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Abstract

Using a cross-country sample of bank-dependent public firms, we study the international spillovers of a change in banking regulation on corporate borrowing. For identification we examine how US firms' liabilities vis-à-vis banks, nonbank lenders, and bond markets evolve after an increase in capital requirements implemented by the European Banking Authority (EBA) in 2011. We find that US firms experience a reduction in credit lines but not in term loans from EU banks. In addition, US firms are able to compensate for reductions in credit lines from EU banks by securing liquidity facilities from US nonbank financial institutions without increasing borrowing from US corporate bond markets. 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: Credit lines; term loans; bank capital requirements; firm-level data; non-bank financial intermediaries

JEL: G21, G32, F32, F34

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1 Introduction

One lesson learned from the Great Financial Crisis (GFC) is that international lending sharply contracts when banks need to deleverage, partly reflecting the tendency of banks to reduce exposures to firms headquartered outside their home jurisdictions (Giannetti and Laeven (2012)). Firms borrowing from such banks could face shrinking credit line commitments, which represent half of all international loans maturing every quarter (Figure 1).[1] Firms could also experience a contraction in bank term loans. Corporate bond markets could in principle make up for a reduction in term loans-but seem less suited to compensate for the loss of cross-border credit lines if foreign-headquartered banks cut them. This raises the question of whether and how domestic credit markets could help firms weather a reduction in international bank lending.

In this paper, we shed light on this question by investigating the impact of international banks' deleveraging on corporate borrowing. We use a cross-country sample of bank-dependent public firms. In doing so, we ask whether firms experience a reduction in bank credit when their foreign creditors need to deleverage. In addition, we investigate the channels through which the banks adjust credit, as well as whether the withdrawal of financing takes place primarily in credit lines, term loans, or both. Finally, we explore whether the contraction in bank credit reduces total corporate borrowing, as well as whether firms maintain their borrowing by issuing corporate bonds or securing loans from non-bank financial institutions.

Empirically identifying how banks' deleveraging pressures affect corporate borrowing is challenging for two reasons. First, one needs to isolate a supply shock to bank credit transmitted internationally, from contemporaneous changes in firms' demand for finance. Second, corporate bond markets in most countries are not large enough and liquid enough to compensate fully for shocks in cross-border corporate financing. To address this empirical challenge,

[1] Credit lines often finance working capital or increase firms' financial flexibility. Market participants sometimes refer to them as revolving loans.

we use a novel dataset with rich cross-sectional information and exploit an exogenous contraction in international lending that affects only (a subset of) European Union (EU) banks. Specifically, 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.[2] The increase, which we call, "the EBA capital exercise", is sizable.[3] Requirements are on a consolidated basis, so affected banks could opt to adjust their international exposures. These exposures were large, as many banks had extended credit to firms headquartered outside the EU, including in the United States.

We carry out a difference-in-differences analysis to estimate how this regulatory change affected firms' debt liabilities. 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 international 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 EBA-dependent firms. Therefore, 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 identification assumption is that the EBA capital exercise did not affect treated firms' demand for financing, relative to the control group. Furthermore, we assume that US corporate bond market is deep, well developed, and could cushion the cut in international bank credit.

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 implementing two filters. First, we remove firms that do not have an outstanding loan vis-à-vis European banks. This way we avoid assortative matching in our control group. Second, we select firms that already disclose financial information, as

[2]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.

[3]This explains its appeal as an opportunity for analyzing domestic credit flows (Gropp et al. (2018)), or banks' decisions to grant collateralized rather than uncollateralized loans (Degryse et al. (2018)).

they comply with the reporting requirements imposed by securities regulations (listed firms, plus some private companies). Of the 2,830 firms in our sample, 1,117 are incorporated in the European Union (EU), 1,415 are incorporated in the United States, and 215 are incorporated in other advanced economies.[4] 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. First, bank liabilities of EBA-dependent firms decrease relative to the control group. However, bank credit to EU firms remains resilient; only US firms experience a reduction in loans from EU banks. The resilience of bank credit to EU firms reflects the sample selection used in the paper, which focuses on large firms.[5] Next, we inspect the mechanism behind the contraction in bank credit, paying special attention to the evolution of credit lines and term loans among US firms. Our main finding is that bank credit lines for treated firms decrease relative to the control group. This suggests that credit lines account for the bulk of the drop in international bank lending.

We also find that credit to US firms does not dry up, as the relative growth of total credit to treated and control firms remains more or less stable. This occurs despite the contraction in bank credit discussed earlier. We find that non-bank credit lines to EBA-dependent firms increase, relative to the control group. There is also a small but quantitatively less important increase in bond borrowing. Term loans provided by non-bank financial institutions do not grow. The main conclusion is, therefore, that non-bank financial intermediaries smooth the contraction in bank credit by providing credit lines.

Our study further documents that the US firms hit by the cut in EU bank lending and switching to non-bank loans change their capital structures: bank borrowing decreases

[4]More specifically, the requirement was imposed on EU banks proper as well as banks in Iceland, Liechtenstein and Norway.

[5]Besides reducing credit to US firms, EU banks also cut back credit to small and medium-size enterprizes (SMEs) in Europe (see for example, Acharya et al. (2018); Balduzzi et al. (2018); Bentolila et al. (2018); Dwenger et al. (2020) and Farinha et al. (2019)). The SMEs tend to carry the highest risk weights in internal ratings-based approach banks use for lending purposes.

and credit from non-bank financial intermediaries rises. This finding potentially implies that funding activity becomes more fragile, as banks generally have a more stable funding structure than do non-banks. Most non-bank financial institutions rely on wholesale funding and lack customer deposits, which may lead them to cut credit in the case of market-wide liquidity stress faster than banks do (Cornett et al. (2011)).

Our paper makes three contributions to the literature. First, we show that non–financial corporates experience a cut in bank lending when their foreign bank creditors need to deleverage. We obtain this result after controlling for changes in corporates' demand for financing, and hence provide further evidence of a "financial home bias" in periods of bank deleveraging. This finding relates to research on how banks adjust their international lending in response to financial stress (Cetorelli and Goldberg (2011), De Haas and Van Horen (2012); Popov and Udell (2012) and Giannetti and Laeven (2012)), as a result of prudential tightening (Buch et al. (2017)), or as part of the deleveraging process after the great financial crisis (McCauley et al. (2017)).

Second, we show that a significant share of the contraction in cross-border bank lending relates to credit lines. This result contributes to the literature on credit line dynamics in periods of financial stress, which so far focus on the demand side, suggesting that firms' drawdowns on credit lines could exacerbate banks' liquidity needs (Ivashina and Scharfstein (2010), Cornett et al. (2011)), Campello et al. (2010) and Acharya et al. (2013)). We show that banks in such situations prefer to cut credit lines rather than term loans.

