Sovereign Stress and SMEs' Access to Finance: Evidence from the ECB's SAFE Survey

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Abstract

We study the effect of sovereign stress on SMEs' capital structure using restricted-access data from the European Central Bank. We find that after the sovereign debt crisis started, and controlling for borrowers' quality, firms in stressed countries became more likely to be credit rationed and to face higher loan rates. At the same time, less creditworthy firms were not more likely to become credit constrained, suggesting no flight to quality in lending. We also find that in order to make up for the decline in bank credit firms in stressed countries began relying considerably more on debt securities.

JEL classification: D22, E58, G21, H63.

Keywords: Sovereign stress, credit access, SMEs.

1. Introduction

What is the effect of sovereign stress on small business firms' credit access and overall capital structure? While the effect of the euro area sovereign debt crisis of 2010–2012 on the banking sector has been studied in great depth,[1] the microeconomic consequences of reduced sovereign credit-worthiness are considerably less well understood. Because SMEs comprise up to 99 percent of firms in Europe, provide two out of three private sector jobs, and contribute more than half of total business-provided value added,[2] small businesses' reduced ability to access credit and the negative effect thereof on their investment and employment decisions can have potentially significant overall consequences for real economic activity.[3]

In this paper, we use restricted-access data from the ECB's "Survey on the Access to Finance of Enterprises" (SAFE) to evaluate the impact of the sovereign debt crisis on credit access and on the use of alternative sources of external finance by small businesses in the euro area. Five countries (Greece, Ireland, Italy, Portugal, and Spain, henceforth denoted as "stressed countries") in the euro area suffered a substantial deterioration in their sovereign creditworthiness. However, countries in the rest of the euro area did not. Investor confidence plummeted dramatically in the banking sectors of these stressed countries because their banks tended to allocate large portions of their portfolios to the debt securities issued by domestic sovereigns.[4] This, in turn, drove bank funding costs upwards.[5] Empirical evidence suggests that

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[1] See Lane (2012) and Popov and van Horen (2015) for a summary of the timeline, causes, and consequences of the crisis.

[2] See the European Commission's "Annual Report on European SMEs 2012/2013" (2013).

[3] This argument extends to the U.S., too, where SMEs account for roughly half of the labor force (Stangler and Litan, 2009).

[4] Acharya and Rajan (2013), Broner et al. (2014), and Gennaioli et al. (2014) offer theoretical models that motivate incentives for domestic banks to buy sovereign debt. Empirical evidence on bank holdings of domestically issued sovereign debt has been analysed by Acharya and Steffen (2015), Gennaioli et al. (2014), and Ongena et al. (2016).

given their high reliance on bank credit (Berger and Udell, 1998; Ferrando et al., 2014), small and medium enterprises (SMEs) are particularly likely to become credit constrained when banks adjust their loan portfolios in response to negative shocks to their balance sheets (Duygan-Bump et al., 2010).

Despite intense policy interest in this topic, our paper is the first to analyse how sovereign stress affects SME access to finance and overall SME capital. Our analysis proceeds along three dimensions. First, we analyse how credit constraints confronted by euro area SMEs evolved before and after the sovereign debt crisis. Second, we use observed proxies for firms' creditworthiness to study which firms are most affected by sovereign stress. Third, we look at how small firms' use of alternative funding sources responds to changes in credit access.

We find that sovereign stress results in a strong supply-driven reduction in credit access. When we investigate the underlying reasons, we find evidence for credit rationing by banks, both in the quantity and in the price dimension (formal credit constraints). In particular, controlling for borrower quality and demand, firms in stressed countries are considerably more likely to receive less than 75 percent of the loan amount they asked for and to reject a loan offer because the cost of credit is too high, than similar firms in non-stressed countries. At the same time, firms in stressed countries are not more likely to have their loan application denied by a bank. The process of reduction in credit access is not accompanied by a flight to quality in lending in that less creditworthy firms are not more likely to become credit constrained. We also find that in order to make up for the decline in bank credit, firms in stressed countries rely considerably more on debt securities after the crisis started. However, this effect is rather small, given that only 2 percent of firms in the sample issue debt securities to begin with. Our evidence thus implies that the cost of funding for SMEs increases as a result of sovereign stress, and that SMEs have a hard time adjusting their capital structure in response to declining availability of bank credit.

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[5] SeeAlbertazzi et al. (2012), for example, for evidence on the link between the spike in the spread on 10-year Italian sovereign bonds and the steep increase in the cost of both wholesale and of retail funding of Italian banks.

Because demand-side effects undoubtedly operate at all stages of the sovereign debt crisis (e.g, by affecting consumer demand for goods and services), our empirical strategy is specifically designed to identify the causal impact of the crisis through the channel of the supply of bank credit. We employ an exhaustive set of fixed effects, notably country-time and sector-time interactions, in order to net out the effect of common demand shocks (e.g., changes in the purchasing power of households in Spain, or in the global demand for housing). We also show that the trends in credit access that we observe during the sovereign debt crisis do not exist before the spring in 2010, suggesting that differences in access to finance across stressed and non-stressed countries are specific to the crisis period. Finally, we isolate the subset of the most creditworthy corporate borrowers, specifically, firms with the highest credit history, collateral quality, and growth opportunities. We show that even within this sample, firms in stressed countries are more likely to be credit constrained during the sovereign debt crisis than those in non-stressed countries.

Theory suggests two primary mechanisms through which sovereign stress can lead firms to experience a supply-driven reduction in access to finance. The first channel works through banks' direct holdings of government securities. In particular, banks' exposure to government debt makes their balance sheets more sensitive to fluctuations in sovereign risk. When sovereign debt is downgraded, the balance sheets of exposed banks are weakened and investors demand higher returns to continue funding these banks. Even when losses on sovereign bond holdings are merely expected and not yet realized, banks' funding costs will increase to reflect growing concerns about the banks' solvency (Gertler and Kiyotaki, 2010). The second channel works through the use of sovereign bonds as collateral to secure wholesale funding: an increase in sovereign risk reduces the eligibility of government debt securities as collateral, with negative consequences for banks' funding costs.[6] In addition, sovereign stress

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[6] In the Eurosystem's refinancing operations, 20 percent of the transactions are secured by government bonds. Furthermore, in the euro area, the amount of outstanding repos in June 2010 was equivalent to 75 percent of GDP, with four fifths of the transactions collateralized by government bonds (Bank for International Settlements, 2011).

can reduce the implicit guarantees issued by the domestic government to the banking sector (Demirguc-Kunt and Huizinga, 2013). While disentangling these mechanisms is beyond the scope of this paper, they all imply that an increase in sovereign risk will affect negatively the funding position of exposed banks. Because higher funding costs lead banks to readjust the asset side of their portfolio, we expect a negative impact on access to finance for SMEs borrowing from such banks.

Our paper builds on a rapidly growing literature on how access to finance is affected by shocks to the banking sector. A major hurdle in this literature is distinguishing between supply and demand effects. Some papers exploit experiments that provide a natural laboratory to achieve identification (e.g., Peek and Rosengren, 1997; Khwaja and Mian 2008; Chava and Purnanandam 2011; Lin and Paravisini, 2013). Natural experiments, however, are hard to find – especially so during the current global crisis. Some papers have exploited observed substitution between the bank loan market and the capital market using instruments such as commercial paper (e.g., Kashyap et al., 1993) or corporate bonds (Becker and Ivashina, 2014). This strategy is not of much value in the SME sector because these firms don't access public debt markets. Another alternative is to use firm level data to estimate demand and supply equations in a disequilibrium model that identifies credit constrained borrowers (e.g., Carbo-Valverde et al., 2016; Kremp and Sevestre, 2013). Yet another strategy is to utilize credit registry data in those countries where it is common for SMEs to borrow from multiple banks. Firm fixed in this setting automatically controls for demand effects (e.g., Albertazzi and Marchetti, 2010; Jimenez et al., 2012; Iyer et al., 2014). In our paper we use an identification approach that measures supply effects directly from a firm-level survey dataset explicitly structured for this purpose. The availability of this type of data has made this approach quite productive in analysing the credit crunch in Europe during the financial crisis (e.g., Popov and Udell, 2012; Beck et al., 2014; Pigini et al., 2014; Presbitero et al., 2014). Our paper, however, is the first to use survey data to study the effect of sovereign stress on SMEs' access to finance.

Several recent papers have examined the effect of the euro area sovereign debt crisis on bank lending, showing that banks reduce lending to the private sector in response to shocks to

sovereign credit-worthiness. The reason can be direct balance sheet exposure to impaired sovereign debt (Correa, Sapriza, and Zlate, 2012; Ivashina et al., 2012; Bofondi et al., 2014; De Marco, 2014; Popov and Van Horen, 2015), spillover risk (Bedendo and Colla, 2014), or a sovereign debt ceiling policy whereby credit ratings agencies downgrade banks at the sovereign limit when the sovereign is downgraded (Adelino and Ferreira, 2014). Unlike our paper, these papers do not examine the impact of the sovereign debt crisis on the supply of credit to small firms, but instead focus on large corporates.

