach a mandatory target set by the EBA, large European banks increased their capital ratios in 2012 by reducing their lending rather than raising their levels of equity. Similar evidence is presented by Berrospide and Edge (2019), who find that large U.S. banks significantly decrease C&I lending to satisfy the quantitative component of the Federeal Reserve's CCAR stress tests.

Also, capital constrained banks actively manage their exposure to unused credit lines. Under the current regulatory framework, funds drawn from credit lines are backed up with more bank capital than undrawn funds. In particular, under the standardized approach for credit risk, a *credit conversion factor* (CCF) of 10% is applied to convert unused balances of credit lines into on-balance-sheet exposures for the calculation of capital requirements (BCBS, 2017). Thus, a spike in credit lines usage can further decrease the capital ratio of a bank in need of recapitalization; hence, such bank may have incentives to reduce its exposure to credit lines.[13] For instance, Acharya et al. (2020) and Chodorow-Reich and Falato (forthcoming) show that, following a covenant violation, banks in worse health are more likely to restrict access to loan commitments. Similarly, Pelzl and Valderrama (2020) find that capital constrained Austrian banks managed their exposure to credit lines during the 2008-09 financial crisis by substantially cutting little-used credit lines.

Firms that depend on liquidity from credit lines can draw down funds in advance if tighter credit conditions are expected from their banks. Credit lines are an important tool for firms' liquidity management, particularly following adverse macroeconomic shocks (Jiménez et al., 2009; Mian and Santos, 2011; Greenwald et al., 2021; Kapan and Minoiu,

[13]For large U.S. commercial banks, committed but undrawn balances on credit lines are more than 40% larger than the total used balances on bank credit lines and term loans combined (Greenwald et al., 2021)

2020).[14] In our sample, available funds at bank credit lines represented 9.6% of Spanish firms' assets in June 2011. Losing access to external funding can have a particularly negative impact on firms when credit supply in the economy is scarce. For instance, Almeida et al. (2012) find that firms whose long-term debt largely matured right before the onset of the Global Financial Crisis reduced investment more than firms whose debt was scheduled to mature well after. Similarly, Campello et al. (2011) show that firms with limited access to credit lines during the 2008-09 financial crisis cut their investment spending. Consequently, if firms are concerned about future credit constraints, they may draw down funds precautionarily from their credit lines. This situation is called a *credit line run*, because drawdowns are not driven by a genuine need for liquidity. Evidence from such type of runs has been documented in Ivashina and Scharfstein (2010), Campello et al. (2010), and Ippolito et al. (2016).[15]

Considering that banks with a CT1R below 6% under the adverse scenario had to strengthen their capital position, firms may have precautionarily drawn down from such banks after stress results became public in July 15, 2011. In particular, the main hypothesis of the paper is stated as follows.

Hypothesis: *After stress results became public, firms drew down preferentially on credit lines granted by banks that were considered inadequately capitalized.*

First, inadequately capitalized banks according to the stress test exercise were required to promptly raise their capital ratios. In the context of the European Sovereign Debt Crisis, that particularly hit peripheral EU countries such as Spain, increasing capital ratios by cutting lending to borrowers seemed more feasible than doing so by raising equity.

[14]Recent papers show that, after the COVID-19 outbreak, non-financial firms drew down significant amounts from their pre-existing credit lines following a sudden and sharp drop in their revenues.

[15]For instance, by using a multi-country survey of CFOs, Campello et al. (2010) report that a significant fraction of constrained firms drew down funds during the 2008-09 financial crisis because of concerns that banks would limit their access to their credit lines in the near future.

Second, firms relied on liquidity from credit lines in a context were bank credit was scarce. Consequently, after processing the information of the stress test results, which were widely publicized, firms may have drawn down from inadequately capitalized banks due to a precautionary motive.[16] That is to say, following the *informational shock* provided by the publication of the stress results, firms drew down more from banks whose CT1R fell below 6% under the stressed scenario out of fear that such banks might restrict credit in the future.

3. Database Construction & Summary Statistics

Our main dataset is constructed from three main sources: (i) the Spanish Credit Register (CIR), which is managed by the Banco de España (BdE), the regulator and supervisor of the Spanish banking system, (ii) the stress test results of the 2011 EU-wide stress test, which was coordinated by the European Banking Authority (EBA), and (iii) Spanish banks' financial statements as of December 2010, which are available at BdE for each banking group. Furthermore, to analyze heterogeneous effects on firm characteristics, we also match the original dataset with firms' balance-sheet information as of December 2010, which is available from the Spanish Mercantile Register.

The information on credit lines, available at the bank-firm level, is obtained from the CIR. This supervisory credit register contains information on any loan commitment above €6,000 granted by any bank operating in Spain, that is, the CIR is an exhaustive database containing almost all credit commitments granted to Spanish firms by different banks. Specifically, we observe drawn and undrawn amounts at the bank, firm, instrument type, maturity, collateral, default status, and currency level, which are reported in a monthly

[16]The stress test results were broadly covered in the main Spanish newspapers. For instance, the main Spanish newspaper, *El País*, published on their front page of July 16, 2011, an article about the performance of Spanish banks in the stress test exercise. In addition, more articles related to the results of the exercise appeared in other newspapers and in the following days.

basis.[17] One important caveat of our database is that we do not explicitly observe whether an observation is a credit line or not. Moreover, the drawn and undrawn amounts of two different products (e.g., a credit line and a fixed-term loan) that share same characteristics are aggregated into a single observation. Thus, to identify a credit line in our database, the following conditions must be satisfied: (i) the undrawn amount in month t has to be greater than zero, (ii) the granted amount, which is the sum of the drawn and undrawn amounts, between t and $t+1$ must remain equal.[18] The first condition keeps only loan commitments that have available funds that can be requested from banks by firms, and it does not take into account fully used credit lines (i.e., undrawn amount equals to zero), which cannot be distinguished from fixed-term loans. However, our interest is to determine whether credit lines were used more intensively after the publication of the stress results, which could not be feasible for credit lines that were already fully used before the results became public. The second condition discards observations whose granted amount decreases in the following month, which can be driven by the risk management practice of the bank or the repayment of a fixed-term loan that happens to share the same characteristics of a credit line. However, the former possibility is less likely to occur within a small period of time, in our case a month, because contractual terms in credit lines remain largely fixed unless a financial covenant is violated. For instance, among all the observations that satisfy condition (i), approximately 10% experiences a drop in their granted amount.[19] The identified credit line could still correspond to an actual credit line plus a term-loan if the the term-loan was not repaid between months. The effect of including this "line" would be to bias downwards our results, since our main variable normalizes the change in credit line usage by the total size of the line (which in this case would be actual line size plus term-loan size), see below. After credit lines are identified, we proceed to aggregate

[17] For a more detailed explanation of the CIR database, see Jimenez and Saurina (2004).

[18] We control for mergers and acquisitions to keep track of credit lines when bank identifiers vary.

[19] Observations whose granted amount increase in the next month are interpreted as a new credit line contract, whereas our analysis focuses on credit lines that were already conceded at month t. Moreover, as part of our robustness checks, we also estimate our main specification including those observations whose granted amount diminishes.

all the credit lines, drawn and undrawn amounts, in euros and with residual maturity less than 3 years that each firm has with any bank in the banking group.[20] This is a necessary step because stress results and bank information are available at the banking group.

Our main variable of interest is the change in the credit line usage rate of firm f from bank b between June 30 and July 31, 2011. That is, two weeks before and after the release of the stress results, which occurred on July 15, 2011. In particular, the change in usage rate for month $t+1$ is computed as

$$\Delta Usage_{f,b,t+1} = \frac{Drawn_{f,b,t+1} - Drawn_{f,b,t}}{Granted_{f,b,t}}, \tag{1}$$

where $Granted_{f,b,t} = Drawn_{f,b,t} + Undrawn_{f,b,t}$. Hence, the change in usage rate for July allows us to analyze whether, for existing credit lines in June that were not fully used, firms chose to use more intensively credit lines granted by banks more affected by the informational shock following the release of the stress results. Moreover, we also extent our analysis for months before July to discard pre-event trends or anticipation of the stress results.

Our sample is composed of non-financial firms that have at least two credit lines from two different banks that participated in the 2011 stress test exercise.This sample of firms enables the addition of firm fixed effects in our main specification, which is part of our identification strategy that is explained in the next section. Specifically, the sample is comprised of 93,010 credit lines granted to 34,773 non-financial firms by Spanish banks that participated in the 2011 stress test. The amount of the select credit lines represents more than 60% of the total amount granted to non-financial firms via credit lines as of June 2011.