Third, we shed new light on the ability of non-bank financial institutions to cushion a reduction in bank lending. We show that if domestic markets are well developed, non-bank financial institutions can fully smooth the shock to short-term bank financing. Furthermore, and consistent with previous research, we find no significant increase in corporate bond financing in response to a contraction in cross-border bank lending (Fernández et al. (2018), and Goel and Zemel (2018)). Interestingly, we find this result in a sample of US firms that have access to a well-developed and liquid corporate bond market.

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 discusses the implications. Section 8 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 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. 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. In some instances (around 1% of the observations), the tranche simultaneously provides term financing and a credit line; we classify them as credit lines. 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 non-bank financial intermediaries (non-banks).

We analyze borrowers (firms) and lenders (banks and non-banks) on a consolidated basis. On the lender side, we consolidate all loans at the ultimate parent level, as banks can restore capital ratios by reducing lending to nonresidents, or curbing the lending activities

of their affiliates.[6] For both reasons, this consolidated approach provides a better measure of international financial integration than the unconsolidated in McCauley et al. (2017)). On the borrower side, consolidating all loans and bonds allows us to account for firms that may borrow through affiliates (Avdjiev et al. (2016)). Defined such way, international loans include credit granted by any affiliate of a bank to any affiliate of a firm as long as the parent companies are incorporated in different countries.[7]

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 non-banks according to their funding structure, following the post-crisis definition of the shadow banking system (Pozsar et al. (2012); FSB (2011a); FSB (2011b)). Consequently, banks are deposit-taking institutions and other lenders relying on stable funding (eg saving banks). non-banks include the rest of the lenders, the majority of which are investment banks (security-broker dealers).[8] 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.[9]

We identify the full list of creditors of each firm, defined as those 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. Having the complete 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

[6]Bank subsidiaries are also subject to individual capital requirements.

[7]This measure is relatively similar to the foreign loans in the BIS Consolidated Banking Statistics (CBS) on a guarantor basis, because we treat lenders and borrowers on a consolidated basis. Specifically, the two measures would be similar if parent companies guarantee the debt of their affiliates; they differ if they do not.

[8]The group of non-bank lenders includes financial institutions subject to bank-like capital requirements but that do not take deposits. See Claessens et al. (2012) for a discussion.

[9]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). 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.

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, as they do not incur additional fixed costs to access bond markets.

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 United States, 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 dependent on banks with exposure to the capital exercise as of 2011Q3 (panel B), and for the rest of bank–dependent firms.[10] The average firm in our sample has a leverage ratio of 30.3% with a median of 28.2%. In addition, the firms in our sample are well collateralized, 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.

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

3 Institutional background and hypotheses

3.1 Firms' financial choices

Understanding some institutional aspects of corporate borrowing is important to explore the role domestic credit markets may play in international bank lending. Large firms raise debt from three major sources: bank, non-banks, and bond markets. Figure 2 shows the fraction of total borrowing that firms secure from each of these three sources, using a pro-rata split of loans across lead arrangers. It confirms the importance of firms' financial mix. It also shows that the relative relevance of funding choices fluctuates over time, which may reflect demand or supply factors.

Several models study the co-existence of loan and bond financing (see for example Bensanko and Kanatas (1993) or Diamond (1991)), although for two reasons bond issuance may not attenuate an adverse shock to bank credit. 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.[11] 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

[11] 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)).

secure credit lines to finance working capital, and exploit potential business opportunities as they arise (Lins et al. (2010)). They do not imply an effective disbursement. The provision of credit lines is, indeed, one of the traditional functions of banks, as they 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)).[12] Bond markets, on the other hand, provide term financing and therefore are not a good alternative to credit lines.

Taken together, these aspects suggest that bond markets may not fully smooth a cut in bank credit when it dries up. In this scenario, credit lines from some non-banks may be a viable alternative. 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, non-bank term loans, and non-bank credit lines. We observe that for US corporate borrowing, non-banks provide around 20% of all credit lines. Thus, they may be in a good position to attenuate a bank funding shock.

3.2 Hypotheses

A large and growing body of literature argues that banking shocks are transmitted internationally and affect the supply of bank loans abroad during banking crises. Giannetti and Laeven (2012), for example, show that when banking crises adversely affect banks in their home markets, they rebalance their portfolios in favor of domestic borrowers by decreasing the proportion of foreign loans. There is also evidence that banks sharply reduce lending to overseas customers (Peek and Rosengren (1997); Cetorelli and Goldberg (2011); De Haas and Van Horen (2012); Popov and Udell (2012)), and shift away from foreign borrowers that are geographically and in other ways more distant (De Haas and Van Horen (2013)). 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 do not contract the flow of lending to the EU's

[12] Appendix B provides stylized facts on credit lines in the syndicated loan market.

real economy" (EBA (2011)). Motivated by these considerations, we hypothesize that the EBA capital exercise affects firms incorporated outside the EU more heavily than their EU counterparts.[13]

Our second testable hypothesis is about the channels through which banks' deleveraging occurs. 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. If banks are liquidity constrained, they may prefer to reduce term loans first. However, banks can sell term loans in the secondary market, but credit lines are highly illiquid and are rarely sold after origination (Bord and Santos (2012)). Therefore, whether banks prefer to cut term loans or credit lines remains an empirical issue.

Finally, our expectation is that certain non-bank financial intermediaries can provide credit lines if banks cut them. Specifically, investment banks borrow in wholesale funding markets, so they are 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.[14]

[13]This hypothesis is further supported by the EBA, which specifically aims at ensuring "that such plans do not lead to a reduced flow of lending to the EU's real economy." (EBA (2011))

[14]Bonds may be an alternative when banks cut term lending, but even in this case switching to bonds may not be easy. Previous research shows that only a subset of high-quality firms manage to issue more bonds after banking crises (Goel and Zemel (2018)). Similarly, Fernández et al. (2018) find that non-bank 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.

4 Empirical strategy

4.1 Identification issues

To test the hypotheses stipulated above we need to address two issues. First, the supply shock to bank credit must be uncorrelated to firms' demand for finance. Second, we should rule out the possibility that firms' response to the shock is independent of the degree of bond market development.

Tackling the first issue is challenging because the majority of the shocks to bank credit transmitted internationally are large enough to impair the overall demand for credit, and they can affect the relative demand for specific sources of credit. For example, the cut in international lending triggered by the GFC contracted economic activity and depressed the demand for finance. Further, bank funding costs rose, so corporates' demand for bank credit decreased relative to market-based finance.