Another contribution of our paper is that in our analysis of the sovereign debt crisis, we look at access to finance both in the quantity and in the price dimension. Loan pricing effects have been considered in some other papers on the current global crisis (e.g., Santos, 2011), but most have confined their analysis to quantity effects (e.g., Ivashina and Sharfstein, 2010; Puri et al., 2011; Jimenez et al., 2012).[7,8]

Finally, ours is the first paper to examine the effect of shocks to the availability of bank lending on the overall capital structure of SMEs. Several recent papers have examined the effect of shocks to credit access on firms' use of trade credit (e.g., Ferrando and Mullier, 2015; Carbo-Valverde et al., 2015; Garcia-Apendini and Montoriol-Garriga, 2015). However, our data permit a broader analysis that includes the universe of financing sources used by SMEs, including equity, retained earnings, debt securities, trade credit, grants and subsidies, and loans from family and friends. This allows us to observe how SMEs substitute across funding sources over time in order to give us a more complete picture of the effect of sovereign stress on the overall cost of funding for small businesses.

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[7] Some firm-level survey data combine price and quantity effects in questions that ask whether the firm was "affected by the cost or availability of credit" (e.g., Campello et al., 2010).

[8] Non-price credit rationing, credit denials, and approving less than the loan request are all quantity effects (e.g., Stiglitz and Weiss, 1981).

The rest of the paper is organized as follows. Section 2 summarizes the data. Section 3 discusses the empirical strategy. Section 4 presents the empirical evidence on the effect of the sovereign debt crisis on credit access and firm financing. Section 5 concludes.

2.   Data

2.1.   Firm-level data

Our primary data source is the "Survey on the Access to Finance of Enterprises" (SAFE) that was started after the onset of the financial crisis in the euro area and run jointly by the ECB and the European Commission. In our analysis we exploit the first six waves of the survey: two waves (numbers 1 and 2) conducted before the sovereign crisis, one wave conducted while the sovereign crisis unfolded (number 3), and three waves conducted after the onset of the sovereign crisis (numbers 4 – 6). Waves 1 and 2 correspond to the period from 1st January until 31st December, 2009); wave 3 corresponds to the period from 1st April until 30th September, 2010); and, waves 4, 5, and 6 correspond to the period from 1st October 2010 until 31st March 2012. The SAFE is a firm-level survey that contains information on the characteristics (size, sector, autonomy, turnover, age, and ownership) the respondent firm and on the firm's assessment of recent short-term developments associated with its financing including its financing needs and its access to finance.[9] The sample contains only non-financial firms and excludes firms in agriculture, public administration, and financial services.

In our analysis, we use all of the waves, with the exception of wave 3, for a total of 38,747 observations and 28,453 firms. Most of the firms are interviewed only once in the survey but there is a small subsample of firms present in several waves. Table 1 reports descriptive statistics on the main variables of interest. All survey-based percentages are weighted statistics that restore the proportions of the economic weight (in terms of number of employees) of each

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[9] The ECB website publishes the survey's main results every six months. See
http://www.ecb.europa.eu/stats/money/surveys/sme/html/index.en.html for more information about the survey.

size class, economic activity, and country. [10] *Credit constrained*, our main dependent variable, is a dummy variable equal to 1 in four different cases: a) the firm's application for a bank loan or credit line in the past 6 months was denied (*Loan application denied*); b) the firm received less than 75 percent of the loan amount it requested (*Rationed*); c) the firm refused the loan offer because the rate was too high (*Refused due to high cost*); or d) the firm did not apply for a loan because it feared a rejection (*Discouraged from* applying).[11] The variable is equal to 0 if the firm's application for a bank loan or a credit line in the past 6 months was approved. Of the 18,152 firms with positive demand for credit,[12] 39 percent were on average credit constrained. Of these firms, 20 percent are discouraged from applying. Of the 11,112 that applied, 12 percent were denied a bank loan, 10 percent were rationed, and 3 percent refused the loan due to its high cost.

Table 1 also reports information on firm financing structure based on the qualitative survey responses. 55 percent of firms regularly use bank loans and credit lines, 33 percent use retained earnings, and 32 percent regularly resort to trade credit. Grants and subsidised loans—the most common measure implemented by governments during the financial crisis to induce banks to reopen their lending facilities—have been used by 3 percent of firm. Market-based sources of finance are less common among European firms. 6 percent of firms report using equity while only 3 percent use debt securities. Additionally, it is common especially among SMEs and young firms to rely more on internal rather than external funds: 35 percent of the firms confirmed the importance of these funds to finance their activities. Almost half of our sample (47 percent) includes firms in stressed countries (Greece, Ireland, Italy, Portugal, and Spain). The survey is mostly composed of SMEs: firms employing more than 250 employees comprise with less than 10 percent of the sample. The majority of firms are small with annual

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[10] The SAFE data oversamples firms in smaller countries.

[11] Merging formally and informally constrained borrowers has been standard in the literature since Jappelli (1990).

[12] I.e., the firm did not declare that it did not apply for bank credit "because of sufficient internal funds".

turnover less than EUR 2 million (47 percent). 27 percent have turnover between EUR 2 and 10 million. Firms are mostly individually or family-owned (77 percent) and independent (87 percent). Most of the firms in the sample are 10 or more years old (74 percent), and about 14 percent are between 2 and 10 years old. Finally, firms report that their outlook in terms of sales and profitability, their capital conditions, and their credit history. Between one-fifth and one-quarter report that their outlook was on average improving during the sample period.

Table 2 reports the dependent variable C*redit constrained* for the two sub-periods (pre-sovereign debt crisis and sovereign debt crisis) and across stressed and non-stressed countries. Overall the difference between the two groups of countries was 13 percent in the first period (i.e., 46 percent and 33 percent of firms reported being credit constrained in stressed non-stressed countries respectively) increasing to 21 percent afterwards (see also Chart 1).

2.2. Country data

Summary statistics for our country level variables that capture the macroeconomic conditions over the sample period are shown at the bottom of Table 1. Table 3 shows these same variables over the two sub-periods and across stressed and non-stressed countries.

We use four variables to distinguish between credit supply and demand. The first, the average cost of lending, ranges from a minimum of 2.4 percent to a maximum of 6.4 percent, reflecting high heterogeneity across euro area countries. Overall the cost of borrowing was lower in non-stressed countries versus stressed countries. Also, it declined over time for non-stressed countries but increased after the sovereign-debt crisis in stressed countries. The second variable is credit standards, taken from the euro area Bank Lending Survey (BLS), which summarizes the internal guidelines or criteria that reflect banks' lending policies.[13] Positive

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[13] The variable is calculated as the difference between the sum of the percentages of banks responding "tightened considerably" and "tightened somewhat" and the sum of the percentages of banks responding "eased somewhat" and "eased considerably". This variable is confidential for some of the euro area countries in our sample (Austria, Ireland, and Finland). Hence it will be used but not presented in the descriptive statistics.

figures indicate that more banks were tightening their credit conditions than easing them. In the period 2009-2012, about 12 percent of banks reported on net tightening their credit standards with some instances of easing (e.g., France, pre-sovereign debt crisis).

We capture real economic activity with variables for real GDP growth and the unemployment rate. Both indicators reached their worst values during the sample period. While on average GDP growth was shrinking by -0.8 percent across all countries and all periods, the ratio was more strongly declining in all euro area countries in the pre-sovereign debt period but recovering immediately afterwards in most non-stressed countries. In contrast, among stressed countries, real GPD only started to grow during the sovereign debt crisis in Ireland and, to a lesser extent, in Italy. GDP growth remained negative in the other stressed countries. In the third sub-period, all stressed countries reported negative GDP growth. The unemployment rate reached historically high levels in stressed countries (particularly in Spain where it reached 22 percent on average during the sovereign debt crisis period) while it remained much lower but stable in the non-stressed countries. We capture banks' perceptions of risk as it relates to general economic activity and bank credit standards with another variable taken from the BLS, the general economic outlook. Like credit standards, it is expressed as a net percentage, with higher values corresponding to higher perceptions of risk in each country. Finally we capture leverage in the financial system, private debt/GDP, calculated as the sum of debt securities and bank loans over GDP. Theoretical and empirical evidence suggests that excessive leverage sowed the seed for the financial crisis and conditioned the severity of the downturn in the euro area. In general, investment (and output) losses were commensurate with the intensity of private debt accumulation prior to the crisis. This was particular the case in Spain, Ireland and Portugal.[14]

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[14] ECB 2013 "Corporate finance and economic activity in the euro area".

3.   Empirical strategy and identification

We investigate the effects of sovereign stress on firms' financing by employing a difference-in-differences (DID) approach. Our treatment group consists of firms in the five countries with sovereign debt problems during the 2010–2012 period (Greece, Ireland, Italy, Portugal, and Spain—stressed countries). Our control group consists of firms in six non-stressed countries (Austria, Belgium, Finland, France, Germany, and the Netherlands). The two groups are of similar size, with the treatment group consisting of 18,304 observations (13,382 firms) and the control group consisting of 20,443 observations (15,071 firms).

