International bank credit, nonbank lenders and corporate debt structure

April 2021

Abstract

We study the propagation of a shock to bank credit supply on firms' access to credit lines and term loans, using a cross-country firm-bank dataset. For identification, we examine how firms' debt structure evolves after an unexpected increase in bank capital requirements by the European Banking Authority (EBA), which did not affect firms' demand for finance. Our results suggest that the EU firms maintain a smooth access to bank credit, while their US counterparts experience constraints in accessing bank credit lines. Yet, US firms are able to secure credit lines from nonbank financial institutions with implications for their capital structure and their real decisions. These results suggest that diversified domestic loan markets, in which banks and nonbank financial institutions lend to corporations, can help overcome cuts in cross-border bank funding.

Key words: Corporate credit; credit lines; financial constraints; nonbank lenders

JEL: G32, E22, F32

1 Introduction

The recent financial crisis, as well as previous crises, have highlighted that disruptions in credit markets have large consequences on economic activity (see for a detailed review Gueller, Mariathasan, Mullier and Okatan, 2021). Switching to alternative sources of funding when bank lending is impaired may not be easy. Although bonds and loans co-exist (Bensanko and Kanatas, 1993; Diamond, 1991), only a subset of high-quality firms manages to switch to bonds after banking crises (Goel and Zemel, 2018). Similarly, Fernández, González and Suárez (2018) find that nonbank credit only partially substitutes for bank loans in bank-dependent firms after the onset of the global financial crisis, with some variation across different countries. Motivated by these considerations, we exploit an intervention by the European Banking Authority (EBA) in 2011 to ask the following questions: Do firms maintain uninterrupted access to term loans and credit lines when their creditors adjust to comply to a minimum capital requirement? Can firms find alternative sources of finance when bank credit conditions tighten? What is the impact of a liquidity shock on firms' capital structure and their real decisions?

In this paper, we shed light on the above questions by investigating the effect of an unexpected increase in bank capital requirements on firms' access to term loans and credit lines, using a cross-country sample of bank-dependent public firms. In doing so, we examine whether firms experience constraints in securing loans from banks hit by a capital requirements increase. In addition, we investigate the role played by nonbank financial institutions and the differential outcomes for credit lines and term loans. Specifically, we analyze if bank retrenchment effectively constrains firms' access to credit, or whether they can overcome cuts in borrowing by issuing corporate bonds or securing loans from nonbank financial institutions. Finally, we investigate the real effects of the introduction of the regulatory change, paying attention to corporates' liquidity and investment policies.

For identification we use an unexpected increase in bank capital requirements that affected only (a subset of) European Union (EU) banks, which allows us to isolate a supply shock to bank credit, independent on contemporaneous changes in firms' demand for finance. Specifically, we use deal-level (syndicated loan and bond) data to enhance the corporate debt structure, including the composition of bank creditors. Using firm-bank matched data for 2005-2014 we exploit the October 2011 EBA announcement, which increased the minimum Core Tier 1 ratio to 9% by the end of 2011 and to 10% by the end of 2012, triggered international deleveraging among EU banks.[1] The increase, which we call, "the EBA capital exercise", was sizable, and left unaffected some EU, and all non-EU banks.[2] Importantly, the EBA capital requirements were set on a consolidated basis, so the affected banks could opt to shy away from their domestic or international corporate customers. In particular for US firms, credit from EU banks was an important source of funding. Specifically, EU banks accounted for 15% of the outstanding (syndicated) loans to US firms.

We carry out a difference-in-differences analysis to estimate how this regulatory change affected firms' corporate debt structure. Our data span a pre-policy (2010Q2–2011Q2) and a post-policy period (2012Q3–2013Q3). On this basis, we identify the exogenous effect of a reduction in bank lending on corporate debt structure. We define two groups: treated firms with half of the European bank loans coming from EBA-affected banks, and the control group, comprising the rest of firms with outstanding loans from European banks. Therefore, we exploit that not all firms are affected in the same way, and the identification comes from cross-sectional differences in firms' exposures to EBA-affected banks. Our

[1] Throughout the paper we mention that the requirement is imposed on EU banks, although it also affect banks in the European Economic Association (EEA), which includes the EU countries plus Iceland, Liechtenstein, and Norway.

[2] This explains its appeal as an opportunity for analyzing domestic credit flows (Gropp, Mosk, Ongena and Wix, 2019), or banks' decisions to grant collateralized rather than uncollateralized loans (Degryse, Karapetyan and Karmakar, 2020).

identification assumption is that the EBA capital exercise did not affect treated firms' demand for financing, relative to the control group.

To conduct the analysis, we construct a cross-country panel of bank-dependent firms, defined as those with at least one outstanding loan at the onset of the EBA capital exercise. We further narrow the sample removing firms that do not have an outstanding loan vis-à-vis European banks. This way we further make our treated and control group similar. Additionally, we select firms that disclose financial information, that is public firms and other large private companies. We end up with a sample of 2,830 firms, of which 1,117 are incorporated in the EU, 1,415 in the US, and 215 in other advanced economies. Hence, the final sample is very well suited to exploring a reduction in international bank credit, triggered by the tightening of bank capital requirements in the EU.

We summarize our main results, which are robust to several tests, as follows. Our baseline findings suggest that treated firms decrease their bank borrowing, relative to the control group. However, only US firms experienced constraints in access to loans from EU banks, and EU firms' bank borrowing remains resilient. The resilience of bank borrowing by EU firms reflects the sample selection used in the paper, which focuses on large firms.[3] The above finding sets the stage for the main analysis which proceeds as follows. First, we inspect the constraints in bank borrowing by US firms and find that they concentrate in credit lines: US treated firms experience a decrease in bank credit lines relative to the control group. However, US treated firms do not display any signs of constraints in accessing term loans, which experience a similar increase relative to control firms. Second, we find that US treated firms raise their nonbank credit lines, relative to the control group.

[3]Previous research shows that EU banks cut back credit to small and medium-size enterprises (SMEs) in Europe (see for example Acharya, Eisert, Eufinger and Hirsch, 2018; Balduzzi, Brancati and Schiantarelli, 2018; Bentolila, Jansen, Jiménez and Ruano, 2018; Dwenger, Fossen and Simmler, 2020; Farinha, Spaliara and Tsoukas, 2019). SMEs tend to carry the highest risk weights in internal ratings-based approach that banks use for lending purposes.

Furthermore, we find that firms also experience a small but quantitatively less important increase in bond borrowing, while term loans provided by nonbanks do not grow. Taken together, our main conclusion is that US firms are able to smooth the contraction in bank credit lines by resorting to nonbank financial intermediaries.

Our study further documents that the US firms hit by the cut in EU bank lending and switching to nonbank loans modify their capital structures: the bank borrowing to total assets share decreases, while the share of credit from nonbank financial intermediaries rises. In addition, we find that changes in firms' financial mix have real effects by showing an increase in firms' assets growth and investment.

Our paper makes two main contributions to the literature. First, we add to the literature investigating how shocks to bank lending impact on corporate financial decisions. Becker and Ivashina (2014) show that bond issuance increases relative to bank financing when lending standards tighten. Goel and Zemel (2018) document financial frictions, and show that only high-quality firms switch to bonds when bank credit supply stalls. Fernández et al. (2018) show that nonbank private debt can partially substitute the contraction in bank credit, in particular in countries with strong creditor rights. We go beyond these studies and analyze separately the evolution of bank term loans and credit lines (including undrawn commitments), and show that a significant share of the contraction in international bank lending relates to credit lines rather than term loans offering new insights. In addition, we underscore the ability of nonbank financial institutions to cushion a reduction in international bank lending, showing that they compensate the dry up of bank credit lines.

Second, we offer new evidence on the ability of financial institutions to provide liquidity insurance to corporates. Previous research shows that deposit-taking institutions are well-suited to provide liquidity insurance to corporates, since deposit flows and credit line

drawdowns typically move in opposite directions (Kashyap, Rajan and Stein, 2002). Our analysis finds evidence that nonbank financial institutions also provide liquidity insurance to corporates and smooth the decrease in bank credit line origination. Hence, the analysis finds evidence that institutions that do not take deposits but other sight liabilities can successfully extend credit lines.

The remainder of the paper is structured as follows. Section 2 describes the data and presents summary statistics. Section 3 discusses institutional aspects concerning corporate borrowing and develops testable hypotheses. Section 4 describes our methodology. Section 5 presents the main empirical results. Section 6 provides robustness checks, and section 7 concludes.

2 Data

2.1 Data description

We construct a firm-level quarterly panel for the period 2009Q3 to 2014Q1 by combining two data sources. We first obtain firms' financial statements from Capital IQ, including balance sheets, cash flow statements, income statements, key financial ratios, and reference data (sector, country of incorporation, etc). To enhance the capital structures that companies disclose in their financial statements, we retrieve information about 223,211 bonds and 229,608 syndicated loans by non-financial firms from Refinitiv SDC Platinum. In the syndicated loan data, we include both term loans and (potentially undrawn) credit lines. We exclude bridge loans, as they may expire before their original maturity date. To classify loans as term loans or credit lines, we use the description of the tranche facility provided by Refinitiv. Term loans include term financing for project finance or capital expenditures. Credit lines are all revolving line facilities, receivables, trade finance instruments (letters of

credit), and liquidity lines. When the tranche simultaneously provides term financing and a credit line (around 1% of the observations), we split them pro-rata. We use the bond and syndicated loan data to generate firm-level credit stocks. Specifically, we produce three measures of outstanding debt: (1) bonds (2) loans by banks and (3) loans by nonbank financial intermediaries (nonbanks).

We analyze borrowers (firms) and lenders (banks and nonbanks) on a consolidated basis, so an international loan is one in which the (ultimate) parent of the borrower and the lender are located in different countries. The reason why we consolidate all loans at the ultimate parent of the lender is that the EBA capital requirements were set on a consolidated basis.[4] Additionally we consolidate all loans and bonds at the ultimate parent of borrower to avoid biases as firms may borrow through SPVs incorporated overseas (Avdjiev, McCauley and Shin, 2016).[5]

Throughout the analysis we focus on the lead arranger, as they are in charge of monitoring borrowers and attracting investors (Sufi, 2007). When a loan has several lead arrangers, we treat each as a different lender. We classify lead arrangers as banks or nonbanks according to their funding structure, following the post-crisis definition of the shadow banking system (Pozsar, Adrian, Ashcraft and Boesky, 2012; FSB, 2011a,b)). Consequently, banks are deposit-taking institutions and other lenders relying on stable funding (eg saving banks). Nonbanks include the rest of the lenders, the majority of which are investment banks (security-broker dealers).[6] To implement this classification, we use the NAICS and the TRBC system. Banks are those under NAICS code 5221, as are other banks that are not investment banks in the TRBC.[7]

[4] Additionally, many bank affiliates are subject to individual capital requirements.

[5] We do not observe loans or bonds issued by independent affiliates, ie listed firms.

[6] The group of nonbank lenders includes financial institutions subject to bank-like capital requirements but that do not take deposits. See Claessens, Pozsar, Ratnovski and Singh (2012) for a discussion.

[7] NAICS stands for the North American Industry Classification Scheme, which superseded the SIC in 1987. The NAICS maps the UN International Standard Industrial Classification of All Economic Activities

We construct the list of creditors of each firm derived from syndicated loans, defined as those lenders with an outstanding loan to a firm. To assess if a loan is outstanding, we use issuance and maturity date. This measure of firm-bank dependency is therefore bilateral and time-varying. Using such list of creditors of each firm in each quarter, we impose three filters to define a homogeneous sample of bank-dependent firms. First, we define a firm as bank-dependent if it has an outstanding loan vis-á-vis a lead arranger banks. Second, we keep companies that have at least one outstanding loan vis-á-vis lead bank headquartered in the EU. This controls for potential assortative matching between firms and banks. This may be particularly important for non-EU firms, as those not borrowing from EBA banks may be very different –perhaps having a more regional focus. Third, we select only listed companies, or those that already disclose financial information.

We merge the firm-level measures of credit stocks with the accounting data from Capital IQ using firms' ISINs and LEIs, which uniquely identify them in both. Following normal selection criteria used in the literature, we control for the potential influence of outliers by excluding observations in the 1% upper and lower tails of the distribution of the regression variables. Our final sample includes 2,830 firms, of which 1,177 are based in the EEA, 1,415 are based in the US, and 215 are based in other developed economies.