To address the concern, we exploit a policy shift that only affected (a subset of) EU banks that had outstanding loans vis-á-vis some US firms. Specifically, we analyze the EBA October 2011 decision requiring a number of banks to raise their Core Tier 1 capital ratio to 9% by June 2012. This exercise (the EBA capital exercise) occured in the backdrop of adverse developments in European capital markets following the sovereign debt crisis. Its main objective was to restore confidence in the EU banking sector by ensuring that banks were adequately capitalized to mitigate unexpected losses. The EBA capital exercise was unexpectedly announced soon after the stress tests conducted in July 2011 (Mésonnier and Monks (2015); Gropp et al. (2018) and Degryse et al. (2018)). The appealing characteristic of this shock is that there are cross-sectional differences in the degree of firms' exposure to EBA-affected banks. That is, some bank-dependent firms had not borrowed from EBA banks. Consequently, we can test if firms that depend on banks subject to the EBA requirements (treatment group) experienced a change in their liabilities relative to those exposed to other European banks that do not participate in the capital exercise (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.

Figure 4 shows the time–line of our differences-in-differences analysis, based on the timing of 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, we define a post-EBA capital exercise period comprising the four quarters after its end, which is 2012Q2-2013Q2.

As for the second requirement, we recognize that corporate bond markets in the majority of jurisdictions are characterized by small size and liquidity (CGFS (2019), BIS (2016), Bhatia et al. (2019)). Hence, the lack of substitution toward bonds may just signal that markets lack depth and not that corporate bond markets cannot smooth cuts in international bank credit. To identify the role of corporate bond markets, we focus the analysis on US firms, as US corporate bond markets are deep and liquid. Finally, to mitigate endogeneity concerns further, we include all firm variables at their levels before the bank EBA capital exercise.

4.2 Baseline model

Our empirical model examines how firms' liabilities change around the EBA capital exercise. We estimate our regressions using a difference-in-difference method to identify how bank capital requirements affect lending composition. For identification, 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 exposed to other European banks that do not participate in the capital exercise. Formally, we estimate the following equation:

$$F_{ijt}^{X} = \alpha_i + \beta_1 Treated_i + \beta_2 Post_t + \beta_3 Treated_i * Post_t + \beta_4 Controls_{it} + \varepsilon_{ijt} \tag{4.1}$$

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. (2018), 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:

$$Share_i^{EBA} = \frac{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EBA}}{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EU}} \tag{4.2}$$

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 covariate $Treated_i$, 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.[15]

$Post_t$ equals 1 for observations in the post-capital exercise period, and 0 in the pre-capital exercise. We collapse the sample into two periods, each with with the first and last quarter. Hecce the pre-capital exercise period includes 2010Q2 and 2011Q2; the post-capital exercise period includes 2012Q3 and 2013Q3.

The coefficient of interest is β_3, which measures the difference in lending X between treated and control firms in the post-EBA period. Put differently, the point estimate measures how the EBA exercise affects borrowing by firms dependent on EBA-affected banks, relative to firms borrowing from banks that are not subject to the capital exercise. To deal

[15]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.

with serial correlation we cluster standard errors at the firm level, and we define a short panel with only two periods before (after) the EBA capital exercise (Bertrand et al. (2004)). Furthermore, we include the 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.

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.

The effect of the EBA capital exercise, β_3, is well identified if two assumptions hold. The first one is that the measures of firms' liabilities we use as dependent variable (eg, bank credit) exhibit a common trend across treated and control firms. Although we cannot test this, 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. 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 et al. (2017); Bose et al. (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 International impact of bank deleveraging

To examine whether the EBA exercise affects firms incorporated outside the EU more heavily than their EU counterparts, we estimate regressions spliting our firms into those incorporated in the EU, those incorporated outside the EU, and those incorporated in the United States.

$$F^B_{ijt} = \alpha_i + \beta_1 Treated_i + \beta_2 Post_t + \beta_3 Treated_i * Post_t + \beta_4 Controls_{it} + \varepsilon_{ijt} \tag{4.3}$$

where the dependent variable is the stock of bank liabilities, so that F^X_{it} equals F^B_{it}. $Post_t$ captures the general increase/decrease in bank credit around the EBA capital exercise. $Treated_i$ accounts for time-invariant differences in bank credit between treated and control firms.[16] 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.

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.

4.4 Channels of adjustment

To quantify the extent to which banks delevarage via different channels, we focus exclusively on US firms, adapting equation 4.1 and remove the subscript country j accordingly:

[16] This variable is absorbed by the firm fixed effects.

$$F_{it}^{X} = \alpha_i + \beta_1 Treated_i + \beta_2 Post_t + \beta_3 Treated_i * Post_t + \beta_4 Controls_{it} + \varepsilon_{it} \quad (4.4)$$

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.

4.5 Credit substitution

To identify a potential switch across financing choices, we estimate equation 4.3 using as dependent variables four stocks of credit, F_{it}^{X}: non-bank credit, F_{it}^{NB}; bonds, F_{it}^{Bonds}; non-bank term loans, F_{it}^{NB-T}; and non-bank credit lines, F_{it}^{NB-CL}.

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.

5 Results

5.1 International impact of bank deleveraging

Our first 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.[17] 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 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-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.

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 4.1. We report coefficient estimates and t-statistics with standard errors clustered at the firm-level. 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 significant coefficient for the whole sample in column 1. This finding, however, masks the heterogeneity across different firm locations. 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), but bank credit to US firms drops (column 3).

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

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 et al. (2017); Jiménez et al. (2017) and Gropp et al. (2018)). In addition, given that we reply 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 much broader sample compared to previous studies, and we rely on a novel policy shift. Therefore, consistent with our expectations and findings from prior studies, negative policy shocks adversely affect banks' supply of credit.

5.2 Channels of adjustment

In this section, we formally explore how the EBA capital exercise affects credit lines and term loans. In other words, our aim is to understand whether the contraction of bank credit to 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 seems to concentrate on credit lines, and less so on term loans.

In our formal analysis, we estimate equation 4.3 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 Nonbank credit: bonds and nonbank loans

We now consider whether bond markets or non-bank lenders can smooth the reduction in credit for US firms. Figure 6 plots the evolution of total credit (panel A), which is the sum of bank and non-bank credit plus three components of non-bank credit: bonds (panel B), non-bank term loans (panel C), and non-bank 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 non-bank 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 non-bank 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.[18] We show non-bank credit lines in panel D, which exhibit a different pattern: post-EBA capital exercise, treated firms significantly increase their reliance on non-bank credit lines. As the blue line increases, the red line (representing control firms) remains relatively flat.