The choice of groups is motivated by the fact that all countries in the treatment group experienced severe problems in accessing government bond markets over the sample period. In 2010, 10-year bond yields reached levels usually associated with a high probability of sovereign default: 1210 basis points (Greece), 950 basis points (Ireland), 470 basis points (Italy), 750 basis points (Portugal), and 550 basis points (Spain). European policy makers recognized the severity of the sovereign problems in these five countries. Greece received a bailout from the EC and the IMF in May 2010, Ireland received one in November 2010, and Portugal agreed on a bailout in May 2011. As mentioned above, the European Central Bank instituted the SMP whereby in May 2010 it started buying (in secondary markets) Greek, Irish, and Portuguese government debt, and in August 2011 it intervened in Italian and Spanish debt markets, too. For comparison, yields on 10-year government bonds for the six countries in the control averaged 340 basis points at the end of 2010, similar to yields on 10-year US treasury bills.

We use two sources of identifying variation in our analysis: the time before and after the beginning of the euro area sovereign debt crisis, and the cross section of firms affected and not affected by the crisis because of sovereign stress. We estimate the following model:

$$\Pr ob(Credit\_constrained_{isct} = 1) = \varphi(\beta_1 Post_t \times Stressed_{isc} + \beta_2 X_{isct} + \beta_3 \phi_{sc} + \beta_4 \eta_t + \varepsilon_{isct}) \qquad (1)$$

In our main tests, $Credit\_constrained_{isct}$ is a dummy variable equal to 1 in the following cases: if the firm's application for a bank loan or credit line was denied; if the firm received less

than 75 percent of the loan amount it requested; if the firm refused the loan offer because the cost was too high; or if the firm was discouraged from applying. Consequently, it is equal to 0 if the firm applied for a bank loan or a credit line in the past 6 months, and its application was approved, it got at least 75 percent of the requested amount, and the cost was "favorable". In robustness tests, we employ different proxies for credit market experience, as well as variables that capture other types of firm financing. $Stressed_{isc}$ is a dummy variable equal to 1 if firm i in sector s is domiciled in country c which belongs to the group of stressed countries (Greece, Ireland, Italy, Portugal, and Spain), and to 0 otherwise.[15] $Post_t$ is a dummy variable equal to 1 between 1st October 2010 and 31st March 2012 (waves 4, 5 and 6), and to 0 between 1st January and 31st December, 2009 (waves 1 and 2). We do not use information from the SAFE wave that took place in 1st April and 31st September 2010 (wave 3) because this is an interim period over the course of which the sovereign debt crisis started unfolding. X_{isct} is a vector of time-varying firm-level control variables; ϕ_{sc} is an interaction of sector and country fixed effects; η_t is a time fixed effect which corresponds to each survey wave; and ε_{isct} is an i.i.d. error term. $Stressed_{isc}$ and $Post_t$ are not included in the specification on their own because the effect of the former is subsumed in the matrix of sector-country fixed effects, and the effect of the latter is subsumed in the time fixed effects.

The coefficient of interest is β_1. In a classical DID sense, it captures the change in access to finance from the pre-treatment to the post-treatment period, for the treatment group (firms domiciled in countries experiencing sovereign stress) *relative to* the control group (firms domiciled in countries not experiencing sovereign stress). A positive coefficient β_1 would imply that all else equal, access to finance deteriorated more for firms in stressed countries.

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[15] While Belgium did not experience sovereign stress to the same extent as Greece, Ireland, Italy, Portugal, and Spain, yields on 10-year Belgian government bonds briefly breached the 400-basis-points threshold, and one of its bank (Dexia) was devastated by its exposure to Greek sovereign debt, ultimately necessitating government intervention. The main results of this paper are not changed by dropping Belgian SMEs from the sample, or by re-classifying them as "affected" (results available upon request).

The model is saturated to provide additional identification of the credit supply effect of sovereign stress. The vector of firm-specific variables X_{isct} controls for credit demand by capturing the independent impact of firm-level heterogeneity related to size, age, turnover, ownership structure, etc. Evidence in the literature points to a negative relation between profitability and the demand for external funds (Almeida and Campello, 2010). Consequently larger and older firms, whose projects have matured, are expected to have a lower demand for external financing. Interactions of sector and country fixed effects and year fixed effects are also included. The inclusion of the former is aimed at eliminating variation in access to finance that is specific to a particular industry in a particular country (e.g., Spanish construction during the housing bust). The inclusion of the latter is aimed at alleviating concerns that variation in credit access is driven by global shocks that are common to all firms (e.g., a global repricing of risk).

Our main sample period is January 1st 2009 – March 31st, 2012 (waves 1–6). The end date captures the period of the sovereign debt crisis right up to the ECB's announcement of the OMT Program in July 2012. The model is estimated using probit and standard errors are clustered at the country level. The combination of firm-level characteristics and various fixed effects addresses the concern that our estimates can be contaminated by shocks to credit demand unrelated to the supply of credit. For example, while agency cost problems may have become more severe and/or growth opportunities may have deteriorated more for firms domiciled in stressed countries, this should be accounted for by the firm-specific information and by the country-sector fixed effects.

4.   The impact of sovereign stress on credit access and firm financing

4.1.   Main result

We first present the empirical results from the estimation of Model (1) where we test for the effect of sovereign stress on access to finance by comparing the change in credit access for firms in stressed countries vs. firms in non-stressed countries. In column (1) of Table 4 we

report a version of Model (1) with firm-specific covariates, but without sector-country and time fixed effects. The data strongly reject the hypothesis that sovereign stress has no effect on credit access. The effect is significant at the 5 percent statistical level, and economically meaningful, too. The point estimate on the interaction term is 0.079. Given that 35 percent of the firms in the sample are either denied credit, quantity or price rationed, or discouraged from applying because they anticipate a rejection (see Table 1), this implies a 22.6 percent higher probability of being credit constrained for a firm in a stressed country relative to an otherwise identical firm in a non-stressed country in the period after the sovereign debt crisis unfolded.

A number of the firm-level covariates have the expected sign. For example, micro firms and firms with low turnover are more likely to be denied credit, potentially because they are more opaque and/or because they (or their entrepreneurs) have less collateral (e.g., Berger and Udell 1998, 2006). Older firms are less likely to be denied credit, potentially because of their lower informational opacity (Berger and Udell, 1995; Cole 1998). Finally, firms whose outlook or credit history improved in the past 6 months are less likely to be credit constrained than firms whose outlook or credit history deteriorated or did not change, implying that banks use both soft and hard information in their credit granting decisions. Whether the firm is a subsidiary or a stand-alone firm, whether it is individually-owned or family-owned rather than exhibiting a different ownership pattern, as well as the gender of the firm owner, does not seem to matter for credit access.

In column (2), we add country-industry and time fixed effects. Once again, after firm size, age, gender of the owner, turnover, ownership, growth prospects, collateral quality, and credit history are accounted for, sovereign stress continues to exhibit a significant negative effect on firms' credit access. The point estimate now implies a 35 percent higher probability of being credit constrained for a firm in a stressed country relative to an otherwise identical firm in a non-stressed country in the period after the sovereign debt crisis unfolded.

4.2. Components of credit constraints

In our regressions in Table 4 we proxy for credit access with a dummy variable equal to 1 if the firm is rejected, quantity rationed, price rationed, or discouraged from applying. This is similar to other papers in the literature that use survey data to study credit access (Jappelli, 1990; Cox and Japelli, 1993; Duca and Rosenthal, 1993; Popov and Udell, 2012; Ongena et al., 2013; Ferrando and Mulier, 2015). This dummy reflects both *formal* and *informal* credit constraints. However, the components of this proxy for credits are important in their own right. But, much of the empirical literature that studies the bank lending channel uses data from credit registries (e.g., Jimenez et al., 2012; Ioannidou et al., 2015) that are necessarily confined to only considering formal constraints and that offer little room for alternative proxies for credit access. Specifically, these studies are confined to an empirical proxy based exclusively on whether the firm's credit application has been accepted or denied by its bank. Recent evidence, however, suggests that informal credit constraints may be even more important in some countries than formal ones (Brown et al., 2011), and that these informal constraints can vary systematically across countries in ways that can lead to biased results (Popov, 2015). Moreover, theory draws a distinction between credit supply adjustments on the quantity dimension versus the price dimension, and where credit rationing emerges in equilibrium in markets characterized by information asymmetry between borrowers and lenders that prevents interest rates from equilibrating the market (Jaffee and Russell, 1976; Stiglitz and Weiss, 1981).

In order to address these issues, we split the *Credit constrained* variable into its four components using four separate dummy variables: *Loan application denied*; *Rationed*; *Refused due to high cost*; and *Discouraged from applying* (using the same definitions for each as before). The results from these new regressions are shown in Table 5. These results show that most of the increase in overall credit constraints is due to quantity and to price rationing: firms in stressed countries are 8.6 percentage points more likely to receive less than 75 percent of the requested loan amount after the start of the crisis than similar firms in non-stressed countries (column (2)). In addition to that, such firms are 5 percentage points more likely to be price rationed in that they refuse the loan offer because of its high cost (column (3)). Firms are also more likely to be discouraged from applying (column (4)), but this effect is not significant.

Interestingly, firms in stressed countries are no less likely to receive the full amount of credit requested than firms in non-stressed countries (column (1)). Our results imply that while some of the shock to banks' balance sheets is passed on through price adjustment, asymmetric information problems may have become more severe in some lender-borrower relationships (e.g., due to an increased borrower opacity), leading to adjustments in lending on the non-price dimension, too (i.e., credit rationing).