Finally, we match each credit line in our dataset to bank (outcome in the 2011 stress

[20]Credit lines in a currency different from euros represent just around 1% of our original sample. Most credit lines offered by banks have maturities between 1 and 3 years; loan commitments with maturities of more than 3 years are mostly related to real estate activities and the construction sector, in which drawdowns typically occur as construction work progresses.

test, size, profitability, liquidity, NPLs, CT1R, and a commercial bank dummy) and firm (size, profitability, liquidity, solvency, and risk) information as of December 2010. Bank data comes from the 2011 stress results, available at the EBA's website, and banks' financial statements, accessible to BdE in its role of supervisor. Firm data comes from the Spanish Mercantile Register, also accessible to BdE. It is worth noting that firm information is only used to study heterogeneous effects on firm characteristics and, when using it, the sample size decreases somewhat.[21] All variables used in our analysis are defined in Table A.2 and their descriptive statistics are reported in Table 3.

4. Empirical Strategy

4.1. Identification of Precautionary Drawdowns

We are interested in analyzing whether precautionary drawdowns from credit lines take place following information disclosures about banks' financial strength. Such analysis faces important empirical challenges for a researcher. First, the need of an informational shock that comes from a reliable source and affects banks differently. Second, banks with worse financial health might be matched with firms that frequently demand funds from their credit lines for business related purposes (e.g., paying wage bills), which complicates the identification of precautionary drawdowns.

To address such concerns, our identification strategy relies on two crucial ingredients: (i) an informational shock that came from the release of the 2011 stress results, coordinated by the EBA, which covered almost every Spanish banking institution; (ii) an exhaustive credit register that records all credit lines granted by different banks to each firm, which allows, by the addition of firm fixed effects, to control for observed and unobserved firm characteristics that may drive demand for liquidity.

The 2011 EBA EU-wide stress test disclosed relevant information about banks' sol-

[21] Our main dataset contains 34,773 firms, whereas the dataset with firm characteristics has 23,863 firms.

Table 3: Descriptive Statistics

	Mean	Median	St. dev.	Obs.
Variable of Interest				
Change in usage rate June/July 2011 (pp)	2.5	0.0	25.5	93,010
Change in usage rate May/June 2011 (pp)	0.6	0.0	24.4	93,403
Change in usage rate April/May 2011 (pp)	0.5	0.0	24.3	94,437
Credit Line Variables				
Dummy past-due w/ bank b	0.017	0.000	0.128	93,010
Collateralized (%)	3.420	0.000	17.964	93,010
Maturity $\leq$ 1 y. (%)	85.729	100.0	34.588	93,010
Share of firm's CL credit with given bank (%)	37.386	34.884	22.313	93,010
Initial usage rate (%)	47.787	52.0	37.571	93,010
Firm Variables				
Assets (mill. €)	33.1	1.5	787.7	23,863
ROA (%)	1.5	1.2	6.6	23,863
Liquidity ratio (%)	6.0	2.4	9.7	23,863
Capital ratio (%)	34.3	31.3	20.3	23,863
Dummy past-due in the system	0.09	0.00	0.28	23,863
Bank Variables				
Dummy Inadequately Capitalized	0.3	0.0	0.5	25
Log(Assets)	19.6	20.1	1.3	25
ROA (%)	0.55	0.76	0.44	25
Liquidity ratio (%)	14.5	17.5	4.6	25
Non-performing loan ratio (%)	3.4	2.8	1.5	25
CT1R (%)	7.4	7.1	1.5	25

This table shows the descriptive statistics of the main variables used in our analysis. The main period of analysis extents from June 30 to July 31, 2011, that is, two weeks before and after the publication of the stress results. The main sample is comprised of 93,010 credit lines granted to 34,773 non-financial firms by Spanish banks that participated in the 2011 stress test exercise. This sample only includes firms that have at least two outstanding and not fully used credit lines on June from two different banks. Moreover, to analyze heterogeneous effects on firm characteristics, we match the previous sample with firms' balance-sheet data. Such smaller sample has 64,261 credit lines granted to 23,863 firms. Bank statistics are computed weighting each bank by its total assets. Variables are defined in Table A.2.

vency. The results of this supervisory stress test were made public on July 15, 2011, at the end of the day. As it is discussed in section 2, the stress exercise provided valuable information to sophisticated investors, as indicated by banks that performed worse in the exercise having lower CARs than banks that performed better, right after the publishing of the results. Moreover, the stress results were not anticipated by them. Furthermore, as opposed to other countries, all Spanish saving banks and almost all commercial banks, 25

banks accounting for nearly 93% of the assets of the Spanish banking sector, participated in the exercise. These banking institutions performed differently under the adverse scenario of the stress test, see Table 1 in section 2. Specifically, 12 banks had a CT1R in the adverse scenario below 6%. According to the EBA, such institutions, featured as *inadequately capitalized*, were expected to strengthen their capital position. Thus, this stress test disclosed relevant information about Spanish banks' solvency, that is, it was a meaningful *informational shock*.

The Spanish Credit Register covers all the outstanding credit lines extended by different banking institutions to each firm. In particular, we carry our analysis at the bank-firm level and employ a sample with the important feature that the same firm has at least two credit lines from two different banks before and after the stress results were announced. Such feature helps, by adding firm fixed effects, to control for credit demand (Khwaja and Mian, 2008). Hence, after isolating shocks to credit demand, precautionary drawdowns can be observed if a particular firm chooses to use more intensively its credit lines extended by inadequately capitalized banks (CT1R<6%) compared to its lines granted by banks that were consider adequately capitalized according to the stress test. This approach helps to address the potential problem that banks that performed worse in the stress test were sorted with firms that may have higher liquidity needs. Moreover, it is important to highlight that our analysis is carried out at the monthly frequency, which helps to better identify whether precautionary drawdowns happened after results were disclosed. For instance, it could happen that a firm withdrew extra funds from banks that appeared weak in the test right after the announcement, but returned the funds a few months later. Such events might be missed if the observation frequency is too coarse.

The aforementioned ingredients permit us to exploit an identification strategy based on a difference-in-differences approach: we compare for the same firm its credit line usage before and after the release of the stress results for banks more or less affected by the adverse scenario of the stress exercise. Thus, our analysis will point to the direction of the

existence of precautionary drawdowns driven by an informational shock if, following the announcement of results, firms with multiple credit lines from different banks preferentially drew down from lines granted by inadequately capitalized banks, according to the stress test, over lines extended by adequately capitalized banks.

4.2. Empirical Model

We regress, for existing credit lines in June that were not fully used, the change in usage rate for a credit line by bank b to firm f between June and July 2011 ($\Delta Usage_{f,b,July}$) on a stress test performance variable ($Inadequately\ Capitalized$), bank and credit line controls, and controlling for credit demand with the inclusion of firm fixed effects (α_f).[22] Formally, we estimate the following specification:

$$\Delta Usage_{f,b,July} = \alpha_f + \beta \times Inadequately\ Capitalized_b + \underbrace{\gamma' bank_b + \delta' credit\ line_{f,b}}_{\text{controls}} + \varepsilon_{f,b}. \quad (2)$$

In particular, we are interested in the coefficient of the stress test performance variable. The *Inadequately Capitalized* dummy takes value 1 if the bank had a CT1R below 6% under the adverse scenario of the stress exercise, and 0 otherwise. Recall that, according to the EBA, such banks were required to promptly strengthen their capital position, and were highlighted in the disclosed results. Thus, if precautionary drawdowns occurred after the disclosure of the results, the coefficient β should be positive and significant only when the results became public and not before, unless important anticipation effects occurred. Recall that precautionary drawdowns are driven by firms' fear that banks identified by the stress test as not adequately capitalized may reduce their lending to firms in the next months. It is important to remark that our dependent variable only increases if more funds are requested by the firm and not because the granted amount is decreased by the

[22] Equation (2) is also estimated for other months to observe whether anticipation or lagged responses occurred.

bank.[23]

In our specification, we control for other possible sources that can explain firms' credit line usage. As we previously pointed out, a key feature of our identification strategy relies on the inclusion of firm fixed effects α_f, which allows us to control for relevant, yet unobservable, firm characteristics that can drive demand for liquidity (e.g., a drop in revenues and thus a need for liquidity). Additionally, we also include bank controls, such as the logarithm of assets, the return on assets, the liquidity ratio, the CT1R ratio, and a dummy for whether the bank is a commercial bank. These controls are meant to isolate the part of the informational shock that firms were not able to predict. Also, firms could have reacted to weaker bank fundamentals; hence, the need for adding bank controls.

Furthermore, we also add credit line controls, such as a dummy for whether a firm has a past-due loan with its bank, the share of the credit line that is collateralized, the share of the credit line that matures within a year, the share of credit lines that a firm has from each bank, and the initial usage rate. These variables could also potentially explain firms' drawdown behavior. For instance, Jiménez et al. (2009) find that a line's default status is a key determinant of its usage as firms with prior defaults access them less, suggesting that banks exert monitoring on firms and, through this, influence firms' usage decisions. They also find that firms draw down less on credit lines granted by their main banks, which indicates that banks limit funding to their most dependent borrowers. All control variables are defined in Table A.2.

5. Results

In this section we analyze whether precautionary drawdowns took place once the stress test results became public in July 2011. Additionally, we explore anticipated or lagged responses of firms by performing our analysis for other months around the announcement

[23] In our robustness section, we also estimate equation (2) including observations whose granted amount decreased between June and July 2011.

date of the results. Finally, we run some robustness checks.