2.2 Sample analysis

In Table 1 we report descriptive statistics for the whole sample (Panel A), for firms heavily dependent on EBA banks (ie affected by the capital exercise) as of 2011Q3 (Panel B), and for the rest of firms dependent on European banks (control group).[8] The average firm in our sample has a leverage ratio of 30.3% with a median of 28.2%. In addition, the firms

(ISIC). TRBC stands for the Thomson Reuters Business Classification, which is a market-based system classifying firms into 10 economic sectors, 136 industries, and 837 activities. Appendix C provides further details on the sectoral classification of financial intermediaries.

[8] In Appendix A, we define all variables and provide the relevant data sources.

in our sample have relatively many tangible assets, with mean tangible assets of 34.6% and median tangible assets of 28.2%. At the foot of the table we report p-values for the tests of equality of medians for the two groups in panels B and C. We observe that with the exception of assets, treated and control firms are similar across a number of financial indicators. These statistics help us inspect residual differences between the two groups.

Figure 1 gives a preliminary glimpse at the role of term loans and credit lines in corporate activity as they serve different purposes. Term loans fund specific business needs (eg capital expenditures) while the latter are facilities that help firms to smooth liquidity shocks. Both are equally important, as underscored by the fact that each typically represents around half of the syndicated loans originations.

We show the relative importance of credit lines and term loans raised by firms in Figure 2. Examining the expected use of proceeds at origination, we observe they differ in their purpose. Term loans are arranged for specific uses (eg to finance capital expenditures, as shown in Figure 2), while credit lines allow firms to secure liquidity and exploit business opportunities as they arise (Lins, Servaes and Tufano, 2010). This is reflected in the lack of detail in the intended use of credit lines at origination; often they are raised for "general corporate purposes."

3 Institutional background and hypotheses

3.1 Firms' financial choices

Understanding basic institutional aspects of corporate borrowing is important to explore the role domestic credit markets may play in international bank lending. A key insight is that large firms raise debt from three major sources: bond markets, bank lenders, and nonbank lenders.

Bond issuance is an important source of external finance, but it may not attenuate an adverse shock to bank credit for two reasons. The first, which is well known, is that loan markets better satisfy the funding needs of companies that are smaller, more opaque, or riskier (Faulkender and Petersen, 2006; Blackwell and Kidwell, 1988; Diamond, 1991; Chemmanur and Fulghieri, 1994; Cantillo and Wright, 2000). This reflects, respectively, that loans have lower flotation costs than bonds (eg no need to register a security), loan markets better address informational asymmetries between borrowers and lenders, and loan markets better handle liquidation and renegotiation in case of distress. Bond markets are appealing to large and public firms, as they can help raise large amounts of funds.[9] Consequently, switching from loans to bonds when bank credit is interrupted is difficult for many companies, including large ones and public ones (Goel and Zemel, 2018), especially if they lack previous market experience (Hale and Santos, 2008).

The second reason, often neglected, is that a significant fraction of bank loans are not term financing, but are credit line commitments, also known as revolving loans. Firms typically secure credit lines as a liquidity insurance, which eventually allows them to exploit potential business opportunities as they arise (Lins et al., 2010). Credit lines do not imply an effective disbursement at origination. Providing credit lines has been one of the traditional functions of banks, as these have an advantage in smoothing liquidity demand on the asset side via credit lines–and on the liability side via sight deposits (Kashyap et al., 2002). Bond markets, on the other hand, provide term financing and therefore are not a good alternative to credit lines.

In summary, these aspects suggest that bond markets may not fully smooth a cut in bank credit when it dries up. Nonbanks may be a viable alternative, in particular as are

[9] An additional appealing characteristic of the bond market is that they give more financial flexibility to make investment decisions, which implies that creditors do not actively monitor how companies use the proceeds during the length of the debt contract (Rajan, 1992).

major providers of credit lines. Figure 3 shows the fraction of loans granted to non-US corporates (Panel A) and US corporates (Panel B), split by type of instrument and lender into four categories: bank term loans, bank credit lines, nonbank term loans, and nonbank credit lines. We observe that for US corporate borrowing, nonbanks provide around 20% of all credit lines. Thus, they may be in a good position to attenuate a bank funding shock.

3.2 The EBA capital exercise

The EBA capital exercise in October 2011 was aimed at restoring confidence in the EU banking sector by ensuring that banks were adequately capitalized to mitigate unexpected losses. The focus was primarily on banks' exposure to sovereigns. Specifically, the EBA decision required 61 banks to raise their Core Tier 1 capital ratio to 9% by June 2012. This exercise occurred in the backdrop of adverse developments in European capital markets following the sovereign debt crisis.

The capital exercise banks were selected to build additional capital buffers based on total assets, while leaving requirements unchanged for all other banks. In each country, the EBA sorted banks in descending order of their market share by total assets, such that the exercise covered at least 50% of the national banking sector. The EBA capital exercise was unexpectedly announced soon after the stress tests conducted in July 2011 (Mésonnier and Monks, 2015; Gropp et al., 2019; Degryse et al., 2020).

The appealing characteristic of this quasi-natural policy experiment is that there are cross-sectional differences in the degree of firms' exposure to EBA-affected banks. That is, some European bank-dependent firms have not borrowed significantly from EBA banks. Consequently, we can test whether firms that heavily depend on banks subject to the EBA requirements (treatment group) experienced a change in their liabilities relative to those lightly exposed and with some borrowing from European banks (control group). We

assume that the EBA capital exercise did not impair the demand for finance of the treated (EBA–dependent firms), relative to the control group. We exploit a policy shift that only affected (a subset of) EU banks that had outstanding loans vis-á-vis some US firms.

3.3 Hypotheses

We start by exploring the impact of an increase in bank capital requirements on access to bank credit of EU and non-EU firms. A large and growing body of literature shows that banking shocks are transmitted internationally (Giannetti and Laeven, 2012; Cetorelli and Goldberg, 2011; De Haas and Van Horen, 2012, 2013). In addition, research using firm-bank data on SMEs argues that this can impact on their access to bank credit (Popov and Udell, 2012; Ongena, Peydro and Horen, 2015). This expectation is enhanced by some features of the EBA capital exercise, which we use to identify the shock to the supply of international bank credit. Specifically, the initiative aimed at ensuring that bank adjustments did not contract the flow of lending to the EU's real economy" (EBA, 2011). Motivated by these considerations, we expect the EBA capital exercise to affect more heavily firms incorporated outside the EU than their EU counterparts.

Second we explore the channel through which the increase in bank capital requirements can negatively impact on corporates' access to bank credit. Specifically, we investigate whether banks cut credit lines, term loans, or both. Two aspects may condition their choice, and pull the final outcome in different directions. For one, term loans imply an effective disbursement, whereas credit lines constitute contingent liquidity. However, credit lines are more illiquid, because unlike term loans they cannot be sold in the secondary market after origination. Therefore, credit lines expose banks to stronger pipeline risks (Bord and Santos, 2012). Whether banks prefer to cut term loans or credit lines remains an empirical issue, but some aspects suggest that capital constrained banks may be reluctant to extend

credit lines. Indeed, credit line usage can sharply increase after adverse economic shocks (Greenwald, Krainer and Paul, 2012), putting significant pressure on banks' capital ratios.

Third, our expectation is that certain nonbank financial intermediaries can provide credit lines if banks cut them. Specifically, investment banks borrow in wholesale funding markets, so they are heavily exposed to liquidity risks on the liability side. This reliance on short-term funding makes them similar to deposit-taking institutions and enables them to provide credit lines (Kashyap et al., 2002). In contrast, bond markets are unlikely to smooth a cut in bank credit if it concentrates in credit lines, as they provide term financing and not contingent liquidity.

4 Empirical strategy

4.1 Identification issues

Our empirical model examines how firms' liabilities change around the EBA capital exercise. To identify the effects of a policy shift, we need to analyze a supply shock to bank credit which is uncorrelated to firms' demand for finance. Tackling this issue is challenging because many shocks to bank credit are large enough to impair the overall demand for credit. For example, the cut in lending triggered by the Great Financial Crisis (GFC) impaired economic activity and depressed the corporate demand for finance. These shocks can also affect the relative demand for specific sources of credit. After the GFC, bank funding costs rose, so corporates' demand for bank credit decreased relative to market-based finance; and the spike in economic uncertainty could have pushed the demand for credit lines up, relative to term loans.

To address these issues, we use the exogenous increase in capital requirements by the EBA in 2011Q3, and we test whether firms that depend on banks subject to the EBA

requirements experience a change in lending composition relative to those firms which had borrowed from European, but had light exposures. Figure 4 shows the time–line of our differences-in-differences analysis, based on the timing of the EBA capital exercise.

Additionally, we recognize that corporate bond markets in the majority of jurisdictions are characterized by small size and liquidity (CGFS, 2019; BIS, 2016; Bhatia, Mitra, Weber, Aiyar, de Almeida, Cuervo, Santos and Gudmundsson, 2019). In these jurisdictions the lack of substitution from bank loans toward bonds may just signal that markets lack depth and not that corporate bond markets cannot per se smooth cuts in bank credit. To identify the role of corporate bond markets, we focus the analysis on US firms, as they have access to a deep and liquid bond market. Finally, to mitigate endogeneity concerns further, we include all firm variables at their levels before the bank EBA capital exercise.

4.2 Baseline model

We estimate our regressions using a difference-in-difference method to identify how bank capital requirements affect corporate debt structure. Formally, we estimate the following equation:

$$F_{ijt}^{X} = \alpha_i + \beta_1 Treated_i + \beta_2 Post_t + \beta_3 Treated_i * Post_t + \beta_4 Controls_{it} + \varepsilon_{ijt} \quad (1)$$

where F_{it}^{X} denotes the stock of liabilities of type X for firm i in country j at quarter t. α_i is a vector capturing firm-specific intercepts, and ε_{ijt} is the disturbance term. In line with Gropp et al. (2019), we measure a firm's i dependence on credit supply from EBA–affected banks prior to the capital exercise using the share of outstanding loans vis-à-vis EBA banks:

$$Share_i^{EBA} = \frac{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EBA}}{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EU}} \tag{2}$$

where $Share_i^{EBA}$ is a firm-specific and time-invariant metric that takes higher values for firms heavily dependent on EBA–affected banks. We use it to define the treatment variable $Treated_i$, which is a binary variable that equals 1 if half of the firm's $Share_i^{EBA}$ is above 50%, and 0 otherwise. By using this approach, we seek to include in the treatment group firms with high dependence on EBA affected banks. The control group is made up of firms with below-average dependence on credit supply from EBA-affected banks, which also depend on EU banks.[10] Our interest lies in the interaction between $Treated$*$Post$, which shows the relative evolution of bank credit between treated and control firms around the EBA capital exercise. Obtaining a negative coefficient β_3 in the subsample of US firms would support the hypothesis that bank credit contracts when foreign bank creditors need to deleverage. To ease interpretation of the results, we standardize the dependent variable with its average value in 2010Q2. Consequently, the coefficient β_3 measures the percentage change experienced by the stock of liabilities of type X among treated firms, relative to the control group, after the EBA capital exercise.

We date the EBA announcement in 2011Q3, because we use quarterly data and the decision was taken in October 2011. We define a pre-EBA capital exercise period that includes the four quarters before the announcement (2010Q2-2011Q2). The exercise ended in 2012Q2. Hence, $Post_t$ equals 1 for observations in the post-capital exercise period (2012Q2-2013Q2), and 0 in the pre-capital exercise. To prevent problems related to serial correlation we cluster standard errors at the firm level, and we collapse the average of all quarterly observations in the pre-treatment period and do the same for the treatment

[10] In this benchmark measure, the denominator does not include credit from non-EU banks. In robustness tests we show that the results are robust to alternative definitions, although by construction lowers the dependency on EBA banks.

period (Bertrand, Duflo and Mullainathan, 2004).[11]

It is important to remember that our identification comes from comparing the stocks of firm liabilities and not stocks of bank claims. Consequently, our only assumption is that the relative demand for bank credit among firms exposed to EBA-affected banks, and for the control group, did not change around the EBA capital exercise. Under this assumption, any change in the growth of bank credit reflects the impact of the EBA capital exercise. Furthermore, we include firm-fixed effects, which effectively remove time-invariant unobserved heterogeneity impact on the demand for finance (including the sector of incorporation) between treated and control firms. The country and industry-specific differences are absorbed by the more granular firm-fixed effects.