We estimate equation 4.3 for total credit and the three components of non-bank credit. Table 4 presents the estimates of various types of non-bank 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, non-bank term loans and non-bank 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 non-bank 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).[19] There is no notable difference in non-bank term loans, as the coefficient in column 3 is statistically insignificant. The main change occurs in treated firms' reliance on non-bank credit lines, shown in column 4. The interaction term is negative and highly significant. Furthermore, the economic impact is large, as the increase in non-bank 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 non-bank credit lines.

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

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

Finally, we explore if the substitution is broad or restricted to firms with previous access 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, non-bank term loans, and non-bank 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 that firms with previous experience increase their borrowing, relative to the control group. Specifically, borrowing through credit lines from non-banks 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 non-bank 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 non-bank credit lines we identify for treated firms, relative to control firms, holds for firms that could tap public markets in the past.

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.[20] The modified equation we estimate is the following:

$$F_{it}^X = \alpha_i + \beta_1 Share_i^{EBA} + \beta_2 Post_t + \beta_3 Share_i^{EBA} * Post_t + \beta_4 Controls_{it} + \varepsilon_{it} \qquad (6.1)$$

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

Table 6 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 non-bank credit. Column 1 reports the impact on bond financing, and columns 2 and 3 non-bank term loans and credit lines. The results confirm the main analysis. Relative to control firms, treated firms increase their borrowing from non-bank credit lines. There are no notable differences in terms of bond financing, or non-bank 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 non-bank 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 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, $Share_i^{EBA-Ex}$:

$$Share_i^{EBA-Ex} = \frac{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EBA-Ex}}{\sum_{q=2010Q2}^{2011Q2} F_{i,q}^{B-EU}} \tag{6.2}$$

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

$$F_{it}^{X} = \alpha_i + \beta_1 Share_i^{EBA-Ex} + \beta_2 Post_t + \beta_3 Share_i^{EBA-Ex} * Post_t + \beta_4 Controls_{it} + \varepsilon_{it} \quad (6.3)$$

We rerun all the regressions using the new measure of EBA dependency, which excludes the above-mentioned loans. We report the results in Table 7. We find that our main results hold, and we conclude that the contraction in bank credit, as well as the increase in non-bank 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.[21]

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 8, remain largely unchanged, as we find a decrease in borrowing for treated firms relative to the control group. This is underscored by the 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 non-bank 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.

[21]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%.

6.4 Other tests

As an additional test, 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. The results–not shown for the sake of brevity– confirm our conclusions.

7 Implications

7.1 Impact on firms' capital structure

Next, we explore if firms' capital structure changes as a result of bank deleveraging pressures, and non-bank 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. We winsorize them at 1% and 90%. [22]

We present the results in table 9. 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 non-bank financial intermediaries as a proportion of their total debt. The effect is economically meaningful because after the policy, non-bank debt rises by 23 percentage points. Finally, in column 1 we do not find a significant changes in firms' bond financing relative to total debt.

Investment banks provide the majority of credit lines, and those investment banks have strong maturity mismatches between assets and liabilities.[23] We conclude that access to liquidity may be more uncertain, because intermediaries with shorter-term liabilities are more vulnerable (Cornett et al. (2011)) to simultaneous runs in short-term liabilities and

[22] We choose the 90th percentile because the ratios are bounded at zero and are highly non-normal.

[23] Few of the rest of lenders in the non-bank group, which includes private equity firms, insurance companies, pension funds, CLOs and Business Development Companies, extend them.

credit line drawdowns (Ivashina and Scharfstein (2010)).

7.2 Financial intermediation in the US

Because European banks are important in the US corporate loan market, the EBA capital exercise had the potential to modify its structure and boost the share of non-bank financial intermediaries. Now we examine if the EBA capital exercise allowed non-bank financial intermediaries to gain importance in the US corporate loan market, relative to EBA banks, exploring their evolution in the league table of syndicated loans to US corporations.[24]

League tables rank lead arrangers in loan markets according to the number or total amount of loans. Lower values (a higher position in the ranking) indicate that a lender is important in the US corporate loan market.

To test our hypothesis, we construct a panel of top 50 lead arrangers in the US corporate loan market, tracking them over four periods of time (from-to): 2009Q3-2010Q2,2010Q3-2011Q2,2011Q4-2012Q3,2012Q4-2013Q3. By defining this narrow window exactly around the EBA capital exercise, we isolate other contemporaneous changes in the demand for financing, as well as other supply factors. Next, we classify lenders into three groups: EBA banks, other banks, and non-bank lenders. Finally, we estimate the following equation:

$$Rank_{it} = \alpha_i + \beta_1 EBA_i * Post_t + \beta_2 non - bank_i * Post_t + \varepsilon_{it} \tag{7.1}$$

where $Rank_{it}$ is the ranking in the league table of lender i at time t. It ranges between 1 (most important lender) and 50. α_i denotes the lender fixed-effects. EBA_i equals 1 for banks subject to the EBA capital exercise, and 0 otherwise. $non - bank_i$ equals 1 for non-bank lenders, and 0 otherwise. $Post_t$ equals 1 for observations in the two periods after the EBA capital exercise, and 0 otherwise. ε_{it} is the disturbance term.

The results in Table 10 indicate that EBA banks lost importance in the US corporate

[24]This is not covered in our previous analysis, as we only examined the funding structure of the sample of US corporates that had loans vis-á-vis EBA banks (and this sample represents only a fraction of the US corporate loan market).

loan market after the capital exercise, as the sign of the interaction term between $Post_t$ and EBA_i is positive in column 1 (which ranks lenders by number of loans) and in column 2 (which ranks them by the total amount). Non-bank lenders gain importance according to the total amount lent (column 2), as the sign of the interaction term is positive and statistically significant in column 2. In addition, they remain similar, in terms of the number of loans, which suggests that they engage in larger transactions.

Therefore, the evidence is not inconsistent with a change in the structure of the U.S. corporate loan market due to the EBA capital exercise. When EBA banks retrench, non-bank lenders fill the void. However, we acknowledge that the rise (decline) of non-banks (EBA banks) could also be related to other contemporaneous changes in supply and demand.

8 Conclusion

Using a cross-country sample of bank-dependent public firms from several advanced economies, we study the global impact of banks' deleveraging pressures on corporate borrowing. For identification we examine how US firms' liabilities vis-à-vis banks, non-bank lenders, and bond markets evolve after the European Banking Authority (EBA) increased capital requirements on a consolidated level in 2011.