5.1. Evidence on Precautionary Drawdowns

Table 4: Effect of the 2011 Stress Test on Credit Line Usage

	June/July 2011		
	Change in Drawn to Granted ($\Delta Usage_{f,b,July}$)		Change in Drawn to Available Funds
	(1)	(2)	(3)
Inadequately Capitalized	0.012***	-0.001	0.095**
	(0.003)	(0.005)	(0.044)
$\times \mathbb{1}(0 < Usage \leq 0.2)$		0.004	
		(0.007)	
$\times \mathbb{1}(0.2 < Usage \leq 0.4)$		0.016**	
		(0.008)	
$\times \mathbb{1}(0.4 < Usage \leq 0.6)$		0.019**	
		(0.007)	
$\times \mathbb{1}(0.6 < Usage \leq 0.8)$		0.023***	
		(0.008)	
$\times \mathbb{1}(Usage > 0.8)$		0.017***	
		(0.005)	
Bank controls	Y	Y	Y
Credit line controls	Y	Y	Y
Firm FE	Y	Y	Y
Observations	93,010	93,010	90,375
R-squared	0.5468	0.5475	0.4460
Within R-squared	0.2015	0.2028	0.0591

This table contains a set of regressions of the change in drawn funds from credit lines over the period June/July 2011, which includes the announcement date of the stress results (July 15, 2011), on a stress test performance variable, bank and credit line control variables (detailed in Table A.2), and firm fixed effects. In column 1 and 2, the change in drawn funds is measured relative to the total granted amount by bank b to firm f as in Equation 1, which includes drawn and undrawn funds. Column 3 measures the change in drawn funds relative to available funds at June 2011. $Inadequately\ Capitalized$ is a dummy variable that takes value 1 if a bank was inadequately capitalized according to the 2011 stress test exercise (CT1R < 6%). The sample only includes firms that have at least two outstanding and not fully used credit lines on June from two different banks. Additionally, to avoid extreme negative values of the dependent variable, column 3 does not include credit lines whose initial usage is above 99%. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Column 1 in Table 4 shows the estimate for the coefficient of the *Inadequately Capitalized* dummy in our main specification, see equation (2). The dependent variable is the change in credit line usage rate between June and July, which is computed as the difference in drawn funds over the period divided by the total granted amount, see equation (1). As it

can be appreciated, the coefficient is positive and statistically significant at the 1% level. Specifically, after the announcement of the stress results on July 15, firms with two (or more) lines provided by different banks chose to draw down on average 1.2 pp more of their credit lines extended by banks that according to the stress test were not adequately capitalized, compared to adequately capitalized banks. Note that the inclusion of firm fixed effects in our main identification allows us to isolate credit demand factors; hence, the results suggest the existence of precautionary drawdowns following an informational shock about banks' solvency when credit in the economy is scarce.

The following remarks are useful to better understand the economic significance of the estimated coefficient. First, it is worth noting that the mean and median change in credit line usage between June and July were relatively low, at 2.5% and 0%, respectively, see Table 3. Our main result indicates that the additional usage of credit lines extended by inadequately capitalized banks is about 50% of the average increase during that month.

Second, a considerable share (72%) of credit lines with initial usage rate equal to zero remained unused on July, accounting for nearly 25% of our sample. It is important to highlight that little-used credit lines are the only ones whose change in usage rate can be potentially high. For instance, a credit line with an initial usage rate of 90% can at most increase its usage 10pp more. Column 2 in Table 4 shows that our results are mainly driven by credit lines whose initial usage rate is above 20%.

Third, if we measure the change in drawn funds over the period relative to available funding in June (undrawn funds) rather than the granted amount (drawn plus undrawn), the observed increase is substantially larger. Note that, when defined in this way, the dependent variable can increase up to 100% independently of the initial usage rate, which would indicate that the firm draws down all the funds left in the credit line. As it can be appreciated from column 3 in Table 4, the magnitude of the estimated coefficient increases for the alternative definition of the dependent variable. Specifically, compared to adequately capitalized banks, firms drew down 9.5pp more of the available funding

(undrawn funds) from their credit lines extended by inadequately capitalized banks.[24] We note that currently under the standardized approach for credit risk only a 10% of the undrawn balances of credit lines is assumed to be drawn for the computation of the *exposure at default* (EAD); whereas, this result suggests that almost an additional 10% could arise due to precautionary motives.

Inadequately capitalized banks, as highlighted in the stress test, did not experience additional drawdowns before the announcement of the results in July 2011. Table 5 shows the placebo tests for our main specification in column 1 of Table 4. Specifically, we run equation (2) for months prior to July 2011. As it can be appreciated, the coefficient of interest is not statistically different from zero for any month before July. Similarly, for the same period in 2010, the coefficient of the *Inadequately Capitalized* dummy is not statistically significant. Hence, there is no evidence that firms drew down preferentially from lines extended by inadequately capitalized banks over lines granted by adequately capitalized banks before the time the stress results became public (July 15). That is, there is no evidence of neither pre-event trends nor predictability of the stress results, which helps to alleviate concerns that our findings might be spurious and not truly due to the release of the stress test results.

However, between August and September, credit lines granted by inadequately capitalized banks were used less intensively than lines granted by adequately capitalized banks, as it can be appreciated in the last column of Table 5. A possible explanation could be that firms that drew down precautionarily on July decided to return the cash a few months after, once they observed that their concerns relating to particular banks did not materialize.[25] That is, after the initial worries dissipated, liquidity came back from firms that made extraordinary drawdowns in July, which reinforces the idea that the increase

[24]The sample size in column 3 of Table 4 decreases because it does not include credit lines with initial usage rate above 99%. This step is needed to avoid extreme negative values of the dependent variable, which would unduly affect the results. This is so because, if the undrawn amount available at June is close to zero, a decrease in the used amount of the credit line between June and July can generate extremely large negative values, while positive values are bounded by 1.

[25]Due to interest payments on drawn amounts, drawing down to create cash reserves is costly.

Table 5: Placebo Tests

	Change in Drawn to Granted ($\Delta Used_{f,b,t+1}/Granted_{f,b,t}$)						
	2010	2011					
	Jun-Jul	Mar-Apr	Apr-May	May-Jun	Jun-Jul	Jul-Aug	Aug-Sep
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inadequately Capitalized	0.005	0.004	0.004	-0.005	0.012***	-0.007	-0.019**
	(0.004)	(0.003)	(0.004)	(0.006)	(0.003)	(0.008)	(0.007)
Controls	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Observations	108,718	98,238	94,437	93,403	93,010	92,723	88,873
R-squared	0.542	0.528	0.535	0.522	0.547	0.548	0.541
Within R-squared	0.193	0.179	0.188	0.179	0.202	0.187	0.182

This table replicates column 1 of Table 4 on data from months before and after the announcement of the stress results. Specifically, we regress the monthly change in usage rate for month $t+1$ on the $Inadequately\ Capitalized$ dummy, bank controls (computed as of December 2010), credit line controls (computed with information available at month t), and firm fixed effects. As reference, the column associated with June-July coincides with the information in column 1 of Table 4. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

in line usage observed after the release of the results were driven by concern about banks' soundness rather than by genuine liquidity needs.

To explore this alternative, and check whether the same firms that drew more from inadequately capitalized banks in July drew less from them in September, we run our main specification for July-August and August-September, but add an interaction term between the *Inadequately Capitalized* dummy and a dummy variable (*Run*) that identifies those firms that incurred in precautionary drawdowns after the announcement of the stress results. Specifically, we consider that a firm *run* on July if the firm's average change in credit line usage with inadequately capitalized banks is strictly positive and larger than the firm's average change with adequately capitalized banks.

The results are shown in Table 6. The decrease in September usage rate of credit lines granted by inadequately capitalized banks, compared to other participating banks, is explained by a reversal of July or August precautionary drawdowns. Columns (2) and (3) of table (6) indicate that firms that incurred in precautionary drawdowns in July used differently their lines extended by adequately and inadequately capitalized banks in the

following months. Specifically, the significance and negative sign of the interaction term between the dummies *Inadequately Capitalized* and *Run* indicate that this type of firms used less intensively credit lines granted by inadequately capitalized banks, which suggests that panicking firms returned back drawn funds to banks in the next two months after results were known. Moreover, once we take into account this interaction term, the coefficient of the *Inadequately Capitalized* dummy is no longer statistically significant for July-August and August-September 2011.