The effect of the EBA capital exercise, β_3, is well identified under one assumption, namely that the measures of firms' liabilities we use as dependent variable (eg, bank credit) exhibit a common trend across treated and control firms. The patterns observed pre-EBA capital exercise are reassuring: in all instances, the evolution is similar for treated and control firms, as we graphically depict in the results section. Furthermore, economic reasoning suggests that the assumption is sensible, as firms typically satisfy their financing needs by increasing borrowing at the extensive margin. Rapid changes from loan to bond markets are unlikely, as these decisions reflect companies' life-cycle (Berger and Udell, 1998). Furthermore, firms have limited incentives to stop borrowing from a lender, as longer lending relationships lower their funding costs (Berger and Udell, 1995; Elyasiani and Goldberg, 2004).

Last, we include additional controls that influence firms' choices of external financing: firm size (total assets), and ratio of tangible to total assets. These are the two dimensions in which treated and control firms differ, according to the summary statistics in Table 1.

[11] We experimented with models that incorporate time fixed effects and absorb the term *Post*. The results, which are reported in the online appendix, remain both qualitatively and quantitatively the same.

Size accounts for the fact that larger firms typically have better access to external financing as they are less likely to be financially constrained (Mizen and Tsoukas, 2014; Almeida, Cunha, Ferreira and Restrepo, 2017; Bose, McDonald and Tsoukas, 2019). In addition, we include the ratio of tangible assets to total assets, which proxies for firms' ability to pledge collateral for external financing.

4.3 Channels of deleveraging

To quantify the extent to which banks delevarage via different channels, we focus exclusively on US firms, adapting equation 1 and removing the subscript country j accordingly:

$$F_{it}^{X} = \alpha_i + \beta_1 Treated_i + \beta_2 Post_t + \beta_3 Treated_i * Post_t + \beta_4 Controls_{it} + \varepsilon_{it} \qquad (3)$$

where the dependent variable is in turn the stock of bank term loans (F_{it}^{B-T}) and credit lines F_{it}^{B-CL}. A negative coefficient β_3 for $Treated$*$Post$ in the regressions signals that a particular type of bank claim contracts. For example, if we find that β_3 is negative when using bank credit lines as the dependent variable, this indicates that banks cut credit lines overseas when they need to deleverage. Once again, we analyze stocks of firm liabilities and not changes in banks' claims. Consequently, the identification assumption is that treated firms do not alter their demand for bank term loans (or credit lines), relative to the control group, around the EBA capital exercise.

4.4 Implications for financial choices

To identify a potential switch across financing choices, we estimate equation 1 using as dependent variables four stocks of credit, F_{it}^{X}: nonbank credit, F_{it}^{NB}; bonds, F_{it}^{Bonds}; nonbank

term loans, F_{it}^{NB-T}; and nonbank credit lines, F_{it}^{NB-CL}.[12]

A positive coefficient for β_3 in $Treated*Post$ in the relevant regression signals that this type of financial claim expands. Here the identification assumption is that the demand for the type of financial claim (eg bonds) among the treated does not change around the EBA capital exercise, relative to the control group. Under this assumption, any change in the use of the specific instrument reflects the impact of the EBA capital exercise.

Finally, given that firms are likely to alter their financial mix, we set out to investigate how the EBA capital exercise affects firms' capital structure. We do so by estimating 1 using the following dependent variables: bank credit to total assets; bank term loans to total assets; bank credit lines to total assets; bonds to total assets; nonbank term loans to total assets and nonbank credit lines to total assets.

4.5 Real effects

Our final objective is to examine the response of firms' cash accumulation, assets and investment to red changes in the creditor structure, as the EBA exercise is expected to encourage the uptake on nonbank credit. To test for real effects, we estimate the following empirical model:

$$F_{it}^{X} = \alpha_i + \beta_1 Increase_{NBCL} + \beta_2 Post_t + \beta_3 Increase_{NBCL} * Post_t + \beta_4 Controls_{it} + \varepsilon_{it} \quad (4)$$

where the dependent variable is cash accumulation, assets or tangible assets. $Increase_{NBCL}$ is a binary variable that equals 1 for firms dependent on EBA exposed banks and whose volume of nonbank credit lines to total assets accelerates in the period post capital exercise (2012-2013), and 0 otherwise. The main variable of interest is the interaction term

[12] Nonbank credit is the sum of bonds, nonbank term loans, and nonbank credit lines.

$Increase_{NBCL} * Post$, which captures the impact of post-exercise access to nonbank credit lines on firms' outcomes for the treated group. The effect of the uptake of nonbank credit lines on the activities of firms previously dependent on EBA banks is *ex ante* uncertain. The reason is that most of the nonbanks providing credit lines are investment banks, which rely on wholesale short-term funding. Since nonbanks can raise this short-term funding more quickly than banks, access to nonbank credit lines could support firms' investment and growth, and leave their cash holdings unchanged. Yet, if corporates perceive that wholesale liabilities are more fickle than bank deposits, they may be reluctant to invest, and hoard cash.[13]

5 Results

5.1 Firms' access to bank credit and bank capital requirements

Our baseline question relates to whether firms suffer a cut in bank credit when their foreign creditors struggle to deleverage. Figure 5 provides a visual inspection of the evolution of bank credit by EU (Panel A) and US firms (Panel B) around the EBA capital exercise.[14] The blue line represents the stock of bank credit for firms highly dependent on EBA banks (treated group), while the red line represents the rest of the firms (control group). The stock of bank credit is indexed at 100 in 2011Q2, and the two dashed vertical lines in each panel mark 2011Q2 and 2012Q2, which are, respectively, the quarters immediately before and after the capital exercise. Three patterns emerge. First, treated and control firms exhibit a common trend before the capital exercise, as bank credit experiences a general increase. Second, EU treated and control firms also exhibit a common trend post-

[13] Along these lines, banks with larger deposits and lower levels of short-term debt are less able to cope with large credit line drawdowns (Cornett, McNutt, Strahan and Tehranian, 2011; Ivashina and Scharfstein, 2010).

[14] Specifically, it plots its evolution four quarters before its beginning, in 2011Q2, and after its end in 2012Q2.

capital exercise, as bank borrowing decreases for both groups, probably reflecting the lower demand for credit. Consistent with our hypothesis, bank borrowing by US firms changes after the EBA capital exercise: it shrinks for firms dependent on EBA banks, and keeps on increasing for the rest. This suggests that US firms face credit constrains in accessing lending from EU banks.

To explore the earlier question formally, we begin by estimating models of credit supply for firms with different exposures to EBA-affected banks. Table 2 shows the results from the estimation of equation 1. Our key variable of interest is the interaction between the firm-level $Treated$ dummy and the time dummy $Post$ ($Treated$*$Post$). Controlling for firm characteristics, industry differences, and country differences, we find a negative but insignificant coefficient for the whole sample in column 1. When we split our sample between EU and US firms, the results underscore significant differences. Specifically, bank credit to EU firms remains resilient (column 2). While bank credit to US firms increases ($Post$ is positive) signaling an increase in their demand for funds, there is a decoupling between the treated and the control group. The coefficient of $Treated$*$Post$ is indeed negative, underscoring that US treated firms faced credit constrains in borrowing from EU banks (column 3).

The negative effect on bank credit to US firms is not only statistically significant, but also it is economically important. Specifically, the policy change leads to a 18% reduction in bank borrowing for US firms dependent on EBA-affected banks, relative to the control group. To give a sense of its importance, this totally offsets the growth in bank borrowing experienced by US firms after the EBA capital exercise, which is given by the coefficient of $Post$.

This finding supports earlier research showing that the deleveraging of the financial sector through the reinforcement of the banks' capital positions is likely to reduce bank

lending (Brun, Fraisse and Thesmar, 2017; Jiménez, Ongena, Peydro and Saurina, 2017; Gropp et al., 2019). In addition, given that we rely on a sample made up by large corporates, our results highlight the banks cut credit to US firms, and shield domestic corporates (Peek and Rosengren, 1997; Cetorelli and Goldberg, 2011; De Haas and Van Horen, 2012; Popov and Udell, 2012). However, we base our analysis on a novel policy shift. Therefore, consistent with our expectations and findings from prior studies, negative policy shocks adversely affect firms' uptake of bank credit.

5.2 The impact of EBA exercise on term loans and credit lines

Having identified a link between the EBA capital exercise and bank credit, our aim is to understand whether the constraints in access to bank credit by US firms occurs through cuts to credit lines or term loans. We begin by providing graphical evidence on the evolution of different types of finance. In Figure 6 we visually inspect the evolution of the stock of bank term loans (panel A) and bank credit lines (panel B). The Figure supports the common pre-trend assumption of bank credit lines and term loans, as the dynamics of treated and control firms are similar before the EBA capital exercise, exhibiting a gradual increase. After the EBA capital exercise, the stock of bank credit lines among treated firms decreases, but control firms experience an increase. In contrast, post-EBA the capital exercise dynamics of bank term loans are more similar for treated and control firms, although the growth of term loans among treated firms seems smoother. All together, banks' deleveraging after the EBA capital exercise concentrates on credit lines, and there are no signs of credit constrains to access term loans.

In our formal analysis, we estimate equation 3 and report the results in Table 3. For reference, column 1 shows the results when we consider all types of loans (already reported in column 3 of Table 2), while columns 2 and 3 report bank term loans and credit lines,

respectively. When we use bank term loans as a dependent variable (column 2), the interaction term is not statistically significant, which suggests that the evolution of bank term loans for EBA-dependent firms (the treated) and the control group do not differ. In contrast, treated firms experience a contraction in bank credit lines, as the coefficient of the interaction term is negative and statistically significant (column 3). The effect is economically important: after the EBA capital exercise, treated firms witness a reduction of 18% in credit lines, relative to the control group.

In summary, our results so far suggest that firms associated with banks that were exposed to the EBA capital exercise experience a decline in credit lines. This new result complements earlier work and highlights the role of international lending shocks in affecting firms' financing mix.

5.3 Credit substitution: bonds and nonbank loans

We now consider whether bond markets or nonbank lenders can smooth the reduction in international bank credit that US firms experience. Figure 6 plots the evolution of total credit (panel A), which is the sum of bank and nonbank credit plus a breakdown into its three components: bonds (panel B), nonbank term loans (panel C), and nonbank credit lines (panel D). The blue and red lines stand for the stock of credit for the treated and control groups, respectively. The Figure supports the common pre-trend assumption (in the four panels both lines increase), signalling that treated and control firms experience a similar growth in total credit, as well as in the three components of nonbank credit. Post-EBA capital exercise, the pattern of total credit is also very similar for treated and control firms. We do not observe notable changes in bond borrowing (panel B), although treated firms seem to increase it slightly relative to control firms. We do not see any differences in borrowing from nonbank term loans (panel C). In the three cases, the red and the blue lines

increase to a similar extent, which signals that the post-EBA capital exercise evolution is similar for treated and control firms.[15] We show nonbank credit lines in panel D, which exhibit a different pattern: post-EBA capital exercise, treated firms significantly increase their reliance on nonbank credit lines. As the blue line increases, the red line (representing control firms) remains relatively flat.

We estimate equation 3 for total credit and the three components of nonbank credit. Table 4 presents the estimates of various types of nonbank credit. In the first column, we report point estimates using total credit as a dependent variable, and in the subsequent columns, we rely on bonds, nonbank term loans and nonbank credit lines. Firms heavily dependent on EBA-affected banks do not seem to face a reduction in total credit as the insignificant coefficient for the interaction term $Treated^{*}Post$ in column 1 shows. This finding underscores that treated firms increase their nonbank borrowing, when they experience a cut in their bank credit lines (highlighted in column 3 of Table 3).

Moving to column 2, we find that treated firms marginally increase their bond borrowing. This is evident from the coefficient of the interaction term, which is positive and statistically significant (an increase of 11%, relative to control firms).[16] There is no notable difference in nonbank term loans, as the coefficient in column 3 is statistically insignificant. The main change occurs in treated firms' reliance on nonbank credit lines, shown in column 4. The interaction term is negative and highly significant. Furthermore, the economic impact is large, as the increase in nonbank credit line borrowing relative to control firms is 64%. The main conclusion is that, after experiencing a cut in bank credit, firms increase their reliance on nonbank credit lines.