4.3. Robustness

We next proceed to address a number of non-trivial concerns about our empirical model. For a start, although our DID specification allows us to control for omitted variables that affect both the treatment and the control group in a similar manner, identification of the causal effect requires controlling for any systematic shocks to the treatment group, that is, controlling for other shocks that might be correlated with the financial sector's exposure to sovereign stress. For example, it might be the case that growth opportunities in different countries changed around the time the sovereign debt crisis unfolded, or that constraints related to firm-specific net worth tightened differently across the treatment and the control group.

We address this concern by controlling for such shocks explicitly. First, we augment our regression specification to include an interaction of country and time dummies, as well as of sector and time dummies. This is a nonparametric way of controlling for time-varying shocks that are specific to a country (e.g., Greece) or to a sector (i.e., construction after the bust of the housing bubble). Column (1) of Table 6 reports that the point estimate for the effect of the sovereign debt crisis on credit access actually increases relative to column (2) of Table 4, to 0.2523. The estimate remains statistically significant, at the 1 percent level.

Second, we include interactions of all firm-specific variables with the Post dummy (column (2)). This procedures aims at accounting for the possibility that the effect of various proxies for net worth is time-varying and our main explanatory variable may be picking part of it. We find that while the magnitude of the main effect declines somewhat relative to column (2) of Table 4, it is once again significant at the 1 percent statistical level.

We next note that the key identifying assumption of our DID approach is that in the absence of shocks to sovereign creditworthiness, firms in all countries would be subject to the same trend in credit access. This need not be the case: for example, the break in trends implied by the estimates in Table 4 may have started already during the global financial crisis of 2008-09 for reasons unrelated to sovereign stress, such as higher financial sector or corporate leverage in stressed countries. For example, two countries in our treatment group, Ireland and Spain, experienced significant housing booms during the early-to-mid 2000s causing severe problems in their banking sectors once the financial crisis unfolded in 2008.

We take advantage of the fact that our data allow us to test this assumption explicitly. Wave 1 of the SAFE took place between 1st January and 30th June 2009, while the second wave took place between 1st July and 31st December 2009. Because both survey waves took place before the sovereign debt crisis unfolded, we can apply our DID strategy to test for differences in credit access trends across firms in stressed versus non-stressed countries between SAFE waves 1 and 2. If the estimate of β_1 is once again positive and significant, we would conclude that the break in trends recorded in Table 3 predates the sovereign debt crisis. The estimate from this regression, reported in column (3) of Table 6, implies that in the fall of 2009, firms in stressed countries were *less* likely to be denied credit, compared with firms in non-stressed countries and relative to the spring of 2009, and this effect is significant at the 1 percent statistical level. This placebo test thus confirms that the deterioration in credit access we observe did not predate the sovereign debt crisis.

One other consideration is related to the fact that Greece is an outlier in the sample: it is the only country to have effectively been shut out of international bond markets and to have experienced a quasi-default when private investors were asked in February 2012 to accept a write off equal to 53.5 percent of the face value of Greek governmental bonds. We therefore test if our results are robust to the exclusion of Greek firms from the sample. The evidence reported in column (4) of Table 6 confirms that this is the case.

So far, we have attempted to identify a credit supply shock related to the sovereign debt crisis by comparing firms in countries affected by the crisis to firms in unaffected countries,

accounting for shocks to credit demand by including an exhaustive list of firm-specific characteristics and a wide range of fixed effects. Arguably, a number of other developments may have affected the supply of credit by banks. For example, high unemployment and/or low GDP growth may signal a higher risk of corporate default in the future and hence deter banks from lending. Alternatively, high levels of private debt may reduce credit supply because banks incorporate in their pricing the deterioration of growth opportunities in an environment of private debt overhang, especially for firms with low growth opportunities (Lang et al., 1996).

Column (5) of Table 6 tests a version of Model (1) where we replace the interaction *Stressed×Post* with a range of country-specific time-varying variables that capture aspects of both credit supply and credit demand. In order to capture shocks to the credit supply, we use data on the average cost of lending to non-financial companies, and also data from the ECB's BLS in which banks report, on a quarterly basis, changes in their credit standards *related to their own balance sheets.* Both measures increased more for stressed countries during the sovereign debt crisis (see Table 3). The evidence suggests that the cost of lending is significantly and positively correlated with credit constraints at the firm level, implying that firms in need of bank credit were less likely to have access to such in countries where the cost of lending increased and credit standards tightened relatively more. We also use proxies that capture aspects of credit demand. In particular, we include real GDP growth, the level of unemployment, the banks' estimate of the general economic outlook reported in the ECB's BLS, and the private debt-to-GDP ratio. Some of the latter have a significant effect on credit access, too, in particular, the unemployment rate and the level of private sector debt.

The evidence from these tests confirms that the tightening of credit standards related to banks' own problems continues to exhibit a strong statistically significant effect on SMEs' credit access, implying that the underlying reasons for the observed changes in credit access are not limited to negative shocks to credit demand. Nevertheless, it does suggest that aggregate developments can affect credit demand. Therefore, our findings can be consistent with a mechanism where firms' balance sheet strength drives the allocation of loanable funds (Ashcraft and Campello, 2007) -- more so in stressed countries where the growth prospects or

creditworthiness of firms has worsened relatively more. If such a divergence in firm prospects, collateral quality, or creditworthiness has resulted in distributions that do not overlap sufficiently across stressed and non-stressed countries, then Model (1) may yield biased estimates.

We address this point formally in column (6) of Table 6. We first isolate the most profitable and creditworthy firms by focusing on the sample of firms which reported that their own growth outlook *and* the quality of their collateral *and* their credit history *improved* over the course of the past 6 months. There are 648 firms in the dataset with full balance sheet information that report an improvement along all three dimensions after the sovereign debt crisis started, about a quarter of which are domiciled in stressed countries. Then we re-run our main test on the sub-samples of firms that improved along all dimensions. The estimates strongly reject the hypothesis that the reduction in credit access we recorded so far is driven by systematic changes in the composition of credit demand and/or quality that we have somehow failed to capture: even the most creditworthy firms in stressed countries continue to be relatively more likely to be denied credit after the sovereign debt crisis started.[16]

4.4. Exploiting firm heterogeneity

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[16] One remaining concern is related to selection, that is, the fact that firms which apply for credit or are discouraged to do so are a non-random sample of the population of firms. To address this issue, we employ a two-stage Heckman model where in the first stage, we account for the fact that the sample of firms that declare a positive need for bank credit (and hence apply or not, or report being discouraged or not) excludes the firms which do not apply for credit because they have enough internal funds. Essentially, we use information from firms that do not need credit to account for the selection of firms into the second-stage sample. The variable *Competition*, measuring the severity of the product competition the firm faces (on a scale of 1 to 10) is included in the first stage (credit demand), but not in the second stage (credit supply). We believe that the exclusion restriction is satisfied because firms that are hit by an unexpected liquidity shock, due for example to weak profits, will have a higher demand for bank credit, without necessarily affecting the bank's likelihood to grant the firm a loan. The inverse Mills' ratio from the first-stage is included in the second stage. See Ongena et al. (2013) for a more in-depth discussion in a similar context. The results from this test are reported in Appendix Table 2, and they confirm that firms in stressed countries were more likely to experience deterioration in credit access after the start of the sovereign debt crisis.

We now address the question: Which firms suffer most when credit access deteriorates? Theory suggests that banks can adopt two different strategies when readjusting their portfolios away from lending. The first one is a flight to quality in lending, whereby banks reduce credit mostly to borrowers facing high agency costs (Bernanke et al., 1996), or more specifically, to firms that are informationally opaque and/or risky (see Albertazzi and Marchetti, 2010, for recent evidence). One version of this phenomenon is the "flight home" effect (e.g., Giannetti and Laeven, 2012; De Haas and van Horen, 2013; Popov and Van Horen, 2015),[17] whereby banks with international operations withdraw relatively more from foreign markets and stick to their domestic relationships. The second one is an overall reduction in credit whereby banks increase credit to the riskiest firms as part of a broader "gambling for resurrection" strategy (Freixas et al., 2003).[18] Empirical evidence has provided support for both mechanisms (e.g., Caballero et al., 2006; De Haas and Van Horen, 2013).

To test the above hypotheses, we choose several firm-specific characteristics which are both theoretically justified and empirically common proxies for firms' risk. The first is firm size: relative to large firms, small firms tend to have more uncertain projects, lower quality collateral, and a higher probability of suffering an involuntary death—although the empirical evidence on this is mixed (e.g., Jovanovic, 1982; Phillips and Kirchhoff, 1989; Agarwal and Gort, 1996; Agarwal, 1996, 1997; and Ghosal and Loungani, 2000).[19] Empirical evidence has shown that better access to finance is disproportionately more important for small firms (e.g., Cetorelli and Strahan, 2006; Beck et al., 2008), and so credit constraints are usually more detrimental to small firms. The second set of proxies is related to the firms' own assessment of their quality

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[17] This home bias has also been found in single country analysis where lenders during this crisis reduced the supply of credit to functionally distant companies (Presbitero et al., 2014).