Table 6: Reversal in Precautionary Drawdowns

	Change in Drawn to Granted ($\Delta Used_{f,b,t+1}/Granted_{f,b,t}$)		
	Jun-Jul (1)	Jul-Aug (2)	Aug-Sep (3)
Inadequately Capitalized	0.012***	0.006	-0.006
	(0.003)	(0.008)	(0.006)
Inadequately Capitalized × Run		-0.044***	-0.027***
		(0.005)	(0.003)
Controls	Y	Y	Y
Firm FE	Y	Y	Y
Observations	93,010	92,723	88,873
R-squared	0.5468	0.5492	0.5412
Within R-squared	0.202	0.189	0.1832

This table contains the regression results for the monthly change in credit line usage on the $Inadequately\ Capitalized$ dummy, a dummy variable Run that identifies firms that incurred in precautionary drawdowns, their interaction, bank and credit line controls, and firm fixed effects for July-August and August-September. For comparison, the first column replicates the results of our main specification, see column 1 in Table 4. Run is a dummy variable that takes value 1 if the firm's average change in credit line usage with inadequately capitalized banks is strictly positive and larger than the average change with adequately capitalized banks in July (column (2)), or July or August (column (3)). Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

If we use the alternative dependent variable in which the change in funds drawn is normalized by the funds available, the results are similar, and are detailed in tables (A.3) and (A.4) in appendix A.

It is possible that the observed increase in credit line drawdowns in July 2011 could be explained by a substitution in firms' bank funding sources. In particular, banks with poor performance in the stress test could have tightened traditional term loans prior to the release of the stress test results (e.g., by not renewing maturing loans). Hence, firms

with access to credit lines could have substituted such decrease in funding by drawing down from their existing credit lines, preferentially from the banks which decreased term funding. In such a case, our findings could also be associated to a rebalance of firms' funding sources rather than to precautionary drawdowns. We study this possibility by regressing the change in log term loans of each bank-firm pair over the *Inadequately capitalized* bank dummy, together with bank controls, credit line controls and firm fixed effects. The results are shown in Table 7. The coefficient for the change in log term loans in June is small and insignificant (column 2), while that of the change in the third quarter of 2011 is positive (column 4). This indicates that firms did not see their term loans reduced preferentially from banks with poor performance in the stress test, and therefore this mechanism cannot explain our main results. It is still possible that firms saw their term funding decreased preferentially from banks with poor performance in the stress tests *before* the results were released (since presumably banks could have anticipated the results); the increase in credit line use from this banks could then be a delayed response to this event. We see no evidence of this effect, as the coefficient of the *Inadequately capitalized* dummy is positive (and significant) for the month or quarter before the release of the stress test (columns 1 and 3). So, if anything, firms saw their term funding preferentially increasing from banks with poor performance in the stress test before the results were released. Thus, the results indicate that firms did not have an additional need to substitute a drop in term funding coming from poorly performing banks, which supports the idea that the extraordinary drawdowns in July 2011 were motivated by precautionary reasons.

To sum up, the analysis in this section shows that, after the announcement of the stress results in mid-July, firms drew down more funds from credit lines extended by banks that were featured as inadequately capitalized in the stress test exercise. Moreover, there is no evidence of such drawdown behavior prior to the release of the results. Finally, a reversal in precautionary drawdowns was found in the months following the publication of the results, presumably once worries about bank safety did not materialize. In addition, firms

Table 7: Effect of the 2011 Stress Test on Term Loans - Sample of Firms with Multiple Credit Lines in June 2011

	Change in Term Loans			
	Jun-2011	Jul-2011	2Q-2011	3Q-2011
	(1)	(2)	(3)	(4)
Inadequately Capitalized	0.017**	-0.005	0.28**	0.018*
	(0.008)	(0.006)	(0.011)	(0.010)
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Observations	68,990	68,990	62,803	62,803
R-squared	0.2786	0.2857	0.3191	0.3175
Within R-squared	0.0258	0.0228	0.0371	0.0279

This table reports the regression results for the change in log term loans on a *Inadequately capitalized* dummy, bank, credit line controls, and firm fixed effects for the sample of firms in our main specification. The dependent variable is the change in log amount of term loans granted to firm f by bank b during the period. In order to have constant samples, only observations available in Jun and July (columns 1 and 2) or 2011q2 and 2011q3 (columns 3 and 4) are included in the regressions. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

did not see their term funding decreasing more from banks with poor performance in the test, so their increase in credit line usage from these banks was not meant to compensate for decreasing term funding. It is important to remark that our analysis controls for credit demand factors by including firm fixed effects in the analysis, which is necessary for the identification of precautionary drawdowns.

5.2. Robustness Checks

In this section, we consider variations in our sample and statistical model in order to examine whether the result found is robust.

We start by estimating our main specification in (2) including commitments whose granted decreased in the period of analysis. Recall that our definition of a credit line relies on the assumption that the granted amount extended in a credit line (drawn plus undrawn funds) remains fixed within a month, see section 3. Consequently, such assumption reduces our sample, because it does not include other loan commitments whose granted amount decreased between June and July 2011. Although such assumption is reasonable and permits to better identify credit lines, we might be ruling out credit lines that were

downsized in that period, generating a potential problem of sample selection.

Table 8 reports the regression results for our main specification in (2) after adding credit lines whose granted amount decreased less than 40%, 80%, or decreased any amount, respectively. To avoid an artificially increase in the usage rate of those lines whose granted diminished on July, we compute the dependent variable as the change between June and July in the drawn funds by firm f from bank b over the granted funds on June to firm f by bank b (i.e., prior to the downsizing). For comparison, the first column in Table 8 replicates the results of column (1) in Table 4. As it can be appreciated, the coefficient of the *Inadequately Capitalized* dummy remains positive and statistically significant across all samples, which supports evidence on precautionary drawdowns after the release of the stress test results.

Additionally, we investigate whether firms with downsized credit lines on July behaved differently after the release of the stress results. To do so, we add the interaction term *Inadequately Capitalized* $\times$ *Drop*, where *Drop* is a dummy variable that takes value 1 if the credit line extended by bank b to firm f is downsized in July. A priory, the sign of the coefficient of this term is unclear. On the one hand, a line that is downsized will mechanically restrict the amount of funds that can be drawn.[26] On the other hand, a firm that experiences a downsizing might react by drawing down available funds if a future downsizing is expected. The results in Table 8 suggest that firms with downsized lines drew down more from inadequately capitalized banks after the release of the results than firms that did not experience a downsizing; see columns (3), (5), and (7). Similar evidence is presented in column (8), though the effect is lower for firms that experienced large drops in their granted amounts. Thus, results suggest that firms with downsized lines on July drew down more after the release of the results than other firms, which is consistent with extraordinary drawdowns being driven by fear that inadequately capitalized banks may

[26]For instance, for a credit line whose granted amount was reduced to almost zero, the drawn amount on July could not surpass this new limit, making it more likely that the drawn amount decreased between June and July.

Table 8: Effect of the 2011 Stress Test on Usage Rate - Including Lines whose Granted Diminished

	Change in Drawn to Granted (June-July)							
	|Δ%Granted| ≤							
	0 %	40%		80%		100%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inadequately Capitalized	0.012***	0.014***	0.012***	0.015***	0.014***	0.017***	0.016***	0.013***
	(0.003)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)
Inadequately Capitalized			0.019*		0.018*		0.016	0.024*
× Drop			(0.010)		(0.010)		(0.011)	(0.012)
Inadequately Capitalized								-0.144***
× Drop × |ΔGranted|/Granted								(0.037)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	93,010	105,290	105,290	107,165	107,165	107,683	107,683	107,683
R-squared	0.5468	0.5381	0.5394	0.5369	0.5409	0.5358	0.5417	0.5576
Within R-squared	0.2020	0.1982	0.2003	0.2001	0.2070	0.1998	0.2099	0.2373

This table reports the difference-in-difference regression estimates for analyzing the effect of the 2011 stress test on credit line usage. As part of our robustness checks, we add lines whose granted amount decreased between June and July 2011. Column (1) replicates, for comparison, our main results, which only include credit lines whose granted amount remained fixed between June and July 2011, see Table 4. In columns (2)-(3), we add lines whose granted amount decreased by less than 40%. Additionally, in columns (4)-(5), we add lines whose granted amount decreased by less than 80%. Finally, columns (6)-(8) include any loan commitment independently of whether the granted amount decreased or not. The dependent variable is the change between June and July in the drawn funds by firm f from bank b over the granted funds on June to firm f by bank b. $Inadequately\ Capitalized$ is a dummy variable that takes value 1 if a bank had a CT1R below 6% in the adverse scenario of the stress test and $Drop$ is a dummy variable that takes value 1 if the credit line extended by bank b to firm f is downsized. All regressions include bank and credit line controls, and firm fixed effects. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

further restrict access to credit lines in the future.