We also explore if the substitution is broad or restricted to firms with previous access

[15] There are some differences, however, in the reliance that treated and control firms have on nonbank term loans, which is higher for control firms.

[16] This result is however feeble, as it does not hold in the robustness checks conducted in Section 6.

to these sources. We hypothesize that the latter occurs, as a lack of previous experience prevents firms from accessing the bond market (Hale and Santos, 2008). Similarly, the evidence suggests that a lack of previous lending relationships limits access to credit lines (Berger and Udell, 1995). Empirically, we analyze the evolution of bonds, nonbank term loans, and nonbank credit lines for two subsets of firms: those with previous access to each source of financing (the intensive margin, Panel A in Table 5), and those with no prior market experience (the extensive margin, Panel B in Table 5). We find that firms with previous experience increase their borrowing, relative to the control group. Specifically, borrowing through credit lines from nonbanks increases by 80% relative to the control group. The rise in bond borrowing is 10%. Panel B shows that treated companies without previous bond market access (column 1) or nonbank borrowing (columns 2 and 3), are not able to improve their borrowing relative to the control group. The main message is that the growth in nonbank credit lines we identify for treated firms, relative to control firms, holds for firms that could tap public markets in the past.

Having identified a credit substitution, we examine whether firms' capital structure changes as a result of bank deleveraging pressures, and nonbank financial intermediaries gain prominence relative to banks. To address this issue, we modify our dependent variables and construct ratios of debt liabilities to total assets.[17] We present the results in table 6. In Panel A we find that treated US firms reduce the proportion of bank credit lines to total assets. To ascertain the magnitude, we find that the introduction of the capital exercise led to a decline in bank loans relative to total debt by 12 percentage points. Further, in column 3 of Panel B we show that after the EBA capital exercise firms increase the credit lines from nonbank financial intermediaries as a proportion of their total debt. The effect is economically meaningful because after the policy, nonbank debt rises by 23 percentage

[17] We winsorize the variables at 1% and 90% because the ratios are bounded at zero and are highly non-normal.

points.

5.4 Real effects

After documenting the impact of the capital exercise on firms' financial choices, we investigate whether this has implications for firms' cash holdings, assets and investment. We estimate equation 4 and illustrate the results in Table 7. The first column shows the impact on cash accumulation, while columns 2 and 3 report the findings for assets and investment (respectively, logarithm of assets and net property, plant and equipment). Firms borrowing from banks affected by the capital exercise and experiencing an increase in nonbank credit lines appear not to alter their cash holdings, but raise their assets and investment. The results indicate a statistically significant, though economically small, increase in assets and investments. Overall, we interpret these findings as evidence that firms do not perceive nonbanks' funding structure as less stable. Quite the opposite, these facilities help them to cushion the shock, growing faster than other firms dependent on EBA banks, and without increasing their cash holdings.

6 Robustness checks

6.1 EBA dependency

In our main results, we define treated firms as those that have more than half of their outstanding loans from European banks vis-à-vis EBA-affected banks. To ensure that the results are not driven by the way we split our sample, we use a continuous variable ($Share_i^{EBA}$) to indicate treatment.[18] The modified equation we estimate is the following:

[18] This variable is firm specific and time invariant, so it is absorbed by the firm fixed effects.

$$F_{it}^{X} = \alpha_i + \beta_1 Share_i^{EBA} + \beta_2 Post_t + \beta_3 Share_i^{EBA} * Post_t + \beta_4 Controls_{it} + \varepsilon_{it} \quad (5)$$

Table 8 shows the results. Panel A reports the analysis when we use total bank credit, bank term loans, and credit lines as dependent variables (columns 1, 2, and 3, respectively). The results are broadly consistent with the ones we obtain using the categorical variable, and they indicate that the contraction in bank credit concentrates in credit lines. In Panel B we summarize the main findings of the impact of firms' reliance on nonbank credit. Column 1 reports the impact on bond financing, and columns 2 and 3 nonbank term loans and credit lines. The results confirm the main analysis. Relative to control firms, treated firms increase their borrowing from nonbank credit lines. There are no notable differences in terms of bond financing, or nonbank term loans. In sum, our results are robust to an alternative definition of the treated group.

6.2 Timing: the European debt crisis

One potential concern about the EBA capital exercise is that the contraction of bank credit (and subsequent expansion of nonbank loans) for EBA-dependent firms may reflect the impact of the European debt crisis on banks' lending policies. To better isolate how bank capital requirements related to sovereign-debt problems affect the flow of credit, we create a new measure of EBA dependency that excludes loans from Greece, Ireland, Italy, Portugal and Spain (GIIPS) banks. The rationale stems from the fact that the sovereign debt crisis most affected banks in the periphery of Europe, which experienced deleveraging pressures during the first half of 2011 (Farinha et al., 2019) . Thus, we create a new measure of EBA dependency that excludes loans from GIIPS banks, $Share_i^{EBA-Ex}$:

$$Share_i^{EBA-Ex} = \frac{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EBA-Ex}}{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EU}} \quad (6)$$

$Share_i^{EBA-Ex}$ takes higher values for firms exposed to banks in non-GIIPS countries. We estimate the following equation:

$$F_{it}^X = \alpha_i + \beta_1 Share_i^{EBA-Ex} + \beta_2 Post_t + \beta_3 Share_i^{EBA-Ex} * Post_t + \beta_4 Controls_{it} + \varepsilon_{it} \quad (7)$$

We rerun all the regressions using the new measure of EBA dependency, which excludes the above-mentioned loans. We report the results in Table 9. We find that our main results hold, and we conclude that the contraction in bank credit, as well as the increase in nonbank loans, reflects how bank capital requirements affect the flow of credit rather than the impact of the European debt crisis.

6.3 Unrated firms

Next we confirm that our findings are not driven by differences in ratings between treated and control firms. This can be one potential concern, as the risk-weight of corporate loans depends on the borrower's rating.[19]

We recover Standard and Poor's and Moody's credit ratings in 2013Q11. Our sample includes firms of different rating categories, but the group of unrated firms is the only one large enough to run a subsample estimation. The number of cross-sectional units decreases substantially, and the sample includes only 475 firms.

The results, reported in Table 10, remain largely unchanged, as we find a decrease in borrowing for treated firms relative to the control group. This is underscored by the

[19] Specifically, the risk-weights by rating are: AAA to AA-, 20%; A+ to A-, 50%; BBB+ to BB-, 100%; below BB-, 150%; and unrated firms, 100%.

negative and statistically significant interaction term *Post*Treated* in column 3 of Panel A, which reflects a 22% decrease. We also find that treated firms increase their borrowing through nonbank credit lines relative to the control group. In column 3 of Panel B, the interaction term is positive and statistically significant, and it signals a strong increase of 42%. We conclude that our main findings hold when we use a sample of unrated firms.

6.4 Other tests

We carry out two additional tests. First, we run the models without the firm-level attributes (total assets and the tangible assets ratio), as their inclusion reduces the number of firms covered due to missing values. This test allows us to analyze the full set of cross-sectional units. Second, we estimate the models with time fixed effects to control for business cycle effects. The results for both tests, which are shown in the appendix for the sake of brevity, confirm our conclusions.

7 Conclusion

Using a cross-country sample of bank-dependent public firms from several advanced economies, we study how firms' funding mix is affected when foreign banks are hit by a liquidity shock. In doing so we distinguish between the two major sources of bank loans: term loans, and credit lines. For identification we examine how firms' liabilities vis-à-vis banks, nonbank lenders, and bond markets evolve after the EBA increased capital requirements on a consolidated level in 2011.

We find that the EBA capital exercise triggered a change in US firms' composition of corporate debt, while European firms were left unaffected. Yet, when we distinguish among different types of credit, we find that the constraints concerned only US firms' borrowing of credit lines. In contrast, access to term loans by US firms remained resilient.

Finally, we show that US firms were able to smooth the shock by securing credit lines from US investment banks, and did not increase their borrowing from corporate bond markets. This had an impact on firms' capital structure and their real decisions. Our results suggest that nonbank financial institutions smooth shocks in bank financing. The general lesson is that a diversified loan market may be key to achieving a robust structure for corporate financing.

References

Acharya, V., Eisert, T., Eufinger, C. and Hirsch, C.: 2018, Real effects of the sovereign debt crisis in Europe: Evidence from syndicated loans, *Review of Financial Studies* **31**, 2855–2896.

Almeida, H., Cunha, I., Ferreira, M. and Restrepo, F.: 2017, The real effects of credit ratings: The sovereign ceiling channel, *Journal of Finance* **72**, 249–290.

Avdjiev, S., McCauley, R. N. and Shin, H. S.: 2016, Breaking free of the triple coincidence in international finance, *Economic Policy* **31**, 409–451.

Balduzzi, P., Brancati, E. and Schiantarelli, F.: 2018, Financial markets, banks' cost of funding, and firms' decisions: Lessons from two crises, *Journal of Financial Intermediation* **36**, 1–15.

Becker, B. and Ivashina, V.: 2014, Cyclicality of credit supply: Firm level evidence, *Journal of Monetary Economics* **62**, 76–93.

Bensanko, D. and Kanatas, G.: 1993, Credit market equilibrium with bank monitoring and moral hazard, *Review of Financial Studies* **6**, 213–232.

Bentolila, S., Jansen, M., Jiménez, G. and Ruano, S.: 2018, When credit dries up: Job losses in the great recession, *Journal of the European Economic Association* **16**, 650–695.

Berger, A. N. and Udell, G. F.: 1995, Relationship lending and lines of credit in small firm finance, *The Journal of Business* **68**, 351–381.

Berger, A. and Udell, G.: 1998, The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle, *Journal of Banking and Finance* **22**, 612–673.

Bertrand, M., Duflo, E. and Mullainathan, S.: 2004, How much should we trust differences–in–differences estimates?, *Quarterly Journal of Economics* **119**, 249–275.

Bhatia, A. V., Mitra, S., Weber, A., Aiyar, S., de Almeida, L. A., Cuervo, C., Santos, A. O. and Gudmundsson, T.: 2019, A capital market union for Europe, *IMF Staff Discussion Note* **SDN 19/07**.

BIS: 2016, A spare tire for capital markets: Fostering corporate bond markets in Asia, *BIS Papers* **85**.

Blackwell, D. and Kidwell, D.: 1988, An investigation of cost differences between public sales and private placements of debt, *Journal of Financial Economics* **22**, 253–278.

Bord, V. M. and Santos, J. A. C.: 2012, The rise of the originate-to-distribute model and the role of banks in financial intermediation, *Economic Policy Review* **18**, 21–34.

Bose, U., McDonald, R. and Tsoukas, S.: 2019, Policy initiatives and firms' access to external finance: Evidence from a panel of emerging Asian economies, *Journal of Corporate Finance* **59**, 162–184.

Brun, M., Fraisse, H. and Thesmar, D.: 2017, The real effects of bank capital requirements, *Working paper number 47, European Systemic Risk Board* .

Cantillo, M. and Wright, J.: 2000, How do firms choose their lenders? An empirical investigation, *Review of Financial Studies* **13**, 155–189.

Cetorelli, N. and Goldberg, L.: 2011, Global banks and international shock transmission: Evidence from the crisis, *IMF Economic Review* **59**, 41–76.

CGFS: 2019, Establishing viable capital markets, *CGFS Papers* **62**.

Chemmanur, T. and Fulghieri, P.: 1994, Reputation, renegotiation, and the choice between bank loans and publicly traded debt, *Review of Financial Studies* **7**, 673–692.

Claessens, S., Pozsar, Z., Ratnovski, L. and Singh, M.: 2012, Shadow banking: Economics and policy, *IMF Staff Discussion Note, 2012 SDN/12/12* .

Cornett, M., McNutt, J., Strahan, P. and Tehranian, H.: 2011, Liquidity risk management and credit supply in the financial crisis, *Journal of Financial Economics* **101**(2), 297–312.

De Haas, R. and Van Horen, N.: 2012, International shock transmission after the Lehman Brothers collapse: Evidence from syndicated lending, *American Economic Review* **102**, 231–237.

De Haas, R. and Van Horen, N.: 2013, Running for the exit? International bank lending during a financial crisis, *Review of Financial Studies* **26**, 244–285.