[18] See Akerlof and Romer (1993) for empirical evidence of gambling for resurrection.

[19] While we are not aware of any direct evidence on this issue of whether small SMEs have lower quality collateral, indirect evidence suggests that this is the case. For example, an analysis of the probability that small business will pledge collateral finds a positive relationship with firm asset size (Berger and Udell 1995).

and prospects: whether their own outlook improved over the past 6 months; whether the quality of their fixed assets, and hence value as collateral, improved over the past 6 months; and whether their credit history improved over the past 6 months. The full set of proxies are chosen to capture different aspects of risk: the effect of size conditional on firm quality, and the effect of firm quality conditional on size.

In order to gauge the differential impact of the sovereign crisis on firms of different riskiness in stressed countries, we estimate a difference-in-difference-in-differences model whereby we create a triple interaction $Post_t \times Stressed_{isc} \times Risk_{isc}$, where $Risk_{isc}$ is any of the four proxies for firm risk discussed above. We also include all other variables from Model (1), as well as all double interactions. The coefficient on the triple interaction measures the difference in credit access, after the crisis started, between risky and non-risky firms, in stressed countries, relative to non-stressed countries.

Table 7 reports the estimates from this modification of our main test, for all definitions of credit constraints. We find that large firms are *more* likely than small firms to be credit constrained in stressed countries than in non-stressed countries (column (1)), mostly because they are more likely to be rationed (column (3)). We also find that firms with better capital are *more* likely to be price rationed (column (4)), and firms with better credit history are *more* likely to be discouraged from applying (column (5)) in stressed countries after the crisis started. To the extent that unconditional firm quality increases in firm size, this fact is inconsistent with a flight-to-quality strategy by banks. The only suggestion of a flight-to-quality effect, is the fact that firms with better credit history are less likely to be price rationed (column (4)). We thus mostly reject the hypothesis that faced with deteriorating balance sheets, banks in stressed countries exhibit a flight to safety by lending relatively less to credit-unworthy borrowers. This is consistent with a study of Italian firms that also found evidence inconsistent with a flight to quality during the crisis (Presbitero et al., 2014).

4.5. Firm financing

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Having determined that access to credit tightened in stressed countries, we now proceed to test for changes in financing patterns induced by the reduction in bank lending. Firms in the SAFE were asked to give a yes/no answer to questions on whether they used an exhaustive range of funding sources: bank loans, equity, retained earnings, corporate bonds and debt securities, trade credit, and government support in the form of direct subsidies or subsidized loans.

This test serves two important purposes. First, it aims to illustrate substitution patterns across funding sources in the presence of a shock to one of them (bank credit). The literature has provided evidence of a pecking order in funding, whereby cheaper sources of funding (such as bank loans and debt securities) are preferred to more expensive sources. For example, Petersen and Rajan (1994, 1997) argue that small businesses only use trade credit if bank loans are unavailable. Nevertheless, very few data sources are rich enough to provide a full picture of substitution across the full range of possible funding sources. Second, in light of the differences in cost implied by substitution across the pecking order, this test may provide insight into the change in the overall cost of external finance driven by a tightening in credit.

Formally, we re-estimate Model (1) replacing the proxy for credit access with dummies for the various sources of funding that firms indicated they used in the past 6 months. Table 8 reports these estimates. We find that firms respond to the tightening of external finance by being more likely to issue debt securities in order to cover their financing needs (column (3))[20]. This is the only statistically significant response by business firms to the tightening of credit standards. Firms in stressed countries also use more retained earnings (column (1)), less equity (column (2)), more trade credit (column (4)), and more subsidized loans and government grants (column (5), but all these effects are insignificant.

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[20] This finding is related to the evidence on the substitutability between bond and bank finance in Massa and Zhang (2013) and in Becker and Ivashina (2014), however, these papers only look at the behaviour of large listed firms which issue corporate bonds.

Overall, the evidence implies that while in normal times firms prefer to use cheaper funding sources, such as bank loans, firms have not been able to tap into a wide range of alternative funding sources, with the exception of debt securities. We conclude that as a result of the crisis, not only has the amount of overall financing available to firms declined, but it is also likely that the overall cost of funding has increased, with potentially negative implications for firms' real investment decisions.

5.   Conclusion

We examine the effects of sovereign stress on SMEs' access to finance. In particular, we investigate whether firms in stressed euro area countries experience a disproportionately higher reduction in access to bank credit during the euro area sovereign debt crisis, relative to similar firms in non-stressed countries. We also study whether shocks to access to finance are associated with a flight to quality in lending. Finally, we examine the adjustment of the capital structure of small businesses in response to shocks to credit access. We do so by comparing credit access for firms in five euro area countries that experienced sovereign debt stress to firms in six euro area countries that did not, using a restricted-access firm-level survey dataset that spans the pre-crisis, crisis, and post-crisis periods. Most of the extant literature has only examined the impact of the credit crunch in single-country studies (e.g., Jimenez et al., 2012; Iyer et al., 2014; Presbitero et al., 2014). While there exist cross-country analyses of SME access to finance using firm-level data in Europe (e.g., Popov and Udell, 2012; Beck et al., 2014), ours is the first paper to study the impact of sovereign stress on SMEs' credit access and overall capital structure.

We find that sovereign stress has a large negative supply-driven impact on access to finance even after controlling for a wide variety of firm characteristics, as well as for country and industry fixed effects. This result survives a number of robustness checks that control for systematic shocks to the treatment group (i.e., firms in stressed countries), for trends that predate the crisis, for alternative proxies for credit access, and for a wide range of proxies for firm credit-worthiness. We also find that less creditworthy firms are not more likely to be credit

constrained, suggesting no flight to quality in lending. Finally, we find that firms in stressed countries are more likely to issue debt securities in response to deteriorating credit access, but this effect does not have large macroeconomic implications as most SMEs do not have access to this source of funding. Moreover, our results imply that operating through the bank lending channel the sovereign debt crises likely could have had a significant indirect negative real effect on the economy to the extent that constraints on firm access to finance ultimately led to a contraction in firm capital expenditures and employment.

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Figure 1. Credit constrained firms across stressed and non-stressed countries
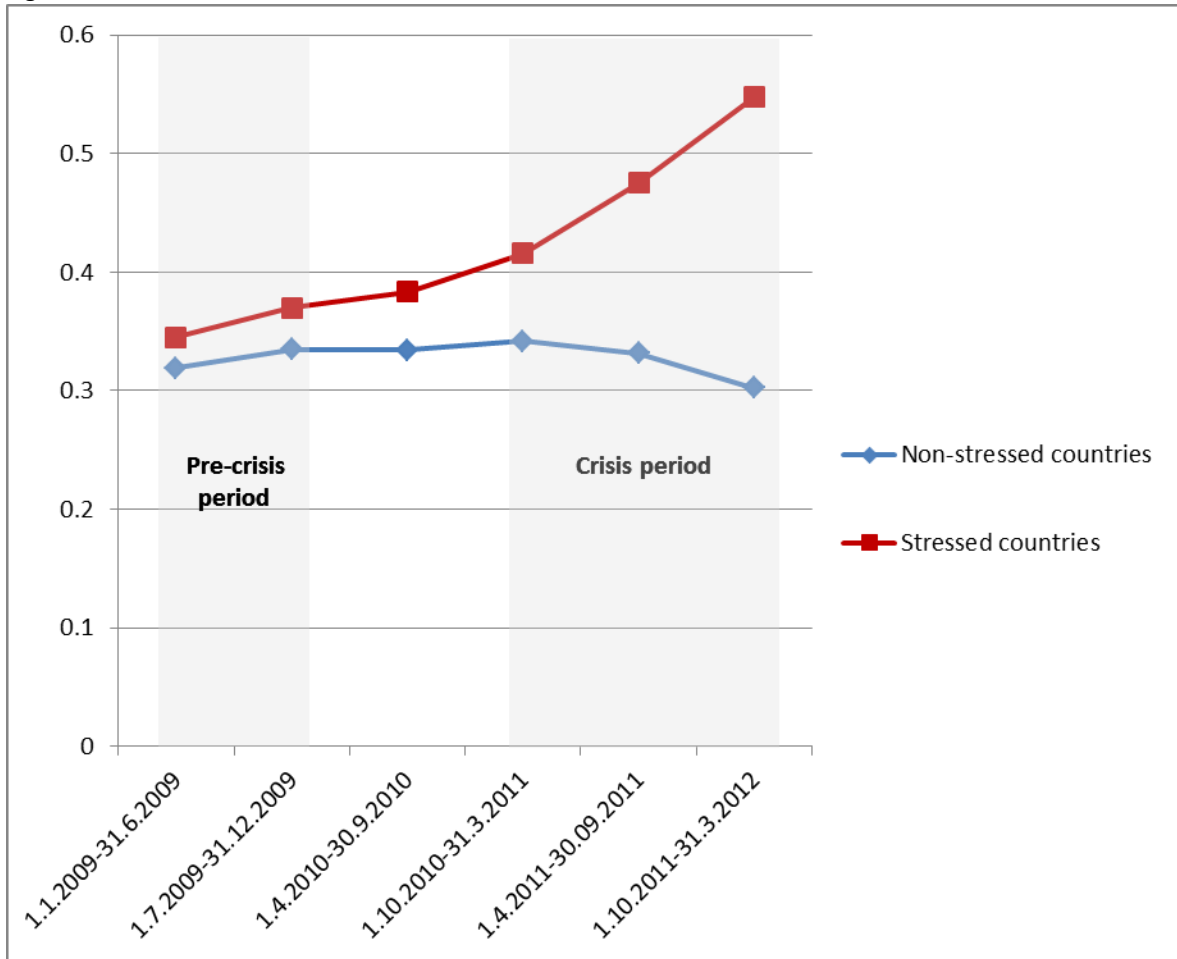
Note: The Chart summarizes weighted averages of credit constrained firms over the sample period. 'Credit constrained' is a dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 6 months, but it did not apply because of possible rejection, it applied and its loan application was rejected, it applied and got less than 75% of the requested amount, or it refused the loan because the cost was too high. 'Stressed countries' are Greece, Ireland, Italy, Portugal, and Spain. 'Non-stressed countries' are Austria, Belgium, Finland, France, Germany, and the Netherlands.