Next, to address concerns that results could be driven by certain group of banks, we explore if our results are robust to changes in the sample of banks. First, we remove from the sample lines extended by banks with CT1R below 5% under the adverse scenario of the stress test. Recall that on April 8, before results became public, the EBA initially announced as benchmark a CT1R of 5%, see Table A.1. Hence, if results had been predicted, the information on banks who did not reach such benchmark could have been limited. However, on the day when results became public, the EBA also recommended banks above but close to the initial threshold to strengthen their capital positions due to the worsening

Table 9: Effect of the 2011 Stress Test on Usage Rate - Different Samples of Banks

Excluding:	Change in Drawn to Granted (June-July)				
	Banks with CT1R<5%	Banks with CT1R<5% & CT1R>7%	IPS merged banks	Banks that received public funds	Top 2 banks
	(1)	(2)	(3)	(4)	(5)
Inadequately Capitalized	0.014***	0.020*	0.036*	0.056**	0.015***
	(0.004)	(0.010)	(0.020)	(0.020)	(0.004)
Controls	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Observations	82,780	41,975	75,023	64,878	56,677
R-squared	0.5531	0.5840	0.5602	0.5703	0.5689
Within R-squared	0.1990	0.2036	0.2075	0.2099	0.2067

This table reports the difference-in-difference regression estimates for analyzing the effect of the 2011 stress test on credit line usage. As part of our robustness checks, we exclude credit lines extended by certain banks. First, we exclude lines extended by banks whose CT1R fell below 5% under the adverse scenario of the stress test. Second, we only maintain in the sample lines extended by banks whose CT1R fell between 5% and 7% under the adverse scenario of the stress test. Third, we exclude lines that were the result of an Institutional Protection Scheme (IPS). Fourth, we exclude lines extended by banks that received government support. Fifth, we exclude lines granted by the two largest Spanish banks. The dependent variable is the change between June and July in the drawn funds by firm f from bank b over the granted funds on June to firm f by bank b. $Inadequately\ Capitalized$ is a dummy variable that takes value 1 if a bank had a CT1R below 6% in the adverse scenario of the stress test. All regressions include bank and credit line controls, and firm fixed effects. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

economic situation in 2011. Thus, the informational shock could have affected more such banks. Second, we keep lines extended by banks whose CT1R under the adverse scenario of the stress test lied between 5% and 7%, that is, banks near the CT1R threshold of 6% for being considered inadequately capitalized. Third, we exclude credit lines granted by banks that were the result of an Institutional Protection Scheme (IPS).[27] Fourth, we do not include credit lines extended by banks that received government support.[28] Finally, we do not consider credit lines extended by the two largest Spanish banks as they could have been considered *too-big-to-fail*. Such robustness checks are presented in Table 9. As it can

[27]During 2009-2011, many restructuring and integration processes of saving banks were carried out in Spain. One particular merging process was the IPS. From an economic, but not legal, perspective an IPS was equivalent to a merging process and it was promoted by savings banks for their restructuring. The most well known example of a successful IPS is Bankia, in which 7 saving banks were integrated into a single entity.

[28]To enhance the strength and solvency of credit institutions, 12 banking institutions were required to take recapitalization measures on 10 March 2011 by BdE. To cover such shortfall, some of these requested public support from the Fund for Orderly Bank Structuring (FROB), see FROB (2019).

be appreciated, the coefficient of the *Inadequately Capitalized* dummy remains positive and statistically significant across all the different samples, which indicates that our findings remain robust to these exclusions.

As discussed, our identification strategy relies on firms with credit lines with more than one bank. However, it is possible that these type of firms have a behaviour different to that of single-bank firms. In particular, firms with lines from several banks tend to be larger, and they could potentially be better informed or more sophisticated, which could lead them to respond more strongly to the release of stress test results; in that case our results would not be applicable to the whole universe of firms. The robustness of our result to including single-bank firms in the study sample is examined in Table 10. In column (2) we consider the initial sample of multi-bank firms but control for credit demand factors via firm observables plus industry×Province fixed effects, rather than by firm fixed effects[29]. Comparing with column (1) we see that the coefficient of interest remains practically unchanged, indicating that this way of controlling for demand factors is similar to using firm fixed effects. Column (3) adds single-bank firms, while column (4) further increases the sample by dropping firm observables (which are only available for a subset of firms) as controls[30]. In both cases the coefficients remain close to the baseline ones, indicating that our result also applies to firms with a single bank.

Tables (A.5, A.6, A.7) in appendix (A) show that the results are similar using our alternative dependent variable where the change in funds is normalized by the available funds.

[29] We quantify industry at the three digit CNAE level. Together with the 50 provinces of Spain, this leads to 8949 groups, providing a relatively tight set of controls

[30] In this last case, the number of observations is more than double than in the baseline sample.

Table 10: Expanding the sample to include single-bank firms

	June/July 2011, Change in Drawn to Granted			
	Multi-bank Firms	Multi-bank Firms	All Firms	All Firms
	(1)	(2)	(3)	(4)
Inadequately Capitalized	0.012***	0.013**	0.014**	0.013*
	(0.003)	(0.006)	(0.014)	(0.007)
Bank controls	Y	Y	Y	Y
Credit line controls	Y	Y	Y	Y
Firm FE	Y	N	N	N
Firm Observables	N	Y	Y	Y
Industry × province FE	N	Y	Y	Y
Observations	93,010	64,261	139,914	225,433
R-squared	0.547	0.206	0.145	0.120
Within R-squared	0.202	0.130	0.096	0.081

This table contains a set of regressions of the change in drawn funds from credit lines over the period June/July 2011, which includes the announcement date of the stress results (July 15, 2011), on a stress test performance variable, bank credit line and firm controls. Column 1 repeats, for ease of comparison, column (1) of table 4. Column (2) drops firm fixed effects, using firm observables and industry × province fixed effect instead. Column (3) uses the same controls as column (2), but increases the sample to include also firms with credit lines with a single bank. Column (4) further expands the sample by dropping firm observables as controls. *Inadequately Capitalized* is a dummy variable that takes value 1 if a bank was inadequately capitalized according to the 2011 stress test exercise (CT1R < 6%). Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

6. Extensions

6.1. Heterogeneous Effects on Bank & Firm Characteristics

In this section, we investigate whether the effect of the stress results on firms' credit line usage is heterogeneous across bank, credit line, and firm characteristics.

First, we explore whether certain bank characteristics affect the size of precautionary drawdowns. In particular, whether drawdowns on inadequately capitalized banks following the release of the stress results were different depending on bank fundamentals. To this end, we estimate our main specification in (2), but adding interactions between the *Inadequately Capitalized* dummy and bank characteristics, such as the logarithm of assets, liquidity ratio, ROA, Non-performing loan ratio, CT1R, and Commercial Bank dummy. All variables are defined in Table A.2. Panel A in Table 11 shows the results. As it can be appreciated, the coefficient of bank size (measured by the logarithm of bank book assets as of December 2010) is negative and statistically significant, indicating that larger precautionary drawdowns were concentrated on smaller *inadequately capitalized* banks. As pointed out by Ippolito et al. (2016), the result on size is consistent with large banks being less financially constrained. Thus, an easier access to external finance can help such banks to sustain an increase in firms' demand for liquidity, possibly abating their clients' fear of tighter credit conditions. The interaction with CT1R is not significant when added on its own, but negative and statistically significant when added together with the other bank characteristics. This result provides some evidence that precautionary drawdowns were larger on ex-ante less solvent banks. Recall that the 2011 EBA stress test indicated what would a bank's CT1R have been if macroeconomic conditions had significantly deteriorated. Therefore, a bank inadequately capitalized according to the stress test might find it more difficult to access to external funds if additionally has a low CT1R, making it harder to sustain an increase in the demand for drawdowns. These results, however, should be interpreted with caution, given that our sample only includes 12 inadequately capitalized

Table 11: Bank, Credit Line, and Firm Heterogeneity

Panel A: Bank heterogeneity							
	Change in usage rate (June-July)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inadequately Capitalized	0.217**	0.016	0.018***	0.005	0.051*	0.014***	0.719***
	(0.097)	(0.025)	(0.006)	(0.024)	(0.030)	(0.004)	(0.225)
× Log(Assets)	-0.011**						-0.033***
	(0.005)						(0.010)
× Liquidity ratio		-0.042					0.601
		(0.219)					(0.356)
× ROA			-2.802				-6.524
			(2.312)				(4.180)
× Non-performing loan ratio				0.153			-0.393
				(0.536)			(0.368)
× CT1R					-0.561		-1.696***
					(0.425)		(0.537)
× Commercial Bank Dummy						-0.010	0.047
						(0.013)	(0.028)
Controls	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Observations	93,010	93,010	93,010	93,010	93,010	93,010	93,010
R-squared	0.5469	0.5468	0.5468	0.5468	0.5469	0.5468	0.5473
Within *R*-squared	0.2017	0.2015	0.2016	0.2015	0.2016	0.2016	0.2025
Panel B: Credit line heterogeneity							
	Change in usage rate (June-July)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inadequately Capitalized	0.012***	0.029***	0.012***	0.017**	0.002	0.005	0.021**
	(0.004)	(0.008)	(0.003)	(0.007)	(0.005)	(0.005)	(0.010)
× Collateralized	-0.004						-0.013
	(0.014)						(0.013)
× Short term maturity		-0.020**					-0.019*
		(0.010)					(0.010)
× Past due			-0.016				-0.016
			(0.039)				(0.039)
× Share of credit line				-0.016			-0.017
				(0.015)			(0.014)
× Initial usage rate					0.019***		0.018**
					(0.007)		(0.006)
× $\mathbb{1}$(Granted ≥ P_{50})						0.013***	0.011**
						(0.004)	(0.004)
Controls	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Observations	93,010	93,010	93,010	93,010	93,010	93,010	93,010
R-squared	0.5468	0.5469	0.5468	0.5468	0.5469	0.5469	0.5472
Within *R*-squared	0.2015	0.2017	0.2015	0.2016	0.2017	0.2018	0.2022
Panel C: Firm heterogeneity							
	Change in usage rate (June-July)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Inadequately Capitalized	0.010**	0.0054	0.0115**	0.0145***	0.0113**	0.0104**	0.013*
	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)	(0.004)	(0.007)
× $\mathbb{1}$(Assets≥ P_{50})		0.007					0.009
		(0.005)					(0.005)
× $\mathbb{1}$(Liquidity ratio≥ P_{50})			-0.003				-0.002
			(0.006)				(0.006)
× $\mathbb{1}$(Capital ratio≥ P_{50})				-0.010*			-0.011**
				(0.005)			(0.004)
× $\mathbb{1}$(ROA≥ P_{50})					-0.002		-0.002
					(0.006)		(0.005)
× Past-due in the system						-0.005	-0.010
						(0.013)	(0.012)
Controls	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Observations	64,261	64,261	64,261	64,261	64,261	64,261	64,261
R-squared	0.5471	0.5471	0.5471	0.5472	0.5471	0.5471	0.5472
Within *R*-squared	0.2060	0.2061	0.2060	0.2061	0.2060	0.2060	0.2063