Degryse, H., Karapetyan, A. and Karmakar, S.: 2020, To ask or not to ask? Collateral versus screening in lending relationships, *forthcoming in Journal of Financial Economics* .

Diamond, D.: 1991, Monitoring and reputation: The choice between bank loans and directly placed debt, *Journal of Political Economy* **99**, 689–721.

Dwenger, N., Fossen, F. and Simmler, M.: 2020, Firms' financial and real responses to credit supply shocks: Evidence from firm-bank relationships in Germany, *Journal of Financial Intermediation* **41**, 100773.

EBA: 2011, EU–wide stress test: Methodological note, *Technical report*.
URL: *http://www.eba.europa.eu/documents/*

Elyasiani, E. and Goldberg, L.: 2004, Relationship lending: a survey of the literature, *Journal of Economics and Business* **56**, 315–330.

Farinha, L., Spaliara, M.-E. and Tsoukas, S.: 2019, Bank shocks and firm performance: New evidence from the sovereign debt crisis, *Journal of Financial Intermediation* **40**, 100818.

Faulkender, M. and Petersen, M.: 2006, Does the source of capital affect capital structure?, *Review of Financial Studies* **19**, 45–79.

Fernández, A., González, F. and Suárez, N.: 2018, Bank supply shocks and the substitution between bank and nonbank debt, *Journal of Corporate Finance* **48**, 122–147.

FSB: 2011a, Shadow banking: Scoping the issues. a background note of the financial stability board, *Technical report*, Financial Stability Board.

FSB: 2011b, Shadow banking: Strengthening oversight and regulation. Recommendations of the financial stability board, *Technical report*, Financial Stability Board.

Giannetti, M. and Laeven, L.: 2012, The flight home effect: Evidence from the syndicated loan market during financial crises, *Journal of Financial Economics* **104**, 23–43.

Goel, M. and Zemel, M.: 2018, Switching to bonds when loans are scarce: Evidence from four U.S. crises, *Journal of Corporate Finance* **52**, 1–27.

Greenwald, D., Krainer, J. and Paul, P.: 2012, The credit line channel, *Working Paper 2020/26*, Federal Reserve Bank of San Francisco.

Gropp, R., Mosk, T., Ongena, S. and Wix, C.: 2019, Bank response to higher capital requirements. Evidence from a quasi-natural experiment, *Review of Financial Studies* **32**, 266–299.

Gueller, T., Mariathasan, M., Mullier, K. and Okatan, N.: 2021, The real effects of banks' corporate credit supply: A literature review, *forthcoming in Economic Inquiry* .

Hale, G. and Santos, J.: 2008, The decision to first enter the public bond market: The role of firm reputation, funding choices, and bank relationships, *Journal of Banking and Finance* **32**, 1928–1940.

Ivashina, V. and Scharfstein, D.: 2010, Bank lending during the financial crisis of 2008, *Journal of Financial Economics* **97**, 319–338.

Jiménez, G., Ongena, S., Peydro, J.-L. and Saurina, J.: 2017, Macroprudential policy, countercyclical bank capital buffers and credit supply: Evidence from the Spanish dynamic provisioning experiments, *Journal of Political Economy* **125**, 2126–2177.

Kashyap, A., Rajan, R. and Stein, J.: 2002, Banks as liquidity providers: An explanation to the coexistence of lending and deposit-taking, *Journal of Finance* **57**, 33–73.

Lins, K., Servaes, H. and Tufano, P.: 2010, What drives corporate liquidity? an international survey of strategic cash and lines of credit, *, Journal of Financial Economics* **98**, 160–176.

Mésonnier, J. and Monks, A.: 2015, Did the EBA capital exercise cause a credit crunch in the Euro area?, *International Journal of Central Banking* **11**, 75–117.

Mizen, P. and Tsoukas, S.: 2014, What promotes greater use of the corporate bond market? A study of the issuance behaviour of firms in Asia, *Oxford Economic Papers* **66**, 227–253.

Ongena, S., Peydro, J. L. and Horen, N. V.: 2015, Shocks abroad, pain at home? Bank-firm-level evidence on the international transmission of financial shocks, *IMF Economic Review* **63**, 698–750.

Peek, J. and Rosengren, E.: 1997, The international transmission of financial shocks: The case of Japan, *American Economic Review* **87**, 495–505.

Popov, A. and Udell, G.: 2012, Cross-border banking, credit access, and the financial crisis, *Journal of International Economics* **87**, 147–161.

Pozsar, Z., Adrian, T., Ashcraft, A. and Boesky, H.: 2012, Shadow banking, *Staff report no. 458*, Federal Reserve Bank of New York.

Rajan, R.: 1992, Insiders and outsiders: the choice between informed and arm's length debt, *Journal of Finance* **47**, 1367–1400.

Sufi, A.: 2007, Information asymmetry and financing arrangements: Evidence from syndicated loans, *Journal of Finance* **62**, 629–668.

Figures

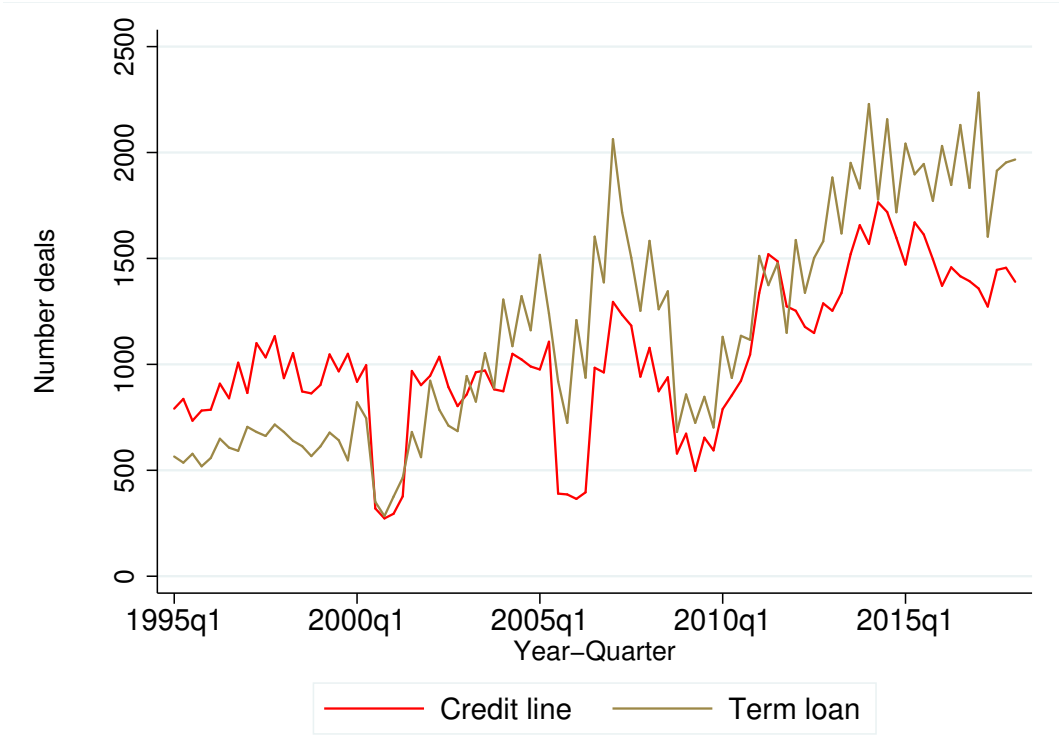

Figure 1: **Origination of credit lines and term loans.** number of loans originated per quarter, for term loans and credit lines.

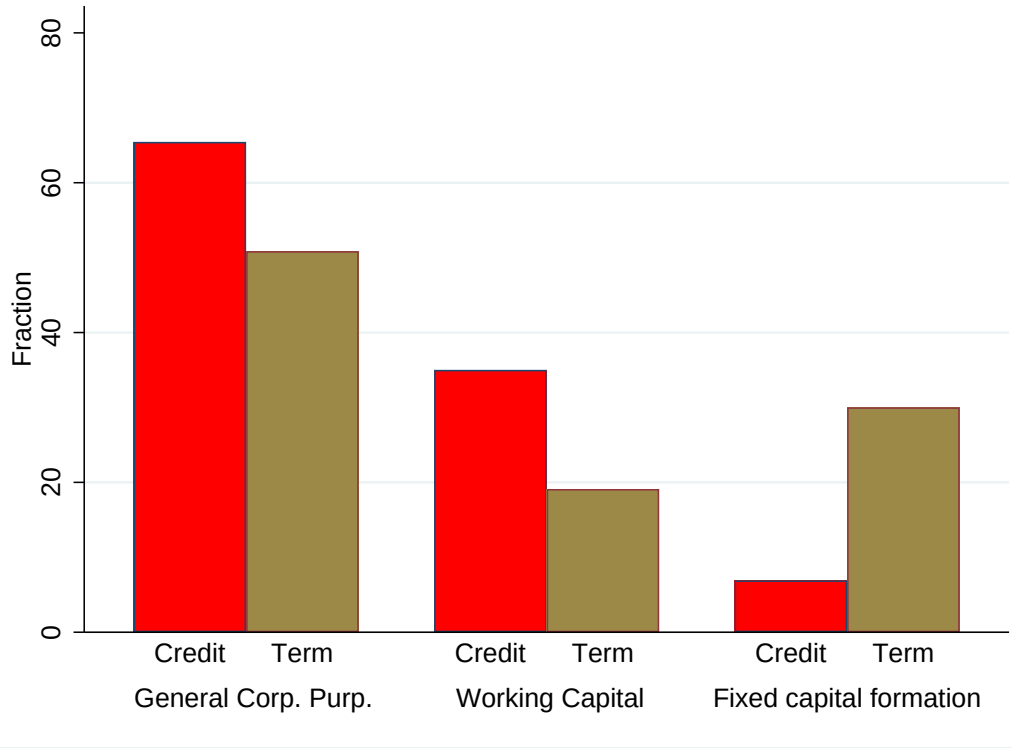

Figure 2: **Use of proceeds, by loan type.** This figure shows the use of proceeds of term loans and credit lines, grouped into three categories: general corporate purposes, working capital, and fixed capital formation. Loans secured for refinancing or to finance buyouts are not included.

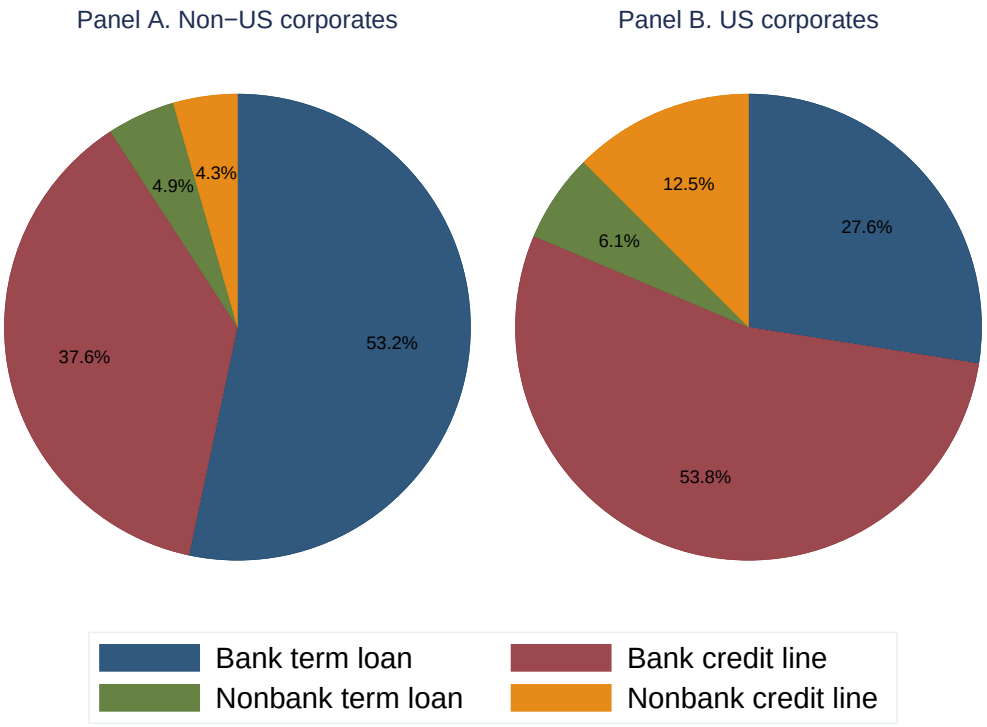

Figure 3: **Nonbanks and credit line originator.** Fraction of term loans and credit lines originated by banks and nonbanks, Panel A shows loans to non-US corporates, and Panel B shows loans to US corporates.