Table 1. Summary statistics

Variable	Observations	Mean	St. dev.	Min	Max
Access to finance					
Credit constrained	13,950	0.39	0.49	0	1
Loan application denied	11,659	0.12	0.32	0	1
Rationed	11,659	0.10	0.30	0	1
Refused due to high cost	11,659	0.03	0.18	0	1
Discouraged from applying	13,950	0.20	0.40	0	1
Bank loan or credit line	38,747	0.55	0.50	0	1
Equity	38,319	0.06	0.24	0	1
Retained earnings	38,299	0.33	0.47	0	1
Debt securities	38,158	0.03	0.16	0	1
Trade credit	38,433	0.32	0.47	0	1
Grants or subsidies	38,129	0.03	0.16	0	1
Other loans	38,445	0.13	0.33	0	1
Firm characteristics					
Stressed	38,747	0.47	0.50	0	1
Stand-alone firm	38,714	0.87	0.34	0	1
Individual- or family-owned	33,135	0.77	0.42	0	1
Female owner	33,073	0.13	0.33	0	1
Size_1	38,747	0.34	0.47	0	1
Size_2	38,747	0.33	0.47	0	1
Size_3	38,747	0.26	0.44	0	1
Size_4	38,747	0.07	0.27	0	1
Age_1	37,429	0.03	0.16	0	1
Age_2	37,429	0.09	0.28	0	1
Age_3	37,429	0.14	0.34	0	1
Age_4	37,429	0.74	0.43	0	1
Turnover_1	37,383	0.47	0.50	0	1
Turnover_2	37,383	0.27	0.44	0	1
Turnover_3	37,383	0.18	0.38	0	1
Turnover_4	37,383	0.08	0.27	0	1
Outlook better	36,603	0.21	0.40	0	1
Capital better	38,083	0.24	0.42	0	1
Credit history better	36,710	0.20	0.40	0	1
Country characteristics					
Cost of lending	38,747	3.46	0.99	1.90	6.85
Credit standards	38,747	16.56	26.01	-25.00	100.00
GDP growth	38,747	-0.47	3.36	-9.61	5.46
Unemployment rate	38,747	10.45	5.19	3.36	23.11
General economic outlook	38,747	25.83	29.32	-30.00	100.00
Private debt / GDP	38,747	65.56	19.20	39.83	104.78

Note: This table presents weighted summary statistics for the variables used in the empirical tests. The weights restore the proportions of the economic weight (in terms of number of employees) of each size class, economic activity and country and are applied to the variables derived from the survey. 'Credit constrained' is a dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 6 months, but it was

discouraged from applying because it believed it would be rejected, or it applied but its loan application was denied, or it applied and got less than 75% of the requested amount (i.e., quantity rationed), or it refused the loan because the cost was too high (i.e., price rationed). 'Loan application denied', 'Rationed', 'Refused due to high cost', and 'Discouraged from applying' are dummy variables for each individual component that are equal to 1 if in the past 6 months the firm was, respectively, denied an application, quantity rationed, price rationed, or discouraged from applying. 'Bank loan or credit line' is a dummy variable equal to 1 if in the past 6 months the firm used a bank loan or a credit line. 'Equity' is a dummy variable equal to 1 if in the past 6 months the firm used equity financing to finance its day-to-day operations. 'Retained earnings' is a dummy variable equal to 1 if in the past 6 months the firm used retained earnings to finance its day-to-day operations. 'Debt securities' is a dummy variable equal to 1 if in the past 6 months the firm used debt securities to finance its day-to-day operations. 'Trade credit' is a dummy variable equal to 1 if in the past 6 months the firm used trade credit to finance its day-to-day operations. 'Grants or subsidies' is a dummy variable equal to 1 if in the past 6 months the firm used government grants or subsidized bank loans to finance its day-to-day operations. 'Other loans' is a dummy variable equal to 1 if in the past 6 months the firm used loans from a related company or shareholders or from family and friends. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Italy, Portugal, or Spain. 'Stand-alone firm' is a dummy variable equal to 1 if the firm is an autonomous profit-oriented enterprise. 'Individual- or family-owned' is a dummy variable equal to 1 if the firm's owner is an individual or a family. 'Female owner' is a dummy variable equal to 1 if the primary owner is a female. 'Size_1' is a dummy variable equal to 1 if the firm has between 1 and 9 employees. 'Size_2' is a dummy variable equal to 1 if the firm has between 10 and 49 employees. 'Size_3' is a dummy variable equal to 1 if the firm has between 50 and 249 employees. 'Size_4' is a dummy variable equal to 1 if the firm has 250+ employees. 'Age_1' is a dummy variable equal to 1 if the firm is less than 2 years old. 'Age_2' is a dummy variable equal to 1 if the firm is between 2 and 5 years old. 'Age_3' is a dummy variable equal to 1 if the firm is between 5 and 10 years old. 'Age_4' is a dummy variable equal to 1 if the firm is 10+ years old. 'Turnover_1' is a dummy variable equal to 1 if the firm's annual turnover is less than €2 mln. 'Turnover_2' is a dummy variable equal to 1 if the firm's annual turnover is between €2 mln. and €5 mln. 'Turnover_3' is a dummy variable equal to 1 if the firm's annual turnover is between €5 mln. and €10 mln. 'Turnover_4' is a dummy variable equal to 1 if the firm's annual turnover is €10+ mln. 'Outlook better' is a dummy variable equal to 1 if the firm's outlook, with respect to sales, profitability, and business plan, improved in the past 6 months. 'Capital better' is a dummy variable equal to 1 if the firm's capital improved in the past 6 months. 'Credit history better' is a dummy variable equal to 1 if the firm's credit history improved in the past 6 months. 'Cost of lending' is calculated by aggregating short and long-term bank interest rates for loans to non-financial corporations using a 24-month moving average of new business volumes. The figures are averages of monthly data for each survey round. 'Credit standards' summarize the internal guidelines or criteria that reflect a bank's lending policy. They are defined as the difference between the sum of the percentages of banks responding "tightened considerably" and "tightened somewhat" and the sum of the percentages of banks responding "eased somewhat" and "eased considerably". 'GDP growth' is the annual growth rate of real GDP based on averages of quarterly data for each survey round. 'Unemployment rate' is the annual unemployment rate based on averages of quarterly data for each survey round. 'General economic outlook' summarises banks' perceptions of risk related to the general economic activity as a factor affecting their decisions when setting the credit standards. It is defined as the difference between the sum of the percentage of banks responding "contributed considerably" and "contributed somewhat" and the sum of the percentage of banks responding "contributed somewhat" and "contributed considerably". 'Private debt / GDP' is the ratio of debt securities and bank loans of the private sector to GDP, based on averages of quarterly data.

Table 2. Credit constraints, by country and time period

| | Credit constrained | |
Country	1st January 2009 – 31st December 2009 (waves 1-2)	1st October 2010 – 31st March 2012 (waves 4-6)
Stressed		
Spain	0.52	0.48
Greece	0.52	0.65
Ireland	0.47	0.57
Italy	0.39	0.39
Portugal	0.43	0.45
Total	0.46	0.48
Non-stressed		
Austria	0.23	0.19
Belgium	0.39	0.29
Germany	0.32	0.21
Finland	0.22	0.23
France	0.25	0.30
Netherlands	0.65	0.56
Total	0.33	0.27

Note: This table presents summary statistics, by country and time period, of the probability of the firm's loan application being rejected by the bank. Summary statistics are weighted means. 'Credit constrained' is a dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 6 months, but it was discouraged from applying because it believed it would be rejected, or it applied but its loan application was denied, or it applied and got less than 75% of the requested amount, or it refused the loan because the cost was too high.