We find that after the EBA capital increase, US firms experienced a decline in cross-border bank credit. This reflected the impact of foreign creditors' deleveraging, which is not surprising given the banks' "financial home bias." Yet, when we distinguish among different types of credit, we find that the reduction concerned only credit line commitments. In contrast, term loans remained resilient. Finally, we find 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.

Our results suggest that non-bank financial institutions smooth shocks in cross-border financing. The general lesson is that a diversified loan market may be key to achieving a

robust structure for corporate financing.

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9 Figures

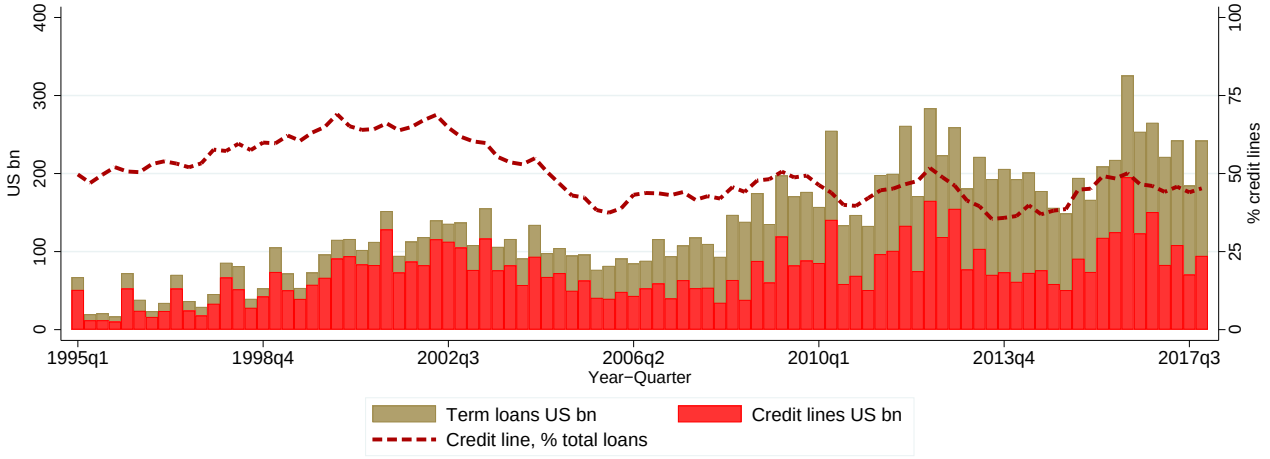

Figure 1: **International rollover risks, redemptions per instrument and quarter.** This graph shows the volume of bank international term loans and credit lines expiring each quarter, as well as the fraction of the total represented by credit lines. International loans are those in which the ultimate parent of the borrower and the lender are incorporated in different countries. Banks are deposit-taking institutions. The unit of observation is the loan tranche, which we classify as a term loan or a credit line using the attached description. Credit lines include undrawn commitments. To estimate banks' share of a syndicated loan, we allocate the total amount among the lead arrangers only.

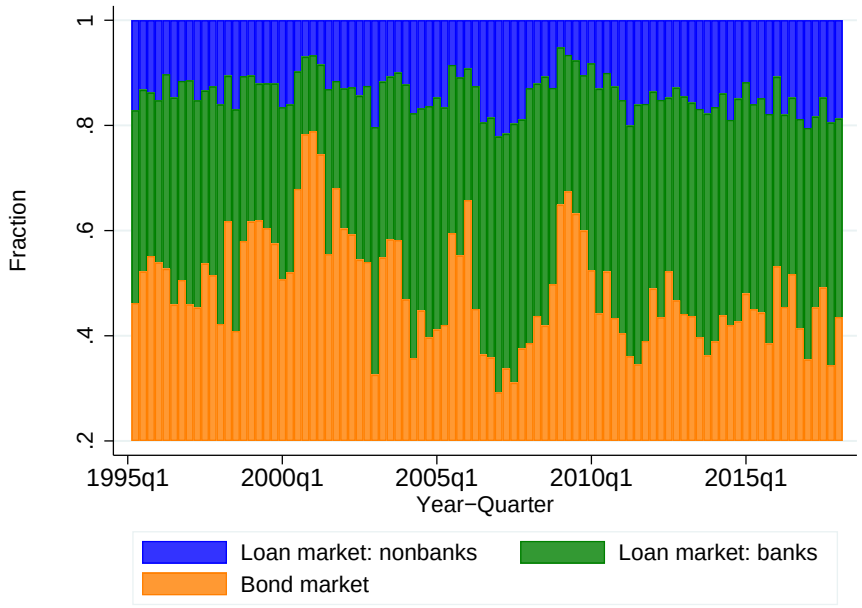

Figure 2: **Sources of corporate funding.** Total amount raised by large corporates in 1995-2018, broken down between bonds and syndicated loans (term loans and credit lines, including undrawn). Syndicated loans are further broken down between bank and non-bank loans.

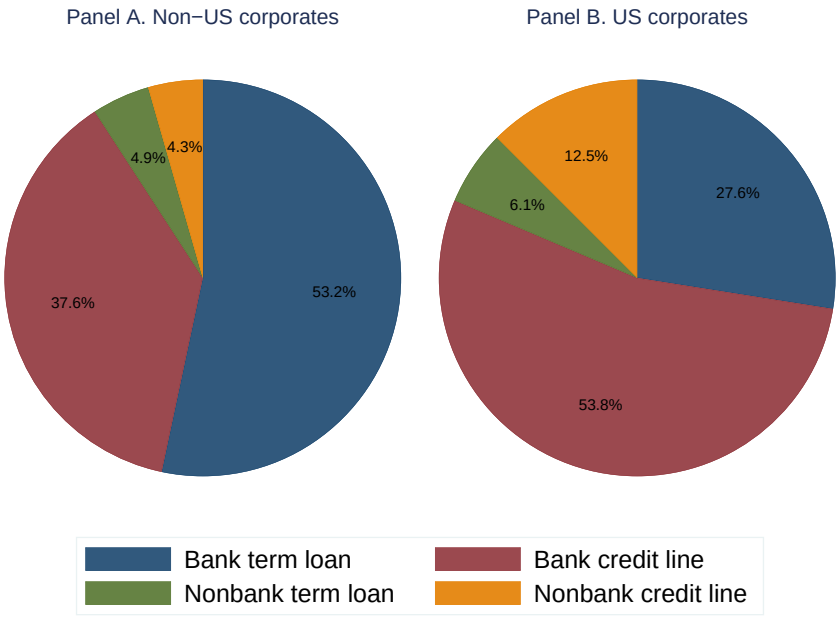

Figure 3: **Nonbanks and credit line originator.** Fraction of term loans and credit lines originated by banks and nonbanks, Panel A shows loans to non-US corporates, and Panel B shows loans to US corporates.