2Q10	2Q11	3Q11	2Q12	2Q13
Jun.10		*Oct.11*	*Jun.12*	*Jun.13*
Pre-capital exercise: 4 quarters, collapsed into two observations 2010Q2 and 2011Q2		*Implementation:* banks raise capital ratios		Post-capital exercise: 4 quarters, collapsed into two observations 2012Q2 and 2013Q2

Figure 4: **Time line EBA capital exercise.** This figure shows the time line of the EBA capital exercise. The EBA announced in October 2011 that some EU banks should raise their capital ratios by June 2012. We define the pre-capital exercise period as the four quarters before the announcement. Since we use quarterly data, we date it in 2011Q3. The post-capital exercise period includes the four quarters after June 2012, that is, 2012Q2-2013Q2.

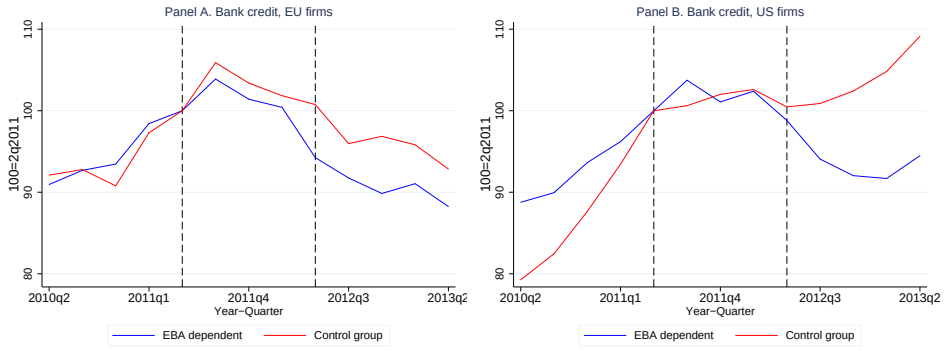

Figure 5: **Bank credit to EU and US firms.** This figure shows the stock of bank liabilities of firms dependent on EBA banks (more than half of the loans vis-á-vis them, blue line) and the control group (red line), four quarters before (2011Q2) and after (2012Q2) the EBA capital exercise. The panel on the left shows the time evolution for firms headquartered in the EU, whereas the bottom panel shows the evolution for US firms. The two dashed vertical lines in each panel mark 2011Q2 and 2012Q2, which are the quarters immediately before and after the capital exercise.

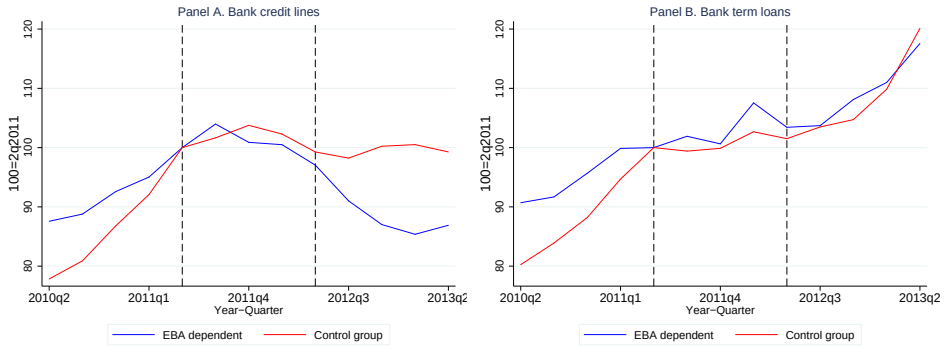

Figure 6: **Bank credit lines and term loans, US firms.** This figure shows the stock of bank credit lines (panel A) and term loans (B) for firms dependent on EBA banks (more than half of the loans vis-á-vis them, blue line) and the control group (red line), four quarters before (2011Q2) and after (2012Q2) the EBA capital exercise. The two dashed vertical lines in each panel mark 2011Q2 and 2012Q2, which are the quarters immediately before and after the capital exercise.

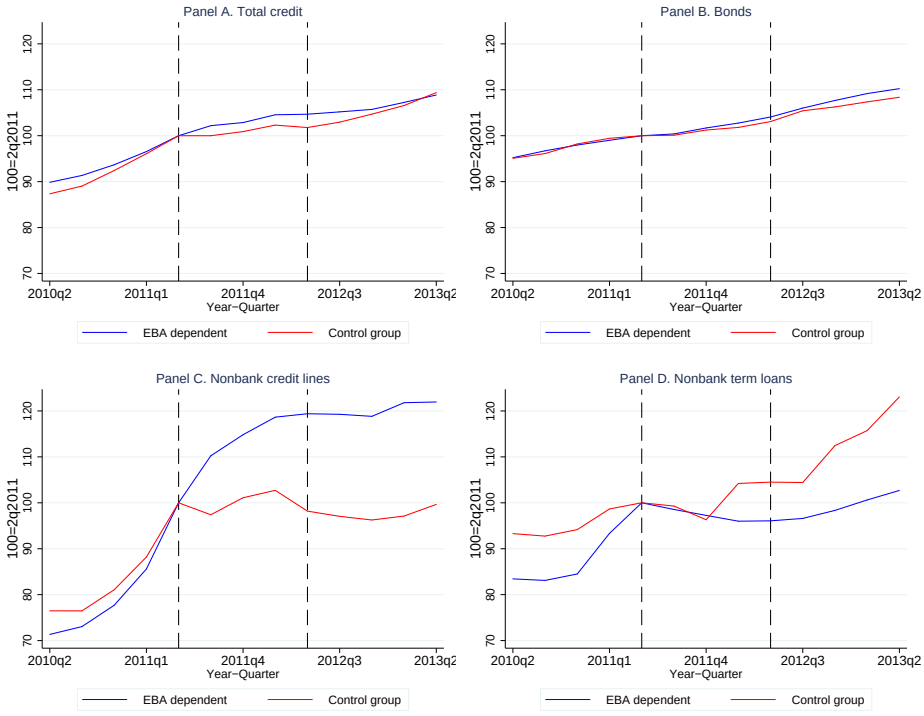

Figure 7: **Nonbank credit, US firms:** This figure shows the stock of total credit (panel A), which is the sum of bank and nonbank credit; and the three components of nonbank credit: bond markets (panel B), nonbank term loans (panel C), and nonbank credit lines (panel D). Each panel depicts firms dependent on EBA banks (more than half of the loans vis-á-vis them, blue line) and the control group (red line), four quarters before (2011Q2) and after (2012Q2) the EBA capital exercise. The two dashed vertical lines in each panel mark 2011Q2 and 2012Q2, which are the quarters immediately before and after the capital exercise.

Tables

Table 1: **Summary statistics.** Panel A reports summary statistics for the whole sample. Panel B reports statistics for firms dependent on EBA-affected banks. Panel C shows statistics for firms dependent on nonEBA-affected banks. At the foot of the table we report p-values for the tests of the median of the variables reported in panels B and C. Stars, ***, **, and *, indicate significance levels at 1%, 5%, and 10%, respectively

Panel A: Full sample

	Assets	Tangible assets	Leverage	Net worth	Current ratio	EBITDA y-o-y growth	Altman score
mean	10,555	35.1	30.3	38.3	1.8	37.0	1.6
p25	1,051	12.3	17.4	27.1	1.0	- 15.9	0.9
p50	2,880	28.8	28.3	39.0	1.4	9.4	1.5
p75	8,698	55.3	40.4	51.8	2.1	41.4	2.2

Panel B: Treated: EBA dependent

	Assets	Tangible assets	Leverage	Net worth	Current ratio	EBITDA y-o-y growth	Altman score
mean	11,309	35.4	29.2	39.1	1.8	36.5	1.6
p25	1,042	12.0	16.7	27.6	1.0	- 15.5	0.9
p50	2,939	28.2	27.2	39.6	1.4	9.7	1.5
p75	9,244	57.4	39.6	52.7	2.0	41.8	2.2

Panel C: Control group

	Assets	Tangible assets	Leverage	Net worth	Current ratio	EBITDA y-o-y growth	Altman score
mean	8,681	34.1	32.8	36.3	1.8	38.1	1.6
p25	1,063	13.2	19.8	25.1	1.1	- 16.5	1.0
p50	2,719	30.3	31.0	37.0	1.5	8.8	1.5
p75	7,386	51.4	41.8	50.0	2.1	41.1	2.2
p-value	0.08	0.15	1	0.00	0.14	0.33	0.48

Table 2: **International impact of a capital requirements tightening.** All specifications are estimated using the difference-in-differences estimator. The dependent variable is the stock of bank credit. Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) ALL	(2) EU	(3) US
Total assets (log)	0.19	−0.58	0.25
	(0.27)	(−0.71)	(0.51)
Tangible assets	0.05	−0.03	0.05
	(0.51)	(−0.33)	(0.58)
Post	0.14**	−0.03	0.19***
	(2.40)	(−0.38)	(2.79)
Post*Treated	−0.08	−0.05	−0.18**
	(−1.24)	(−0.45)	(−2.42)
Observations	6583	2549	3359
Number of clusters	1773	686	907
R-squared	0.860	0.889	0.896

Table 3: **Channels of international adjustment. Term loans and credit lines.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are stock of bank credit (column 1), bank term loans (column 2) and bank credit lines (column 3). Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) Bank-Loans	(2) Bank-Term	(3) Bank-Lines
Total assets (log)	0.25	−0.24	0.57
	(0.51)	(−0.47)	(0.66)
Tangible assets	0.05	−0.05	0.12
	(0.58)	(−0.61)	(0.99)
Post	0.19***	0.33***	0.10
	(2.79)	(2.72)	(1.49)
Post*Treated	−0.18**	−0.20	−0.18**
	(−2.42)	(−1.51)	(−1.98)
Observations	3359	3359	3359
Number of clusters	907	907	907
R-squared	0.896	0.908	0.848

Table 4: **Nonbank credit.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are stock of bank credit (column 1), bonds (column 2) nonbank term loans (column 3) and nonbank credit lines. Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	(1) Credit	(2) Bond	(3) Non-bank Term	(4) Non-bank Lines
Total assets (log)	0.77***	2.42**	−0.76	3.01
	(3.10)	(2.06)	(−1.00)	(1.56)
Tangible assets	0.08	−0.01	0.21	0.10
	(1.09)	(−0.14)	(0.83)	(0.45)
Post	0.18***	0.04	0.46*	0.05
	(3.36)	(1.01)	(1.72)	(0.48)
Post*Treated	−0.02	0.08**	−0.26	0.64***
	(−0.31)	(2.49)	(−0.93)	(3.57)
Observations	3359	3359	3359	3359
Number of clusters	907	907	907	907
R-squared	0.951	0.977	0.902	0.833

Table 5: **Intensive and extensive borrowing margin.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are bonds (column 1), bonds (column 2) nonbank term loans (column 3) and nonbank credit lines. Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

Panel A. Recurrent borrowers, intensive margin: The sample of firms includes only those with outstanding bonds (column 1) and nonbank loans (columns 2 and 3) as of 2011Q2.

	(1) Bond	(2) Non-bank Term	(3) Non-bank Lines
Total assets (log)	2.82**	−0.80	2.95
	(2.10)	(−1.03)	(1.49)
Tangible assets	0.02	0.38	0.14
	(0.19)	(0.88)	(0.37)
Post	0.04	0.62*	0.10
	(0.89)	(1.70)	(0.72)
Post*Treated	0.10**	−0.39	0.80***
	(2.54)	(−1.02)	(3.45)
Observations	2506	2559	2559
Number of clusters	662	679	679
R-squared	0.977	0.901	0.828

Panel B. Inexperienced borrowers, extensive margin: The sample of firms includes only those without outstanding bonds (column 1) and nonbank loans (columns 2 and 3) as of 2011Q2.