This table reports the difference-in-difference regression estimates for analyzing the effect of the 2011 stress test on credit line usage. The dependent variable is the change between June and July in the drawn funds by firm f from bank b over the granted funds on June to firm f by bank b. *Inadequately Capitalized* is a dummy variable that takes value 1 if a bank had a CT1R below 6% in the adverse scenario of the stress test. Regressions include interactions between *Inadequately Capitalized* and bank, credit line, and firm characteristics in Panel A, B, and C, respectively. The last column in each panel includes all interactions. All variables are defined in Table A.2. All regressions include bank and credit line controls, and firm fixed effects. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

banks according to the stress test.

Next, we analyze whether drawdowns on lines extended by inadequately capitalized banks are affected by certain contractual terms of the credit lines. To do so, we add to our main specification in (2) an interaction term of *Inadequately Capitalized* with each credit line characteristic. A positive and significant coefficient on this term points that larger precautionary drawdowns are observed on credit lines that share such characteristic. The results are shown in Panel B of Table 11. In particular, higher precautionary drawdowns are observed on credit lines with high initial usage rate, large granted amount and long maturity. Table 4 already indicated that lines with higher initial usage rate were more affected by runs. In this regard, Jiménez et al. (2009) find that, as a firm's financial condition worsens, its credit line usage increases. Thus, considering that firms with high initial usage rate might face, on average, a worsening of their financial conditions, this group may especially worry about losing access to their credit lines, since banks can withhold funds due to an increase in their risk profile. Hence, a positive sign of the interaction of *Inadequately Capitalized* with *Initial Usage Rate* is expected. With regards to size, as large credit lines can expose fragile banks to higher liquidity risk, firms with such lines extended by an inadequately capitalized bank may precautionarily draw down more from them in anticipation to potential downsizings of these lines. Finally, it is important to remark that, if a credit line is close to expiring, any drawdown has to be paid back to the bank before its maturity. Hence, a precautionary drawdown on a nearly expired credit line will be of little use for a firm because funds have to be almost immediately returned to the bank, which is consistent with the negative sign of the interaction term between *Inadequately Capitalized* and *Short Term Maturity*.

Last but not least, we focus on whether larger precautionary drawdowns are observed for certain type of firms. In order to carry out this analysis, we merge our main dataset with the Spanish Mercantile Register. This allows us to add firm balance-sheet information into our data, tough the sample of credit lines becomes smaller as not all firms can be

matched. The first column of Panel C in Table 11 shows the regression results for our main specification using this sample. We also find evidence of precautionary drawdowns after the release of the stress results for the sample of firms with balance-sheet information, tough the effect becomes slightly smaller (1% rather than 1.2%). To perform our analysis of heterogeneous effects across firms characteristics, we create a set of dummies using firm balance-sheet variables. In particular, each dummy variable takes value one if the firm is above the median for assets, liquidity ratio, capital ratio and ROA. In columns (2)-(6) of Panel C in Table 11, we add to the specification in column (1) the interaction of *Inadequately Capitalized* with one of the previous firm dummy variables, whereas all interactions are added in column (7). As it can be appreciated, more leveraged firms (book capital ratio below the median) were more prone to create larger precautionary drawdowns as these firms may find it harder to comply with financial covenants. This finding is consistent with the fact that one of the most common financial covenants have to do with leverage restrictions, see Acharya et al. (2020).

6.2. Heterogeneous Effects Based on Financial Covenants

Financial covenants in credit line contracts permit banks to restrict usage of credit lines. Acharya et al. (2020) find, for their sample of U.S. stock exchange listed firms, that the most common financial covenants are related with leverage restrictions, interest coverage limitations, and capitalization and collateral requirements. Hence, high leveraged firms may find it harder to draw down funds from their credit lines; whereas low leveraged firms can easily dispose funds available at their lines, as they are more likely to comply with financial covenants.

To capture the effect of complying with financial covenants, we employ firm balance sheet data to construct a capital ratio and an interest coverage ratio. The capital ratio is computed as the ratio of book equity to book assets, and we expect that firms with low capital ratios will face higher restrictions to use their credit lines. The interest coverage

ratio is measured as the ratio of net interest payments over revenues, and we expect that firms which use a larger fraction of revenues to pay debt will find it more difficult to access their credit lines. For each of our measures, we divide equally our sample of firms in three different groups. Firms that belong to the first, second, and third tercile of the distribution of firms' capital ratio (coverage ratio) are labeled as having low, medium, and high capital (interest burden), respectively. Regarding their response to the release of the stress test results, we would expect larger response from firms with medium ratios. High leverage firms may be unable to react as banks might have restricted access to credit lines to these firms by not waiving a covenant violation. On the other extreme, low leveraged firms will tend to not react either, since they are not worried about losing access to liquidity, as banks would not be able to withhold funds to these firms. However, medium leverage firms are more likely to react to the results if they fear failing to comply with a financial covenant in the near future and, consequently, losing access to their credit lines. Those are, however, only rough expectations, as we lack data on the precise covenants each credit line is subjected to.

Table 12 presents the regression results for our main specification in Table 4, but interacting the stress test variable with our proxies for firms' compliance with financial covenants. Columns (1) and (3) show the results for the categories based on the leverage ratio. If the capital ratio is below some threshold specified by the lender, the firm will presumably not be in compliance with a financial covenant. The results points out that firms with high capital ratios (low leverage) did not react to disclosure of the stress test results, which is consistent with the fact that their banks cannot contractually restrict access to their lines as no financial covenant is violated. However, less capitalized (more leveraged) firms reacted more to the information disclosed by stress tests. This can be explained, as discussed above, by the fact that banks could withhold funds by not waiving a covenant violation; hence, fearful of losing access to liquidity, firms may decide to draw down funds due to precaution. In this case, we do not find that more leveraged firms

were unable to respond due to covenant violations. Columns (2) and (4) show the results based on the coverage ratio. Particularly, if a larger fraction of the revenue is used to pay debt, it is more likely that the lender will deny funds from the credit line due to a covenant violation. We find that firms with low interest burden did not draw more funds from poorly performing banks. Only firms with medium or high interest burdens reacted to the release of the stress test results, which is in line with the hypothesis that those firms are more at risk of losing access to funding due to covenant violations.

6.3. Banks' Credit Line Risk Management During the Crisis

In this section, we explore credit line risk management by banks around the date, July 15, when stress test results became public. Specifically, whether credit lines granted by inadequately capitalized banks were more likely to be downsized. To do so, we estimate a linear probability model, in which we regress a dummy that takes value 1 if bank b downsized the credit line extended to firm f within a quarter on *Inadequately Capitalized*, bank and credit line characteristics, and firm fixed effects. It is important to remark that, differently from before, we carry out this analysis quarterly rather than monthly, because, as we pointed out before, contractual terms of credit lines remain largely fixed within a short period of time.