Table 3. Country characteristics, by country and time period

	Cost of lending		Credit standards	
	1st January 2009 – 31st December 2009 (waves 1-2)	1st October 2011 – 31st March 2012 (waves 4-6)	1st January 2009 – 31st December 2009 (waves 1-2)	1st October 2011 – 31st March 2012 (waves 4-6)
Country				
Stressed				
Spain	2.8	3.6	15.0	1.7
Greece	2.6	6.4	45.0	33.3
Ireland	3.6	4.0	c.d.	c.d.
Italy	2.4	3.7	18.8	18.8
Portugal	2.9	6.0	45.0	86.7
Non-stressed				
Austria	2.8	2.7	c.d.	c.d.
Belgium	2.6	2.7	12.5	0.0
Germany	3.6	3.4	14.4	-4.4
Finland	2.4	2.6	c.d.	c.d.
France	2.9	3.0	10.1	7.6
Netherlands	3.0	3.0	55.0	8.3

	GDP growth		Unemployment rate	
	1st January 2009 – 31st December 2009 (waves 1-2)	1st October 2011 – 31st March 2012 (waves 4-6)	1st January 2009 – 31st December 2009 (waves 1-2)	1st October 2011 – 31st March 2012 (waves 4-6)
Country				
Stressed				
Spain	-3.8	-0.1	17.9	21.6
Greece	-3.2	-7.6	9.6	18.0
Ireland	-6.4	1.7	12.0	14.8
Italy	-5.5	0.5	7.8	8.7
Portugal	-2.9	-1.0	10.5	13.1
Non-stressed				
Austria	-3.4	2.5	4.8	4.1
Belgium	-2.8	1.6	7.9	7.3

Country				
Germany	-5.1	3.2	7.8	6.0
Finland	-8.5	3.0	8.2	7.8
France	-2.9	1.9	9.1	9.2
Netherlands	-3.6	0.8	3.7	4.5

	General economic outlook		Private credit / GDP	
Country	1st January 2009 – 31st December 2009 (waves 1-2)	1st October 2011 – 31st March 2012 (waves 4-6)	1st January 2009 – 31st December 2009 (waves 1-2)	1st October 2011 – 31st March 2012 (waves 4-6)
Stressed				
Spain	32.0	16.7	90.5	87.5
Greece	65.0	73.3	47.1	41.6
Ireland	65.0	46.7	98.7	100.7
Italy	31.3	31.3	61.1	63.3
Portugal	75.0	96.7	93.9	95.4
Non-stressed				
Austria	30.0	13.3	71.1	71.5
Belgium	18.8	8.3	40.7	41.6
Germany	23.3	-4.5	44.3	40.8
Finland	43.8	25.0	45.9	46.8
France	31.7	10.0	61.2	63.7
Netherlands	54.2	2.1	73.0	76.7

Note: This table presents summary statistics, by country and time period. 'Cost of lending' is calculated by aggregating short and long-term bank interest rates for loans to non-financial corporations using a 24-month moving average of new business volumes. The figures are averages of monthly data for each survey round. 'Credit standards' summarize the internal guidelines or criteria that reflect a bank's lending policy. They are defined as the difference between the sum of the percentages of banks responding "tightened considerably" and "tightened somewhat" and the sum of the percentages of banks responding "eased somewhat" and "eased considerably". Data are confidential (c.d.) for Austria, Finland and Ireland. 'GDP growth' is the annual growth rate of real GDP based on averages of quarterly data for each survey round. 'Unemployment rate' is the annual unemployment rate based on averages of quarterly data for each survey round. 'General economic outlook' summarises banks' perceptions of risk related to the general economic activity as a factor affecting their decisions when setting the credit standards. It is defined as the difference between the sum of the percentages of banks responding "contributed considerably" and "contributed somewhat" and the sum of the percentages of banks responding "contributed somewhat" and "contributed considerably". 'Private debt / GDP' is the ratio of debt securities and bank loans of the private sector to GDP, based on averages of quarterly data.

Table 4. Sovereign stress and credit access

	Credit constrained	
	(1)	(2)
Stressed×Post	0.0785**	0.1234**
	(0.0396)	(0.0599)
Stand-alone firm	-0.0230	-0.0182
	(0.0165)	(0.0211)
Individual- or family-owned	0.0071	0.0072
	(0.0162)	(0.0176)
Female owner	0.0233	0.0286
	(0.0279)	(0.0283)
Size_1	0.1408***	0.1503***
	(0.0150)	(0.0148)
Size_2	0.0067	0.0029
	(0.0091)	(0.0080)
Size_4	0.0003	-0.0040
	(0.0321)	(0.0280)
Age_1	-0.0006	-0.0080
	(0.0571)	(0.0531)
Age_2	0.0608***	0.0644***
	(0.0125)	(0.0155)
Age_4	-0.0363	-0.0405
	(0.0369)	(0.0369)
Turnover_1	0.0956***	0.1068***
	(0.0324)	(0.0339)
Turnover_2	0.0479**	0.0489**
	(0.0219)	(0.0227)
Turnover_4	-0.0718*	-0.0609
	(0.0405)	(0.0378)
Outlook better	-0.0287*	-0.0261*
	(0.0152)	(0.0153)
Capital better	-0.0320	-0.0313
	(0.0224)	(0.0240)
Credit history better	-0.0762***	-0.0689***
	(0.0203)	(0.0239)
Country×Industry FEs	No	Yes
Time FEs	No	Yes
No. Observations	8,916	8,907
R-squared	0.08	0.11

Note: This table presents difference-in-differences estimates of the probability of the firm having been credit constrained in the past 6 months. The estimation period is 1st January 2009 – 31st March 2012. 'Credit constrained' is a dummy variable equal to 1 if in the past 6 months the firm was denied credit, quantity rationed, price rationed or discouraged from applying. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Italy, Portugal, or Spain. 'Post' is a dummy variable equal to 0 if the time period is between 1st January 2009 and 31st December 2009 (waves 1–2), and to 1 if the time period is between 1st October 2010 and 31st March 2012 (waves 4–6). See Appendix Table 1 for all variable definitions and sources. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 5. Sovereign stress and credit access: Components of credit constraint

	Loan application denied	Rationed	Refused due to high cost	Discouraged from applying
	(1)	(2)	(3)	(4)
Stressed×Post	-0.0102	0.0857***	0.0505***	0.0525
	(0.0411)	(0.0107)	(0.0138)	(0.0486)
Firm-specific controls	Yes	Yes	Yes	Yes
Country×Industry FEs	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes
No. Observations	7,292	6,434	7,281	8,905
R-squared	0.14	0.07	0.08	0.11

Note: This table presents difference-in-differences estimates where the dependent variable is a dummy variable equal to 1 if the firm was in the past 6 months denied credit (column (1)); quantity rationed (column (2)); price rationed (column (3)); or discouraged from applying (column (4)). 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Italy, Portugal, or Spain. 'Post' is a dummy variable equal to 0 if the time period is between 1st January 2009 and 31st December 2009 (waves 1–2), and to 1 if the time period is between 1st October 2010 and 31st March 2012 (waves 4–6). All firm-specific control variables from Table 4 are included in the regressions. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 6. Sovereign stress and credit access: Robustness

	Credit constrained					
	(1)	(2)	(3)	(4)	(5)	(6)
Stressed×Post	0.2523***	0.0785***		0.1057***		0.3167*
	(0.0086)	(0.0338)		(0.0541)		(0.1953)
Stressed×Post (Pre-Crisis)			-0.1233***			
			(0.0287)			
Cost of lending					0.1108***	
					(0.0341)	
Credit standards					0.0008	
					(0.0006)	
GDP growth					0.0203***	
					(0.0105)	
Unemployment rate					0.0223***	
					(0.0060)	
General economic outlook					0.0007	
					(0.0007)	
Private debt / GDP					0.0080**	
					(0.0034)	
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-specific controls×Post	No	Yes	No	No	No	No
Country×Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	No	Yes	Yes	Yes	Yes	Yes
Country×Time FEs	Yes	No	No	No	No	No
Industry×Time FEs	Yes	No	No	No	No	No
No. Observations	8,907	8,907	2,626	8,261	18,510	648
R-squared	0.13	0.12	0.19	0.10	0.12	0.15

Note: This table presents difference-in-differences estimates where the dependent variable is a dummy variable equal to 1 if in the past 6 months was denied credit, quantity rationed, price rationed or discouraged from applying. In column (4), all firms domiciled in Greece are excluded from the analysis. In column (6), only the firms whose outlook and capital and credit history improved in the past 6 months are included in the regression. The estimation period is 1st January 2009 -- 31st March 2012. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Italy, Portugal, or Spain. 'Post' is a dummy variable equal to 0 if the time period is between 1st January 2009 and 31st December 2009 (waves 1–2), and to 1 if the time period is between 1st October 2010 and 31st March 2012 (waves 4–6). 'Post (Pre-crisis)' is a dummy variable equal to 0 if the time period is between 1st January 2009 and 30th June 2009 (wave 1), and to 1 if the time period is between 1st July and 31st December 2009 (wave 2). All firm-specific control variables from Table 4 are included in the regressions. See Appendix Table 1 for all variable definitions and sources. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 7. Sovereign stress and credit access: Exploiting cross-sectional heterogeneity