	(1) Bond	(2) Non-bank Term	(3) Non-bank Lines
Total assets (log)	0.03	0.01	0.04
	(0.74)	(0.05)	(0.16)
Tangible assets	−0.00	0.03	0.03
	(−0.01)	(0.72)	(1.19)
Post	0.02*	0.03	−0.03
	(1.78)	(0.98)	(−1.27)
Post*Treated	−0.01	0.04	0.03
	(−0.59)	(0.71)	(1.05)
Observations	853	800	800
Number of clusters	245	228	228
R-squared	0.142	0.109	0.358

Table 6: **Firms' capital structure.** All specifications are estimated using the difference-in-differences estimator. In panel A the dependent variables are bank credit to total assets (column 1), bank term loans to total assets (column 2) and bank credit lines to total assets (column 3). In panel B the dependent variables are bonds to total assets (column 1), nonbank term loans to total assets (column 2) and nonbank credit lines to total assets (column 3). Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

Panel A. Nonbank credit to US firms

	(1) Bank-Loans	(2) Bank-Term	(3) Bank-Lines
Total assets (log)	−0.12**	−0.12	−0.13*
	(−2.03)	(−1.55)	(−1.72)
Tangible assets	0.08	−0.07	0.16*
	(0.60)	(−0.43)	(1.69)
Post	0.01	0.02	0.00
	(0.19)	(0.32)	(0.08)
Post*Treated	−0.09	−0.06	−0.12*
	(−1.53)	(−0.65)	(−1.92)
Observations	3359	3359	3359
Number of clusters	907	907	907
R-squared	0.770	0.797	0.755

Panel B. Nonbank credit to US firms

	(1) Bond	(2) Non-bank Term	(3) Non-bank Lines
Total assets (log)	−0.34***	−0.15	−0.06
	(−3.49)	(−1.12)	(−0.31)
Tangible assets	0.04	−0.01	0.13
	(0.44)	(−0.02)	(0.94)
Post	0.08**	0.02	−0.17*
	(2.24)	(0.12)	(−1.68)
Post*Treated	0.00	0.00	0.23*
	(0.09)	(0.00)	(1.87)
Observations	3359	3359	3359
Number of clusters	907	907	907
R-squared	0.932	0.780	0.718

Table 7: **Real effects.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are cash over total assets (column 1), total assets (column 2) and net property, plant and equipment (column 3). $Increase_{NBCL}$ is a binary variable that equals 1 for firms dependent on EBA exposed banks and whose volume of nonbank credit lines to total assets accelerates in the period post capital exercise (2012-2013), and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) CASH	(2) ASSSETS	(3) FIXED-ASSETS
Total assets (log)	−0.81	0.50***	0.49***
	(−1.07)	(10.80)	(9.73)
Tangible assets	−6.98***	−0.15***	0.60***
	(−11.03)	(−4.02)	(14.27)
Post	−0.42*	0.12***	0.10***
	(−1.88)	(8.91)	(7.12)
Post × IncreaseNBCL	−0.32	0.06***	0.07***
	(−0.89)	(2.93)	(2.79)
Observations	2393	2403	2399
Number of clusters	907	907	907
R-squared	0.756	0.977	0.982

Table 8: **Alternative measure of EBA-bank dependency.** All specifications are estimated using the difference-in-differences estimator. In panel A the dependent variable is bank credit. In panel B the dependent variables are bond (column 1), nonbank term loan (column 2) and nonbank credit lines (column 3). EBAshare is the share of loans from both EBA- and non-EBA-affected banks prior to the capital exercise over the total borrowing in the same time period. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

Panel A. International impact of bank deleveraging

	(1) ALL	(2) EU	(3) US
Total assets (log)	0.14	−0.59	0.23
	(0.20)	(−0.72)	(0.48)
Tangible assets	0.04	−0.03	0.04
	(0.39)	(−0.39)	(0.50)
Post	0.14*	−0.09	0.19***
	(1.86)	(−0.81)	(2.63)
Post=1 × EBAShare	−0.12	0.02	−0.21**
	(−1.48)	(0.13)	(−2.40)
Observations	6310	2480	3235
Number of clusters	1702	668	875
R-squared	0.863	0.889	0.896

Panel B. Nonbank credit to US firms

	(1) Bond	(2) Non-bank Term	(3) Non-bank Lines
Total assets (log)	2.42**	−0.77	3.05
	(2.06)	(−0.99)	(1.57)
Tangible assets	−0.01	0.24	0.09
	(−0.18)	(0.89)	(0.39)
Post	0.05	0.45**	0.16
	(0.93)	(2.01)	(1.24)
Post=1×EBAShare	0.06	−0.27	0.50**
	(1.46)	(−1.14)	(2.36)
Observations	3235	3235	3235
Number of clusters	875	875	875
R-squared	0.977	0.902	0.832

Table 9: **Timing the European debt crisis.** All specifications are estimated using the difference-in-differences estimator. In panel A the dependent variable is bank credit. In panel B the dependent variables are bond (column 1), nonbank term loan (column 2) and nonbank credit lines (column 3). Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust *t*-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

Panel A. International impact of bank deleveraging

	(1) ALL	(2) EU	(3) US
Total assets (log)	0.19	−0.58	0.23
	(0.27)	(−0.71)	(0.49)
Tangible assets	0.05	−0.03	0.05
	(0.49)	(−0.34)	(0.64)
Post	0.12**	−0.01	0.15***
	(2.33)	(−0.13)	(2.81)
Post*Treated	−0.06	−0.07	−0.14**
	(−0.99)	(−0.65)	(−2.04)
Observations	6583	2549	3359
Number of clusters	1773	686	907
R-squared	0.860	0.889	0.895

Panel B. Nonbank credit to US firms

	(1) Bond	(2) Non-bank Term	(3) Non-bank Lines
Total assets (log)	2.42**	−0.78	2.99
	(2.06)	(−1.02)	(1.56)
Tangible assets	−0.01	0.22	0.10
	(−0.14)	(0.87)	(0.44)
Post	0.04	0.35*	0.14
	(1.03)	(1.87)	(1.37)
Post*Treated	0.08**	−0.13	0.64***
	(2.16)	(−0.59)	(3.19)
Observations	3359	3359	3359
Number of clusters	907	907	907
R-squared	0.977	0.901	0.833

Table 10: **Unrated borrowers.** All specifications are estimated using the difference-in-differences estimator. In panel A the dependent variables are bank credit (column 1), bank term loans (column 2) and bank credit lines (column 3). In panel B the dependent variables are bond (column 1), nonbank term loan (column 2) and nonbank credit lines (column 3). Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

Panel A. International impact of bank deleveraging

	(1) Bank-Loans	(2) Bank-Term	(3) Bank-Lines
Total assets (log)	0.14	0.55	−0.14
	(0.18)	(1.41)	(−0.11)
Tangible assets	0.06	−0.11	0.19
	(0.66)	(−1.19)	(1.29)
Post	0.16**	0.07	0.23**
	(2.06)	(0.76)	(2.24)
Post*Treated	−0.13	−0.01	−0.22*
	(−1.47)	(−0.05)	(−1.79)
Observations	1765	1765	1765
Number of clusters	475	475	475
R-squared	0.884	0.904	0.857

Panel B. Nonbank credit to US firms

	(1) Bond	(2) Non-bank Term	(3) Non-bank Lines
Total assets (log)	1.09*	1.03	5.27
	(1.90)	(1.12)	(1.42)
Tangible assets	0.03	0.03	0.07
	(0.61)	(0.13)	(0.26)
Post	0.07**	0.01	0.03
	(2.27)	(0.03)	(0.15)
Post*Treated	0.03	0.04	0.42*
	(0.66)	(0.12)	(1.81)
Observations	1765	1765	1765
Number of clusters	475	475	475
R-squared	0.988	0.954	0.780

Online Appendix for "International bank credit, nonbank lenders and corporate debt structure"

April 2021

1 Data appendix

1.1 Definition of the variables used

- *Bank Loans*: is the stock of outstanding loans from banks.
- *Nonbank loans*: is the stock of outstanding loans from nonbank financial intermediaries.
- *Bonds*: is the stock of outstanding bonds.
- *Credit*: sum of outstanding stock of loans from banks, from nonbanks, and bonds.
- *Creditline*: is the stock of outstanding credit lines (including undrawn).
- *Termloan*: is the stock of term loans.
- *EBA Share*: is denoted by the stock of outstanding loans to EBA banks, relative to the total stock of loans vis-á-vis European banks.
- *Treated*: is a dummy that equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise.
- *Post*: is a dummy that equals 1 for quarters 2012Q3 -2013Q4 (post-exercise), and 0 for quarters 2010Q2 -2011Q2 (pre-exercise).
- *Total Assets*: denotes the logarithm of firms' assets (in USD millions).
- *Leverage*: is the ratio of firms' total debt to total assets.
- *Tangible Assets*: is the ratio of firms' net property, plant, and equipment to total assets.
- *Current Ratio*: is defined as short-term assets (< one year) to liabilities.
- $EBITDA\ 1-year\ growth$: is the growth in EBITDA, year-over-year.

- *Altman's Score*: is the z-score following Altman (1968)).
- *Cash*: is cash accumulation.
- *Assets*: is the logarithm of assets.
- *Fixed Assets*: denotes the logarithm of net property, plant and equipment.

1.2 Sample selection

We use data from different sources. We gather from Refinitiv SDC Platinum the universe of 245,881 syndicated loans and 220,531 bonds issued by nonfinancial corporations. To identify them, we use the Thompson Reuters Business Classification (TRBC) definition of nonfinancial corporations, leaving aside financial and government bond issuers and loan borrowers.[1] We obtain from Refinitiv Eikon the hierarchical structure and sectoral classification of each of the entities in every syndicate loan and bond (immediate lender and immediate borrower of the borrower and lender). For all these entities, and their immediate and ultimate parents, we obtain the country of incorporation, as well as the NAICS codes and TRBC codes.[2] In order to retrieve entities' reference data from Refinitiv Eikon, we use mapping tables between the SDC CUSIP and their Thompson Reuters Permanent ID.

We use deal-level data to enhance the capital structure that firms disclose in their financial statements. To disentangle bank from nonbank loans, we follow Gropp et al. (2019) and define a full list of loan creditors of each firm in each quarter. We use this information to assess which firms are bank-dependent, and whether they had lending relationships with banks that were selected into the EBA capital exercise.[3]

[1] We use the TRBC schema at its highest level, and we expect it to be very similar to business classification schemas. In practice the filter leaves aside bonds and loans issued by entities whose ultimate parent company is financial or affiliated with a government. State-owned enterprises are included in our sample.

[2] NAICS stands for the North American Industry Classification Scheme, which superseded the SIC in 1987. The NAICS maps the UN International Standard Industrial Classification of All Economic Activities (ISIC). Refinitiv provides the NAICS for non-US firms as well.

[3] Unlike Gropp et al. (2019), we use the Refinitiv SDC syndicated loan data, and not Dealscan, since

Of the 1.4 million bank-firm-loan shares in our data, we identify 375,316 distinct bank*firm pairs.[4] To compute the total amount of loans from by EBA-affected banks, we estimate the fraction of the total loans granted by European banks it represents. We obtain the list of banks subject to the additional capital requirements from the EBA report (EBA (2011)). Following Ivashina and Scharfstein (2010), we split pro-rata the total amount each lead arranger lends; beforehand, we split the loan amount pro rata between lead arrangers and other participants.[5]

2 Sectoral classification of consolidated financial groups

In the paper we consolidate lenders at the ultimate parent level. We depart from this principle in a few cases, and consolidate up to the second-highest level, if the ultimate parent is the government (NAICS code 92, Public Administration), a charity (NAICS 81321, Grant Making and Giving Services), or a holding company (NAICS code 551112, Investment Holding Companies; NAICS code 523920, Investment Management and Fund Operators; NAICS code 55, Management of Companies and Enterprises).

The practical question we face is how to define the sectoral classification of these consolidated financial groups. This is particularly difficult in the case of US financial intermediaries, as they are complex and have many affiliates (Cetorelli and Goldberg (2014), Goldberg and Meehl (2019)), which often belong to different subsectors. We use the sectoral classification of the parent company, and specifically the NAICS subsector, which we obtain from Refinitiv Eikon. The reason is that the sectoral classification of the parent company reflects the main activity of the group, as the "The principal activity of an economic entity is the activity that contributes most to the value added of the entity[..]" (quoted from the UN et al. (2008), which provides the ISIC guidelines in which the NAICS system is based).

the former allows a better integration into Refinitiv Eikon (eg obtaining sectoral classifications, hierarchical structure, or country of incorporation). We do not expect major differences in loan coverage between SDC and Dealscan. Both databases include a similar number of loans, and are distributed by Refinitiv.