The results are presented in Table 13. As it can be appreciated, credit lines extended by inadequately capitalized banks were 4.1pp and 2.3pp more likely to be downsized during the second and third quarter of 2011, respectively. Thus, firms' fears of losing access to funds on their credit lines during the European debt crisis were justified. As opposed to firms, banks knew their financial condition before the announcement of the results. As a consequence, the results suggest that, even before results were known, more affected banks managed their exposure to credit lines by restricting access to them. Such findings are consistent with the literature that shows that stress tested banks reduce lending (Acharya et al., 2018; Gropp et al., 2018; Berrospide and Edge, 2019; Cortés et al., 2020). Also, it is

Table 12: Heterogeneous Effects Based on Covenants

	Change in Drawn to Granted		Change in Drawn to Available	
	(1)	(2)	(3)	(4)
Inadequately Capitalized				
× low capitalized	0.013**		0.195***	
	(0.005)		(0.064)	
× medium capitalized	0.010**		0.031	
	(0.005)		(0.053)	
× high capitalized	0.007		0.029	
	(0.005)		(0.056)	
× low interest burden		0.006		0.046
		(0.005)		(0.061)
× medium interest burden		0.017***		0.102*
		(0.005)		(0.054)
× high interest burden		0.006		0.104*
		(0.006)		(0.060)
Controls	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Observations	64,873	64,873	63,325	63,325
R-squared	0.5479	0.5479	0.4498	0.4497
Within R-squared	0.2054	0.2053	0.0607	0.0605

This table reports the difference-in-difference regression estimates for analyzing the effect of the 2011 stress test on credit line usage. In column (1) and (2), the dependent variable is the change between June and July in the drawn funds by firm f from bank b over the granted funds on June to firm f by bank b; whereas, in column (3) and (4), the dependent variable is the change in drawn funds between June and July over available funds on June. $Inadequately\ Capitalized$ is a dummy variable that takes value 1 if a bank had a CT1R below 6% in the adverse scenario of the stress test. Regressions include interactions between $Inadequately\ Capitalized$ and categories based on proxies of firms' compliance with financial covenants. On the one hand, low, medium, and high capitalized firms correspond to the first, second, and third tercile of the distribution of firms' book capital-to-book assets. On the other hand, low, medium, and high interest burden firms correspond to the first, second, and third tercile of the distribution of firms' net interest payment-to-revenues. All variables are defined in Table A.2. In columns (3) and (4) lines with an initial usage rate larger than 99% have been dropped, in order to prevent extremely negative values of the dependent variable. All regressions include bank and credit line controls, and firm fixed effects. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 13: Banks' Credit Line Risk Management

	Downsized Dummy	
	2Q-2011	3Q-2011
	(1)	(2)
Inadequately Capitalized	0.0406**	0.0230*
	(0.0169)	(0.0126)
Controls	Y	Y
Firm FE	Y	Y
Observations	101,866	101,376
R-squared	0.4426	0.4394
Within R-squared	0.0368	0.0361

This table reports a linear probability model regression of the probability that a credit line is downsized, as a function of the stress test performance variable, bank and credit line controls, and firm fixed effects. The dependent variable is a dummy that takes value 1 if bank b downsizes the credit line extended to firm f during the quarter. The first column covers the second quarter of 2011, that is, prior to the announcement of the results; whereas, the second column considers the third quarter of 2011, after results became public. The Inadequately Capitalized dummy takes value 1 if the bank's CT1R under the adverse scenario of the stress test is below 6%. All control variables are defined in Table A.2. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

important to remark that such response of banks during the second quarter of 2011, before the announcement of the results, may have limited the size of precautionary drawdowns. This would imply that our results are a lower bound of the effect that could be expected after the release of truly unexpected negative news about banks.

7. Conclusions and Policy Implications

Credit lines are fundamental instruments for firm financing and banks' business model. The flexible nature of these instruments, whereby firms can borrow funds at will (up to a predetermined amount), expose banks to potential credit line runs. In this paper, we provide evidence that banks can be subjected to extraordinary credit line drawdowns when information questioning their solvency is released, that is, information-driven credit line runs can occur. Using loan-level data from the Spanish Credit Registry and the release of the results of the 2011 EBA EU-wide stress test, we show that, after controlling for demand factors via firm fixed effects, firms drew down on average 1.2 pp more of their credit lines

granted by banks that were inadequately capitalized according to the stress test following the release of the stress results. The increase climbs to 9.5 pp when normalizing by the unused part of the credit line. Additionally, we find that these extraordinary drawdowns reverted in September, confirming that they were of precautionary nature, that is, driven by concern on banks' prospects rather than genuine immediate liquidity needs. Lastly, we also show that precautionary drawdowns were concentrated on smaller and ex-ante less solvent banks, credit lines with long residual maturity, high usage rate, large in size, and that already experienced a downsizing, as well as on more leveraged firms. All of these findings are consistent with precautionary drawdowns being driven by firms' fear that more vulnerable banks may tighten their lending standards.

These findings contribute to the literature on credit line runs and bear important implications for the calibration of liquidity and capital requirements of credit lines, particularly from a macroprudential perspective. Precautionary credit line drawdowns might be more likely in crisis situations where lost credit access is harder to substitute. Given that credit line runs can take place when a bank is perceived to be under solvency stress, the unused part of credit lines might need to be subjected to higher capital requirements. Currently, the unused part of a credit line is subjected to a 10% capital requirement in the standardized approach of credit risk. Our results indicate that if information becomes public about a bank being under capital stress, the bank could expect to see an additional 9.5 pp of its unused credit lines drawn. This would come on top of increases in usage due to other reasons, which suggests that the current 10% requirement could be low.

Our results also add to the literature studying the financial effects of the public release of stress test results. The evidence in this paper indicates that there are costs associated to that publication, in the form of possible credit line runs for weaker banks. However, the publication of stress test results also provides very valuable information to all market participants, reducing uncertainty and improving market functioning, which might prevent more general bank runs. Furthermore, stress test disclosures can act as a disci-

plining device that provides ex-ante incentives for prudent risk management by banks. By contributing to a better understanding of the cost-benefit trade-offs associated to this policy tool, this article can help to improve the planning and execution of stress tests. In particular, supervisors should communicate carefully results for weaker banks and consider the announcement of complementary measures that address their weaknesses at the time of publication of the stress tests, which in some cases might entail more supervisory flexibility. The study also suggests that regulators may consider ex-ante stricter liquidity and capital requirements on unused credit lines as a way to ameliorate the possibility of runs in these products when negative financial news emerge for some banks.

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A. Additional tables

Table A.1: Key Dates of the 2011 EBA EU-Wide Stress Test

Date	Events
Jan. 13, 2011	The stress test exercise was announced by the EBA.
Mar. 2, 2011	An overview and timeline of the exercise were provided.
Mar. 18, 2011	Stress test scenarios (baseline and adverse) and methodology were published.
Apr. 8, 2011	The sample of participating banks was announced. A Core Tier 1 capital ratio (CT1R) of 5% was chosen as benchmark.
Jul. 15, 2011	Results became public at the end of the day. EBA recommended that banks with CT1R between 5%-6% should also strengthen their capital position.
May 2, 2012	A report on the fulfilment of the EBA's recommendation was published.

Table A.2: Definitions of All Variables Used in the Estimations

	Description	Source
Bank-Firm Variables		
Change in usage rate	Monthly change in the drawn-to-granted ratio of a credit line granted by bank b to firm f	Credit Register
Past-due	Dummy variable equal to 1 if firm f has past due loans with bank b	Credit Register
Collateralized	The fraction of the granted amount of the credit line that is collateralized	Credit Register
Short Maturity	The fraction of the granted amount of the credit line that expires within a year	Credit Register
Share of credit line	Share of the granted amount of the credit line with bank b out of the total amount granted to firm f via credit lines	Credit Register
Initial usage rate	Drawn-to-granted ratio of credit line granted by bank b to firm f	Credit Register
Granted	Total committed funds (drawn plus undrawn) extended by bank b to firm f	Credit Register
Firm Variables		
Assets	Total assets of firm f	Mercantile Register
ROA	Ratio of profits over total assets of firm f	Mercantile Register
Liquidity ratio	Ratio of cash over total assets of firm f	Mercantile Register
Capital ratio	Ratio of own funds over total assets of firm f	Mercantile Register
Past-due in the system	Dummy variable equal to 1 if firm f had past due loans with any bank	Credit Register
Bank Variables		
Inadequately Capitalized	Dummy variable equal to 1 if bank b had a CT1R below 6% in the adverse scenario of the 2011 EBA stress test.	EBA
CT1R	Core Tier 1 capital (equity and retained profits) to risk weighted assets of bank b.	EBA
Log(Assets)	The log of the total assets of bank b.	Supervisory Reports
ROA	The total net income over assets of bank b.	Supervisory Reports
Liquidity ratio	The ratio of liquid assets (cash and balance with central banks, and loans and advances to governments and credit institutions) held by bank b over its total assets.	Supervisory Reports
Non-performing loan ratio	The doubtful loan ratio of bank b.	Supervisory Reports
Commercial Bank Dummy	A dummy variable, which equals 1 if bank b is a commercial bank and equals zero otherwise.	Supervisory Reports

Table A.3: Placebo Tests

	Change in Drawn to Available ($\Delta Used_{f,b,t+1}/Available f,b,t$)						
	2010	2011					
	Jun-Jul (1)	Mar-Apr (2)	Apr-May (3)	May-Jun (4)	Jun-Jul (5)	Jul-Aug (6)	Aug-Sep (7)
Inadequately Capitalized	0.017	0.023	0.100**	-0.026	0.095**	0.048	-0.116*
	(0.029)	(0.029)	(0.040)	(0.054)	(0.044)	(0.056)	(0.059)
Controls	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y
Observations	105,566	95,197	91,454	90,618	90,375	89,866	86,132
R-squared							
Within R-squared	0.0564	0.0519	0.0556	0.0575	0.0591	0.0497	0.0579