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.

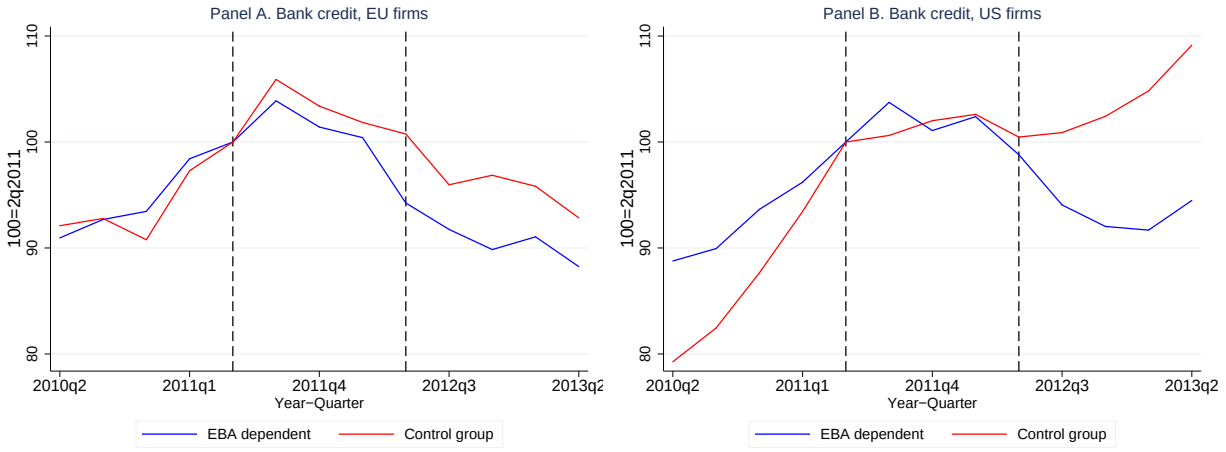

Figure 5: **Bank credit to EU and US firms.** This figure shows the stock of bank liabilities of firms dependent on EBA banks (more than half of the loans vis-á-vis them, blue line) and the control group (red line), four quarters before (2011Q2) and after (2012Q2) the EBA capital exercise. The panel 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.

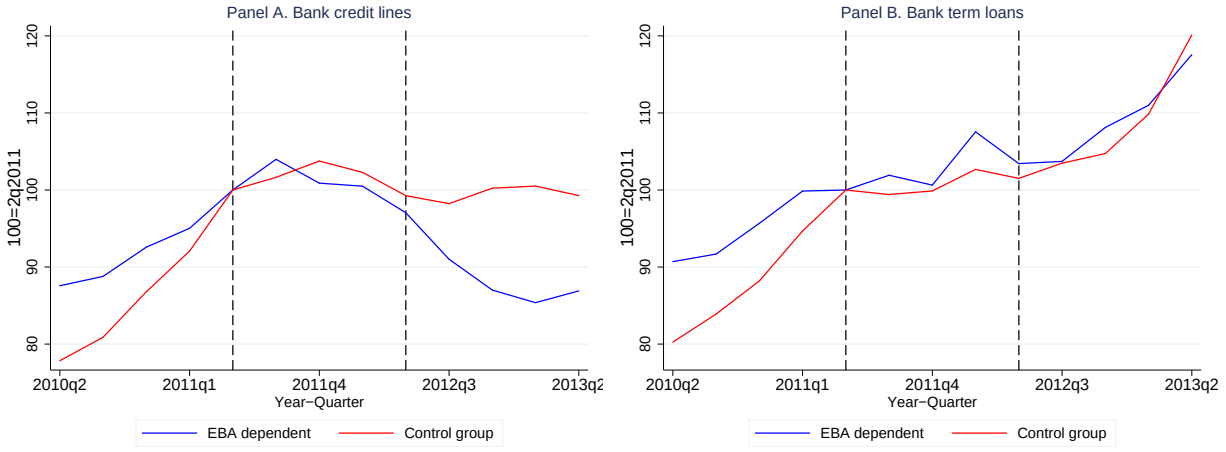

Figure 6: **Bank credit lines and term loans, US firms.** This figure shows the stock of bank credit lines (panel A) and term loans (B) for firms dependent on EBA banks (more than half of the loans vis-á-vis them, blue line) and the control group (red line), four quarters before (2011Q2) and after (2012Q2)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