[4]We identify a total of 1.7 million lender-firm-shares, but 0.3 million correspond to nonbank firm shares.

[5]Lenders' shares are often unavailable in Refinitiv SDC data, as happens in Refinitiv Dealscan.

Following this criterion, the majority of the lenders are financial companies classified under code 52 ("Finance and Insurance") and in the following subsectors: 522, Credit Intermediation and Related Activities; 523, Securities, Commodity Contracts, and Other Financial Investments and Related Activities (which include investment banks); 524, Insurance Carriers and Related Activities and 525, Funds, Trusts, and Other Financial Vehicles.

We define banks financial intermediaries belonging to NAICS subsector 522. Most belong to the subsubsector of commercial banking (NAICS 5221). Nonbank financial intermediaries are companies belonging in subsectors 523, 524, and 525. Consequently, bank loans are those from entities whose parent company belongs to NAICS subsector 522. Nonbank loans include loans from entities whose parent company is not in subsector 522.

Because financial groups are very complex, many consolidated financial groups in the banking sector have nonbank affiliates, and the other way around (Cetorelli and Goldberg (2014)). Specifically, US investment banks have bank affiliates, while US banks have nonbank affiliates.

By construction, our approach is different from the one followed in compilation of the Financial Accounts. The reason is that our units of analyses are the consolidated financial groups, but the Financial Accounts focus on institutional units. These are classified on a solo basis ie as "...an economic entity that is capable, in its own right, of owning assets, incurring liabilities and engaging in economic activities and in transactions with other entities". For this reason, our classification cannot be reconciled either from the one in the FSB reports on nonbank financial intermediation, which use Financial Accounts as a starting point.

In the syndicated loan market, banks arrange three quarters of term loans (Panel A, Figure A2) and credit lines (Panel B), but nonbank financial institutions arrange the remaining quarter. Within this group, investment banks arrange the majority (NAICS code 523). The role of other types of nonbank financial institutions is residual, in particular in the origination of credit lines.[6]

[6]NAICS code 523 encompasses investment banks (subsubsector 52311) and other entities involved in securities brokerage (subsubsector 52312), as well as commodity contract dealers (subsubsector 52313). In

3 Additional tests

We discuss in Section 6.4 of the manuscript two additional tests that are aimed at ensuring the robustness of our main findings.

Removing firm-specific controls. Tables A2 and A3 report regressions after removing from the models firm-specific characteristics. This is to ensure that our results are not affected by missing values in the firm controls. We find that this modification does not alter our findings.

Incorporating time fixed effects. Finally, we add time fixed effects to our models to control for macroeconomic shocks. We show in Tables A4 and A5 that our main findings are robust to including time fixed effects.

practice, investment banks are the only institutions active in the syndicated loan market.

References

Altman, E.: 1968, Financial ratios, discriminant analysis and the prediction of corporate bankruptcy, *Journal of Finance* **23**, 589–609.

Cetorelli, N. and Goldberg, L.: 2014, Measuring complexity in global banks., *Federal Reserve Bank of New York Economic Policy Review* **20**, 107–126.

EBA: 2011, EU–wide stress test: Methodological note, *Technical report*.
URL: *http://www.eba.europa.eu/documents/*

Goldberg, L. and Meehl, A.: 2019, Complexity in large U.S. banks, *FRB of New York Staff Report* (880).

Gropp, R., Mosk, T., Ongena, S. and Wix, C.: 2019, Bank response to higher capital requirements. Evidence from a quasi-natural experiment, *Review of Financial Studies* **32**, 266–299.

Ivashina, V. and Scharfstein, D.: 2010, Bank lending during the financial crisis of 2008, *Journal of Financial Economics* **97**, 319–338.

UN, EC, IMF, OECD and WB: 2008, *System of national accounts 2008*, United Nations.

4 Figures

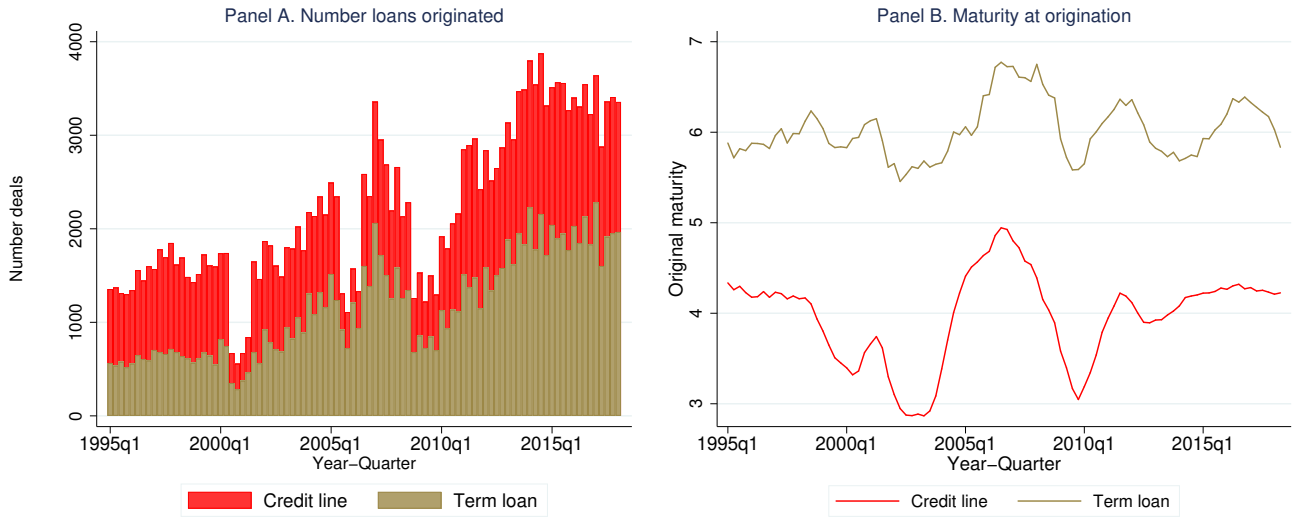

Figure A1: **Credit lines and term loans at origination.** This figure shows the number of loans originated per quarter (panel A), and the original maturity (panel B), for term loans and credit lines.

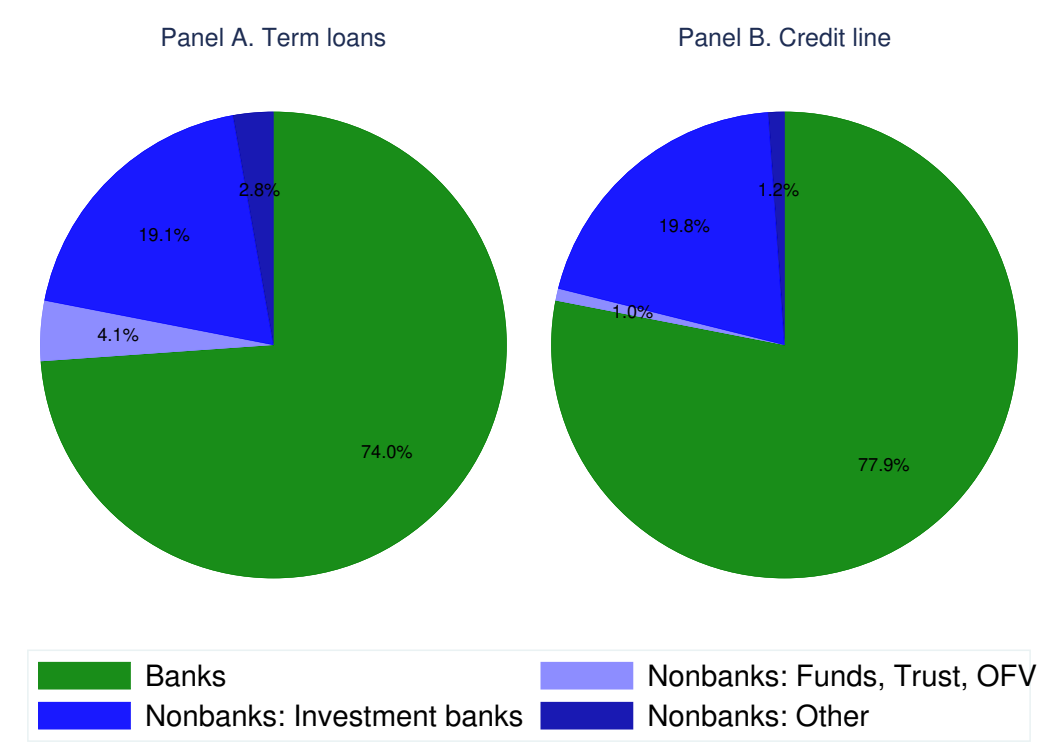

Figure A2: **Classification of loans' lead arrangers, by loan type.** This figure shows the fraction of loans originated by type of lender: banks; broker-dealers; trusts, funds, and other financial vehicles; and other. Panel A shows the breakdown for term loans, and Panel B shows the breakdown for credit lines.

5 Tables

Table A1: **Degree of dependency on EBA banks, 2011Q3.** The table presents the fraction of outstanding loans vis-á-vis banks subject to the EBA capital exercise, relative to total outstanding loans vis-á-vis other European banks.

	Share distribution				Treated	
	Mean	p25	p50	p75	No	Yes
Total	68	45	82	100	786	2,044
EU	71	50	80	100	289	888
US	66	33	82	100	441	974
Other developed	71	50	87	100	56	182

Table A2: **Removing firm-specific controls: Channels of adjustment.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are stock of bank credit (column 1), bank term loans (column 2) and bank credit lines (column 3). Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) Bank-Loans	(2) Bank-Term	(3) Bank-Lines
Post	0.13***	0.21***	0.08*
	(3.17)	(3.18)	(1.78)
Post*Treated	−0.12**	−0.13*	−0.13**
	(−2.52)	(−1.66)	(−2.15)
Observations	5836	5836	5836
Number of clusters	1459	1459	1459
R-squared	0.894	0.894	0.852

Table A3: **Removing firm-specific controls: Nonbank credit.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are bonds (column 1), nonbank term loans (column 2) and nonbank credit lines (column 3). Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) Bond	(2) Non-bank Term	(3) Non-bank Lines
Post	0.07***	0.23	0.09
	(5.13)	(1.57)	(1.20)
Post*Treated	0.12***	−0.19	0.59***
	(3.44)	(−1.11)	(4.41)
Observations	5836	5836	5836
Number of clusters	1459	1459	1459
R-squared	0.974	0.894	0.837

Table A4: **Incorporating time fixed effects: Channels of adjustment.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are stock of bank credit (column 1), bank term loans (column 2) and bank credit lines (column 3). Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include time, firm, country and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) Bank-Loans	(2) Bank-Term	(3) Bank-Lines
Post	0.09**	0.23***	−0.00
	(2.07)	(3.24)	(−0.06)
Post*Treated	−0.12**	−0.13*	−0.13**
	(−2.52)	(−1.65)	(−2.15)
Observations	5836	5836	5836
Number of clusters	1459	1459	1459
R-squared	0.896	0.894	0.853

Table A5: **Incorporating time fixed effects: Nonbank credit.** All specifications are estimated using the difference-in-differences estimator. The dependent variables are bank credit (column 1), bonds (column 2), nonbank term loans (column 3) and nonbank credit lines (column 4). Treated equals 1 if half the firm's bank loans are from banks subject to EBA requirements, and 0 otherwise. Post equals 1 for observations in the post-EBA period. All regressions include time, firm, county and sector fixed effects. The figures in parentheses are robust t-statistics. The standard errors are clustered at the firm level. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) Credit	(2) Bond	(3) Non-bank Term	(4) Non-bank Lines
Post	0.08**	0.07***	0.24	−0.03
	(1.99)	(4.52)	(1.42)	(−0.35)
Post*Treated	0.03	0.12***	−0.19	0.59***
	(0.56)	(3.44)	(−1.11)	(4.41)
Observations	5836	5836	5836	5836
Number of clusters	1459	1459	1459	1459
R-squared	0.941	0.974	0.894	0.838