This table replicates column 3 of Table 4 on data from months before and after the announcement of the stress results. Specifically, we regress the monthly change in used over available for month $t+1$ on the $Inadequately\ Capitalized$ dummy, bank controls (computed as of December 2010), credit line controls (computed with information available at month t), and firm fixed effects. As reference, the column associated with June-July coincides with the information in column 3 of Table 4. In order to avoid extreme negative values of the dependent variable, credit lines whose initial usage is above 99% have been dropped. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A.4: Reversal in Precautionary Drawdowns

	Change in Drawn to Available ($\Delta Used_{f,b,t+1}/Available_{f,b,t}$)		
	Jun-Jul (1)	Jul-Aug (2)	Aug-Sep (3)
Inadequately Capitalized	0.095**	0.1392**	-0.024
	(0.044)	(0.052)	(0.060)
Inadequately Capitalized × Run		-0.318***	-0.186***
		(0.052)	(0.041)
Controls	Y	Y	Y
Firm FE	Y	Y	Y
Observations	90,375	89,866	86,132
R-squared	0.446	0.433	0.444
Within R-squared	0.059	0.051	0.058

This table contains the regression results for the monthly change in credit line usage on the $Inadequately\ Capitalized$ dummy, a dummy variable Run that identifies firms that incurred in precautionary drawdowns, their interaction, bank and credit line controls, and firm fixed effects for July-August and August-September. For comparison, the first column replicates the results of our main specification, see column 3 in Table 4. Run is a dummy variable that takes value 1 if the firm's average change in credit line usage with inadequately capitalized banks is strictly positive and larger than the average change with adequately capitalized banks in July (column (2)), or July or August (column (3)). In order to avoid extreme negative values of the dependent variable, credit lines whose initial usage is above 99% have been dropped. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table A.5: Effect of the 2011 Stress Test on Usage Rate - Including Lines whose Granted Diminished

	Change in Drawn to Available (June-July)							
	|Δ%Granted| ≤							
	0 %	40%		80%		100%		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inadequately Capitalized	0.95**	0.106**	0.084*	0.132**	0.128**	0.156***	0.162***	0.128**
	(0.044)	(0.046)	(0.048)	(0.053)	(0.053)	(0.053)	(0.052)	(0.052)
Inadequately Capitalized			0.21		0.11		0.047	0.279*
× Drop			(0.13)		(0.14)		(0.158)	(0.156)
Inadequately Capitalized								-2.78***
× Drop × |ΔGranted|/Granted								(0.97)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	90,375	102,204	102,204	104,017	104,017	104,509	104,509	104,509
R-squared	0.446	0.4373	0.4376	0.4305	0.4325	0.4258	0.429	0.4496
Within R-squared	0.0591	0.0610	0.0614	0.0619	0.0652	0.0612	0.0664	0.1002

This table reports the difference-in-difference regression estimates for analyzing the effect of the 2011 stress test on credit line usage. As part of our robustness checks, we add lines whose granted amount decreased between June and July 2011. Column (1) replicates, for comparison, our main results, which only include credit lines whose granted amount remained fixed between June and July 2011, see Table 4. In columns (2)-(3), we add lines whose granted amount decreased by less than 40%. Additionally, in columns (4)-(5), we add lines whose granted amount decreased by less than 80%. Finally, columns (6)-(8) include any loan commitment independently of whether the granted amount decreased or not. The dependent variable is the change between June and July in the drawn funds by firm f from bank b over the granted funds on June to firm f by bank b. $Inadequately\ Capitalized$ is a dummy variable that takes value 1 if a bank had a CT1R below 6% in the adverse scenario of the stress test and $Drop$ is a dummy variable that takes value 1 if the credit line extended by bank b to firm f is downsized. All regressions include bank and credit line controls, and firm fixed effects. In order to avoid extreme negative values of the dependent variable, lines with an initial usage rate larger than 99% have been dropped. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

B. Computation of Cumulative Abnormal Returns

In this section, it is explained how cumulative abnormal returns (CAR) are computed to obtain the results for the estimation regression model in Table 2. The methodology follows Petrella and Resti (2013). Price information is obtained from Bloomberg for 46 European banks with stock price information that participated in the 2011 EBA EU-wide stress test.

Let t^* be the event date, that is, the next trading day after the stress results became public (Monday July 18th, 2011).[31] First, we estimate a one-factor model (CAPM) using the 200-trading day window ranging from $t^* - 210$ to $t^* - 11$. Specifically, we estimate the

[31]Note that the stress results were released on Friday July 15th after markets had closed.

Table A.6: Effect of the 2011 Stress Test on Usage Rate - Different Samples of Banks

Excluding:	Change in Drawn to Available (June-July) ($\Delta Used_{f,b,jul}/Available_{f,b,jun}$)				
	Banks with CT1R<5%	Banks with CT1R<5% & CT1R>7%	IPS merged banks	Banks that received public funds	Top 2 banks
	(1)	(2)	(3)	(4)	(5)
Inadequately Capitalized	0.120***	0.062	0.21*	0.27**	0.129**
	(0.042)	(0.166)	(0.12)	(0.12)	(0.055)
Controls	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y
Observations	80,316	40,757	72,927	63,008	56,677
R-squared	0.45	0.48	0.46	0.47	0.47
Within R-squared	0.059	0.061	0.062	0.064	0.060

This table reports the difference-in-difference regression estimates for analyzing the effect of the 2011 stress test on credit line usage. As part of our robustness checks, we exclude credit lines extended by certain banks. First, we exclude lines extended by banks whose CT1R fell below 5% under the adverse scenario of the stress test. Second, we only maintain in the sample lines extended by banks whose CT1R fell between 5% and 7% under the adverse scenario of the stress test. Third, we exclude lines that were the result of an Institutional Protection Scheme (IPS). Fourth, we exclude lines extended by banks that received government support. Fifth, we exclude lines granted by the two largest Spanish banks. The dependent variable is the change between June and July in the drawn funds by firm f from bank b over the available funds on June to firm f by bank b. $Inadequately\ Capitalized$ is a dummy variable that takes value 1 if a bank had a CT1R below 6% in the adverse scenario of the stress test. All regressions include bank and credit line controls, and firm fixed effects. In order to avoid extreme negative values of the dependent variable, lines with usage rate in rate larger than 99% have been excluded. Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

following model

$$R_{j,t} = \alpha_j + \beta_j R^M_{c(j),t} + \varepsilon_{j,t}, \tag{3}$$

where $R_{j,t}$ is the logarithmic return of security j at time t, α_j is the average CAPM pricing error for security j, and $R^M_{c(j),t}$ is the return of a country-specific stock market index. For instance, in the case of Spanish banks, we use the IBEX-35.

Next, we compute abnormal returns ($AR_{j,t}$) as the difference between the actual stock return and the expected stock return generated by the model estimated in equation (3).

Finally, cumulative abnormal returns (CAR_j) are computed as the sum of $AR_{j,t}$ over an interval. For instance, in column (2) of Table 2, we compute CAR_j for each bank as the sum of $AR_{j,t}$ between July 18 and 20, that is, a 3-day interval that includes the event date.

Table A.7: Expanding the sample to include single-bank firms

	June/July 2011, Change in Drawn to Available			
	Multi-bank Firms	Multi-bank Firms	All Firms	All Firms
	(1)	(2)	(3)	(4)
Inadequately Capitalized	0.095**	0.098**	0.093***	0.089***
	(0.044)	(0.038)	(0.020)	(0.018)
Bank controls	Y	Y	Y	Y
Credit line controls	Y	Y	Y	Y
Firm FE	Y	N	N	N
Firm Observables	N	Y	Y	Y
Industry × province FE	N	Y	Y	Y
Observations	90,375	63,072	137,997	221,940
R-squared	0.446	0.141	0.097	0.076
Within R-squared	0.059	0.054	0.047	0.042

This table contains a set of regressions of the change in drawn funds from credit lines over the period June/July 2011, which includes the announcement date of the stress results (July 15, 2011), on a stress test performance variable, bank, credit line and firm controls. Column 1 repeats, for ease of comparison, column (3) of table 4. Column (2) drops firm fixed effects, using firm observables and industry × province fixed effect instead. Column (3) uses the same controls as column (2), but increases the sample to include also firms with credit lines with a single bank. Column (4) further expands the sample by dropping firm observables as controls. In all cases, credit lines with a usage rate larger than 99% in June are excluded, to avoid extreme negative values of the dependent variable. $Inadequately\ Capitalized$ is a dummy variable that takes value 1 if a bank was inadequately capitalized according to the 2011 stress test exercise (CT1R < 6%). Standard errors are double clustered at the bank and firm levels and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.