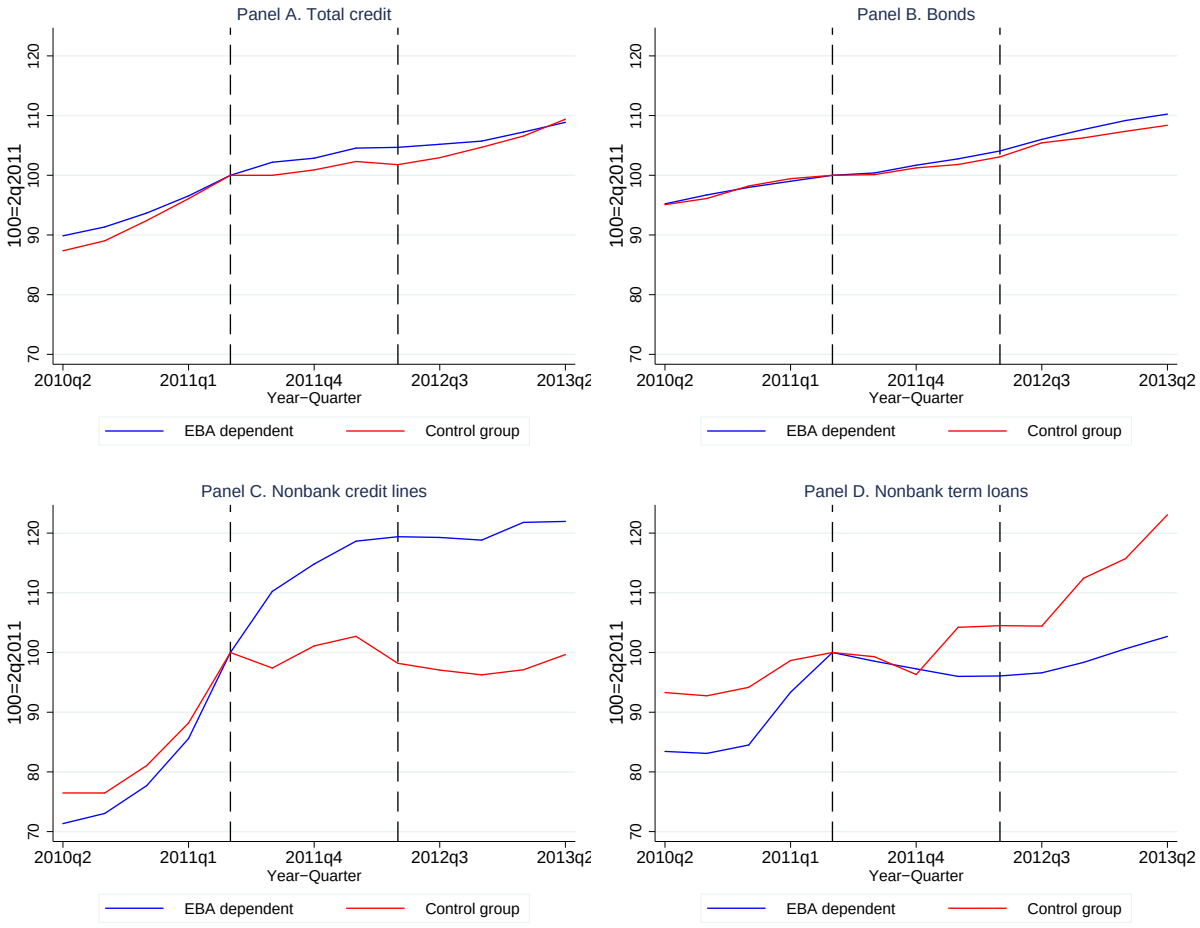

Figure 7: **Nonbank credit, US firms:** This figure shows the stock of total credit (panel A), which is the sum of bank and nonbank credit; and the three components of nonbank credit: bond markets (panel B), nonbank term loans (panel C), and nonbank credit lines (panel D). Each panel depicts firms dependent 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.

10 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	13 299	34.6	30.3	38.1	2.7	90.5	1.6
p25	1 130	12.3	17.5	27.1	1.0	-14.9	0.9
p50	3 060	28.2	28.3	38.7	1.4	9.8	1.5
p75	9 574	54.9	40.3	51.2	2.0	41.0	2.2

Panel B: Treated: EBA dependent

	Assets	Tangible assets	Leverage	Net worth	Current ratio	EBITDA y-o-y growth	Altman score
mean	14 526	34.9	29.3	38.9	3.0	97.1	1.6
p25	1 138	11.8	16.8	27.6	1.0	-14.4	0.9
p50	3 222	27.6	27.2	39.3	1.4	9.8	1.5
p75	10 430	56.3	39.6	52.0	2.0	41.2	2.2

Panel C: Control group

	Assets	Tangible assets	Leverage	Net worth	Current ratio	EBITDA y-o-y growth	Altman score
mean	10 209	33.9	32.7	36.2	1.8	74.3	1.6
p25	1 080	13.3	19.6	25.0	1.1	-15.8	1.0
p50	2 816	29.4	30.9	37.0	1.5	10.1	1.5
p75	8 059	50.9	41.7	49.8	2.1	41.0	2.3
p-value	0.05	0.15	1	0.00	0.14	0.33	0.48

Table 2: **International impact of bank deleveraging.** All specifications are estimated using the difference-in-differences estimator. 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 fixed effects. The specifications further include 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 adjustment. Term loans and credit lines.** All specifications are estimated using the difference-in-differences estimator. EBAshare is the share of loans from both EBA- and nonEBA-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 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. 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 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) NonBank-Term	(4) NonBank-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. Post equals 1 for observations in the post-EBA period. All regressions include firm 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) NonBank-Term	(3) NonBank-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) NonBank-Term	(3) NonBank-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: **Alternative measure of EBA-bank dependency.** All specifications are estimated using the difference-in-differences estimator. Post equals 1 for observations in the post-EBA period. All regressions include firm 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) Nonbank-Term	(3) NonBank-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 7: **Timing the European debt crisis.** All specifications are estimated using the difference-in-differences estimator. Post equals 1 for observations in the post-EBA period. All regressions include firm 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) NonBank-Term	(3) NonBank-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 8: **Unrated borrowers.** All specifications are estimated using the difference-in-differences estimator. Post equals 1 for observations in the post-EBA period. All regressions include firm 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) NonBank-Term	(3) NonBank-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

Table 9: **Firms' capital structure.** All specifications are estimated using the difference-in-differences estimator. Post equals 1 for observations in the post-EBA period. All regressions include firm 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) NonBank-Term	(3) NonBank-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 10: **League table of lead arrangers in the US corporate loan market.** The ranking ranges between 1 (most important lender) to 50 (least important). A negative sign signals that the importance in the ranking has increased. All specifications are estimated using the difference-in-differences estimator. EBA bank equals 1 if the bank was subject to the EBA requirements, and 0 otherwise. Nonbank equals 1 if the lender is a nonbank. Post equals 1 for observations in the post-EBA period. In column 1 the dependent variable is a ranking based on the number of loans. In column 2 the ranking is constructed using the total amount arranged by the lender. All regressions include lender fixed effects. The figures in parentheses are robust t-statistics. Statistical significance is denoted at 1% (***), 5% (**), and 10% (*).

	(1) Count	(2) Amount
Post=1*EBA bank=1	2.28*	2.52**
	(1.89)	(2.38)
Post=1*Nonbank lender=1	0.74	−1.86*
	(0.64)	(−1.92)
Observations	197	197
Number of clusters	58	58
R-squared	0.000	0.000

On-line Appendix for "International bank lending and corporate debt structure"

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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)).

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. (2018) 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]

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

[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. (2018), we use the Refinitiv SDC syndicated loan data, and not Dealscan, since 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 non-bank firm shares.

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]

Table 1: **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

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

2 Credit lines: stylized facts

Credit lines represent around half of the syndicated loans originated by banks (Figure 1, Panel A).