	Credit constrained	Loan application denied	Rationed	Refused due to high cost	Discouraged from applying
	(1)	(2)	(3)	(4)	(5)
Stressed×Post×Size_4	0.1473**	-0.0036	0.0454*	0.0258	-0.0188
	(0.0751)	(0.0428)	(0.0290)	(0.0332)	(0.0721)
Stressed×Post×Outlook better	0.0585	0.0264	-0.0108	0.0707	0.0347
	(0.0506)	(0.0554)	(0.0322)	(0.0551)	(0.1111)
Stressed×Post×Capital better	-0.0054	0.0326	-0.0251	0.0869***	-0.0883
	(0.0633)	(0.0425)	(0.0263)	(0.0204)	(0.0545)
Stressed×Post×Credit history better	0.1878	-0.0479	0.0405	-0.0715**	0.2051*
	(0.1958)	(0.0372)	(0.0504)	(0.0300)	(0.1321)
Firm-level controls	Yes	Yes	Yes	Yes	Yes
Double interactions	Yes	Yes	Yes	Yes	Yes
Country×Industry FEs	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes
No. Observations	8,907	7,292	6,434	7,439	8,905
R-squared	0.11	0.14	0.07	0.04	0.11

Note: This table presents difference-in-differences estimates where the dependent variable is a dummy variable equal to 1 if in the past 6 months the firm has been credit constrained (column (1)); denied credit (column (2)); quantity rationed (column (3)); price rationed (column (4)); and discouraged from applying (column (5)). 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Italy, Portugal, or Spain. 'Post' is a dummy variable equal to 0 if the time period is between 1st January 2009 and 31st December 2009 (waves 1–2), and to 1 if the time period is between 1st October 2010 and 31st March 2012 (waves 4–6). 'Size_4' is a dummy variable equal to 1 if the firm has 250+ employees. 'Outlook better' is a dummy variable equal to 1 if the firm's own outlook, with respect to sales, profitability, and business plan, improved in the past 6 months. 'Capital better' is a dummy variable equal to 1 if the firm's capital improved in the past 6 months. 'Credit history better' is a dummy variable equal to 1 if the firm's credit history improved in the past 6 months. All firm-level control variables from Table 4 are included in the regressions. All double interactions are also included. See Appendix Table 1 for all variable definitions and sources. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 8. Sovereign stress and alternative sources of firm financing

	Retained earnings	Equity	Debt securities	Trade credit	Grants or subsidies	Other loans
	(1)	(2)	(3)	(4)	(5)	(6)
Stressed×Post	0.1029	-0.0016	0.0142**	0.0082	0.0037	-0.0163
	(0.1265)	(0.0189)	(0.0083)	(0.0728)	(0.0570)	(0.0267)
Firm-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Country×Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes
Time	Yes	Yes	Yes	Yes	Yes	Yes
No. Observations	22,498	22,466	22,408	22,561	22,525	22,533
R-squared	0.13	0.08	0.08	0.10	0.06	0.09

Note: This table presents difference-in-differences estimates of the firm's use of different sourced of firm financing. 'Retained earnings' is a dummy variable equal to 1 if in the past 6 months the firm used retained earnings to finance its day-to-day operations. 'Equity' is a dummy variable equal to 1 if in the past 6 months the firm used equity financing to finance its day-to-day operations. 'Debt securities' is a dummy variable equal to 1 if in the past 6 months the firm used debt securities to finance its day-to-day operations. 'Trade credit' is a dummy variable equal to 1 if in the past 6 months the firm used trade credit to finance its day-to-day operations. 'Grants or subsidies' is a dummy variable equal to 1 if in the past 6 months the firm used government grants or subsidized bank loans to finance its day-to-day operations. 'Other loans' is a dummy variable equal to 1 if in the past 6 months the firm used loans from a related company or shareholders or from family and friends. 'Stressed' is a dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Italy, Portugal, or Spain. 'Post' is a dummy variable equal to 0 if the time period is between 1st January 2009 and 31st December 2009 (waves 1–2), and to 1 if the time period is between 1st October 2010 and 31st March 2012 (waves 4–6). All firm-level control variables from Table 4 are included in the regressions. See Appendix Table 1 for all variable definitions and sources. All regressions use sampling weights that adjust the sample to be representative of the population. All regressions include fixed effects as specified. Standard errors clustered at the country level appear in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Appendix Table 1: Variable definitions

Variables	Definition	Sources
Credit constrained	Dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 6 months, but it did not apply because of possible rejection, it applied and its loan application was rejected, it applied and got less than 75% of the requested amount, or it refused the loan because the cost was too high	ECB/EC SAFE
Loan application denied	Dummy variable equal to 1 if in the past 6 months the firm applied for a loan and its loan application was rejected	ECB/EC SAFE
Rationed	Dummy variable equal to 1 if in the past 6 months the firm applied for a loan and it got less than 75% of the requested amount	ECB/EC SAFE
Refused due to high cost	Dummy variable equal to 1 if in the past 6 months the firm applied for a loan and it refused the loan because the cost was too high	ECB/EC SAFE
Discouraged from applying	Dummy variable equal to 1 if the firm declared a positive demand for bank financing in the past 6 months, but it did not apply because of possible rejection	ECB/EC SAFE
Equity	Dummy variable equal to 1 if in the past 6 months the firm used equity financing to finance its day-to-day operations	ECB/EC SAFE
Retained earnings	Dummy variable equal to 1 if in the past 6 months the firm used retained earnings to finance its day-to-day operations	ECB/EC SAFE
Debt securities	Dummy variable equal to 1 if in the past 6 months the firm used debt securities to finance its day-to-day operations	ECB/EC SAFE
Trade credit	Dummy variable equal to 1 if in the past 6 months the firm used trade credit to finance its day-to-day operations	ECB/EC SAFE
Grants or subsidies	Dummy variable equal to 1 if in the past 6 months the firm used government grants or subsidized bank loans to finance its day-to-day operations	ECB/EC SAFE
Other loans	Dummy variable equal to 1 if in the past 6 months the firm used loans from a related company or shareholders or from family and friends	ECB/EC SAFE
Stand-alone firm	Dummy variable equal to 1 if the firm is an autonomous profit-oriented enterprise	ECB/EC SAFE
Individual- or family-owned	Dummy variable equal to 1 if the firm's owner is an individual or a family	ECB/EC SAFE
Female owner	Dummy variable equal to 1 if the primary owner is a female	ECB/EC SAFE
Size	'Size_1' is a dummy variable equal to 1 if the firm has between 1 and 9 employees. 'Size_2' is a dummy variable equal to 1 if the firm has between 10 and 49 employees. 'Size_3' is a dummy variable equal to 1 if the firm has between 50 and 249 employees. 'Size_4' is a dummy variable equal to 1 if the firm has 250+ employees.	ECB/EC SAFE
Age	'Age_1' is a dummy variable equal to 1 if the firm is less than 2 years old. 'Age_2' is a dummy variable equal to 1 if the firm is between 2 and 5 years old. 'Age_3' is a dummy variable equal to 1 if the firm is between 5 and 10 years old. 'Age_4' is a dummy variable equal to 1 if the firm is 10+ years old.	ECB/EC SAFE

Turnover	'Turnover_1' is a dummy variable equal to 1 if the firm's annual turnover is less than €2 mln. 'Turnover_2' is a dummy variable equal to 1 if the firm's annual turnover is between €2 mln. and €5 mln. 'Turnover_3' is a dummy variable equal to 1 if the firm's annual turnover is between €5 mln. and €10 mln. 'Turnover_4' is a dummy variable equal to 1 if the firm's annual turnover is €10+ mln.	ECB/EC SAFE
Outlook better	Dummy variable equal to 1 if the firm's outlook, with respect to sales, profitability, and business plan, improved in the past 6 months.	ECB/EC SAFE
Capital better	Dummy variable equal to 1 if the firm's capital improved in the past 6 months.	ECB/EC SAFE
Credit history better	Dummy variable equal to 1 if the firm's credit history improved in the past 6 months.	ECB/EC SAFE
Cost of lending	The variable is calculated by aggregating short and long-term bank interest rates for loans to non-financial corporations using a 24-month moving average of new business volumes.	ECB
Credit standards	The variable is defined as the difference between the sum of the percentages of banks responding "tightened considerably" and "tightened somewhat" and the sum of the percentages of banks responding "eased somewhat" and "eased considerably" in the Bank lending survey.	ECB BLS
GDP growth	The annual growth rate of real GDP based on averages of quarterly data for each survey round.	Eurostat
Unemployment rate	The annual unemployment rate based on averages of quarterly data for each survey round	Eurostat
General economic outlook	The variable is defined as the difference between the sum of the percentages of banks responding "contributed considerably" and "contributed somewhat" and the sum of the percentages of banks responding "contributed somewhat" and "contributed considerably" in the Bank lending survey.	ECB BLS
Private debt / GDP	The variable is defined as the ratio of debt securities and bank loans of the private sector to GDP, based on averages of quarterly data	ECB and Eurostat
Stressed	Dummy variable equal to 1 if the firm is domiciled in Greece, Ireland, Italy, Portugal, or Spain	
Post	Dummy variable equal to 0 if the time period is between 1st January 2009 and 31st December 2009 (waves 1-2), and to 1 if the time period is between 1st October 2010 and 31st March 2012 (waves 4-6).	
Post (Pre-crisis)	Dummy variable equal to 0 if the time period is between 1st January 2009 and 30th June 2009 (wave 1), and to 1 if the time period is between 1st July and 31st December 2009 (wave 2).	