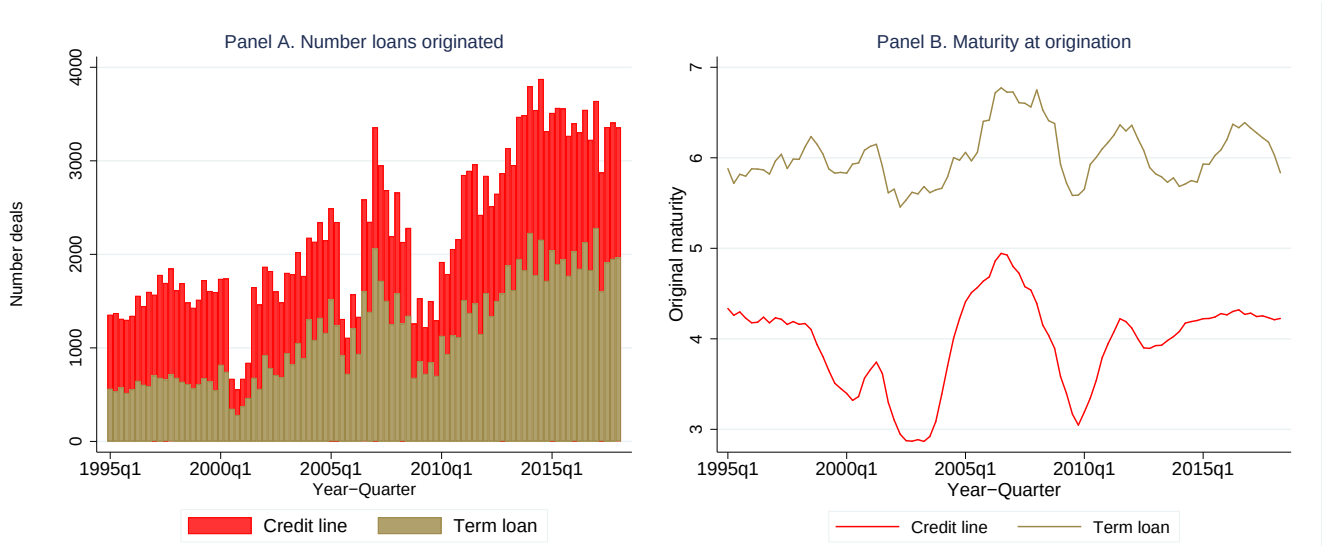

Figure 1: **Credit lines and term loans at origination.** This figure shows the number of loans originated per quarter (panel A), and the original maturity (panel B), for term loans and credit lines.

Credit lines have shorter maturities than term loans (Figure 1, Panel B), which reflects that they often fund working capital and rarely finance capital expenditures (Figure 2. Many firms also arrange them to secure liquidity and exploit business opportunities as they arise (Lins et al. (2010)). For this reason, in many instances companies do not detail at origination the intended use of credit lines; often they are for "general corporate purposes."

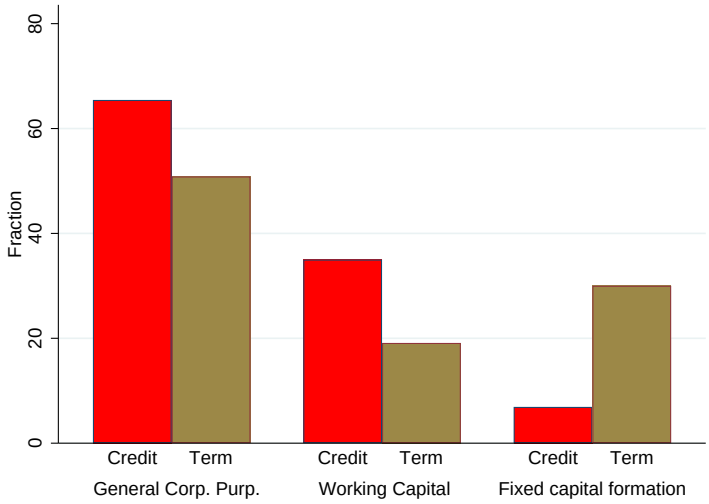

Figure 2: **Use of proceeds, by loan type.** This figure shows the use of proceeds of term loans and credit lines, grouped into three categories: general corporate purposes, working capital, and fixed capital formation. Loans secured for refinancing or to finance buyouts are not included.

3 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).

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 non-bank 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 3) 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

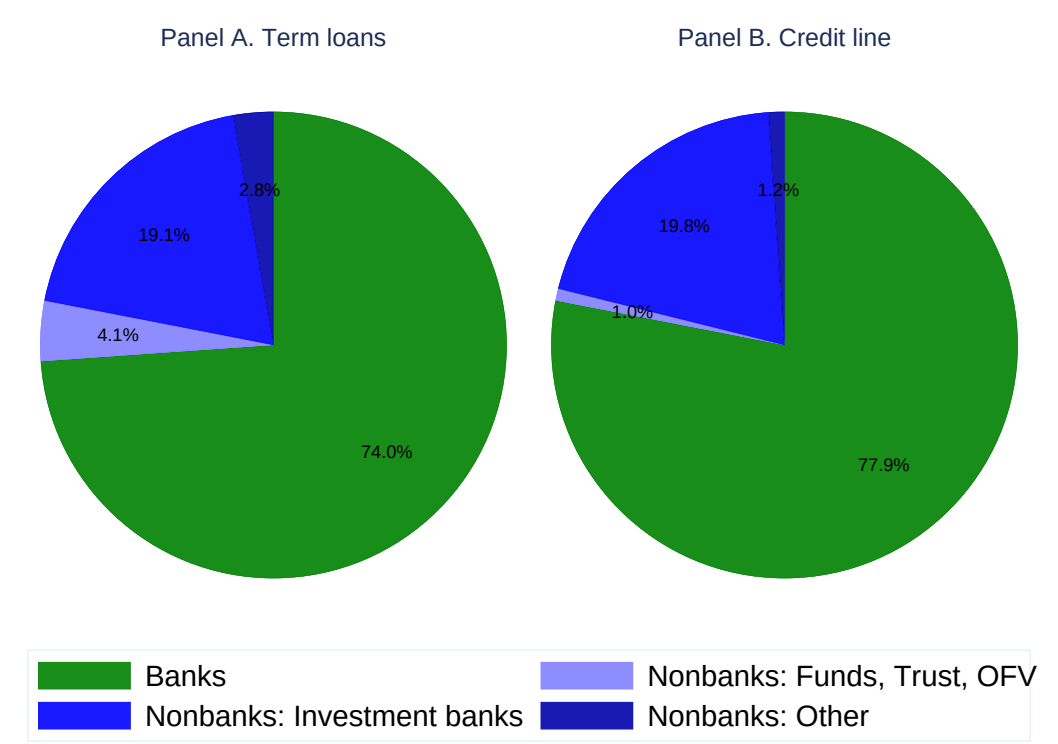

Figure 3: **Classification of loans' lead arrangers, by loan type.** This figure shows the fraction of loans originated by type of lender: banks; broker-dealers; trusts, funds, and other financial vehicles; and other. Panel A shows the breakdown for term loans, and Panel B shows the breakdown for credit lines.

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

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