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New evidence from survey data

European Investment Bank

The EU bank

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What firms don't like about bank loans: New evidence from survey data

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Abstract

We use the association between non-financial firms and their banks, an information available in the European Investment Bank Investment Survey (EIBIS), to disentangle the effects of borrowers' and lenders' financial weakness on the satisfaction with the loan contracted. The dataset matches survey data of non-financial firms about their satisfaction with bank lending with their financial data and the financial data of their banks. We find evidence of both demand and supply factors determining firm satisfaction with bank loan financing: non-financial firms with weaker finances and those financed by weaker banks are less satisfied with their bank financing. We also find that the impact of supply factors differs across regions within the EU: the effect of bank's financial weakness on borrower satisfaction is not significant in core countries but is in periphery countries.

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1 Introduction

Conditions to access external finance are important determinants of firms' investment policies. According to the European Investment Bank Investment Survey (EIBIS), in 2018, the average share of external finance in EU corporate investment expenditure is around 35%.[2] The financial crisis of 2008-9 and the subsequent sovereign debt crisis in Europe in 2010-12 provided a forceful reminder of the importance of external finance through the detrimental impact of credit supply shocks and borrowers' balance sheet strength on investment and real activity (Jiménez et al. 2012, Iyer et al. 2014, Jiménez et al. 2017, Kalemli-Ozcan et al. 2018).

The main contribution of this paper is to estimate the relative importance of non-financial firms' and their banks' financial weakness on bank lending conditions using new data available from the EIBIS. Existing empirical evidence on this relationship is scarce given the necessity to have matched bank-firm data and information on access to credit conditions. The EIBIS, whose first wave was in 2016, provides such information for all Member States of the European Union. To the best of our knowledge, our paper is among the first to use qualitative information on bank financing conditions for non-financial firms and link it to financial characteristics of both non-financial firms and their respective banks.[3] Indeed, compared to loan-level data traditionally used in this literature, the EIBIS allows to assess the difficulties of firms to access bank lending along several dimensions, including non-price terms of loans such as maturity and collateral requirements.

We build financial weakness indicators for non-financial firms and for the corresponding banks using their respective financial ratios. We then evaluate the relative impact of these indicators on firms' satisfaction with their loan contracts. Using a simple econometric framework we attempt to disentangle the role of supply (lender) and demand (borrower) characteristics in explaining this satisfaction, which we measure with qualitative information from the EIBIS. We show evidence that, up to at least 2015 and 2016[4] - eight years after the global financial crisis and four years after the sovereign debt crisis in Europe - banks' financial conditions still exert negative effects on credit supply. Furthermore, the relative importance of banks' and firms' financial weakness differs across country groups.[5] In core countries, firm's financial weakness is the main determinant of satisfaction with bank finance. Bank's financial position has virtually no statistically significant effects. This suggests that firms' financing conditions are impacted by banks' risk management practices rather than banks' financial constraints. In periphery countries, corporates associated with banks with weaker financial conditions are significantly more likely to be dissatisfied with their

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[2]Information about the EIBIS is available on `http://www.eib.org/eibis`.

[3]Preliminary results on the impact of banks' non-performing loans on firms' satisfaction are provided in EIB (2016) using the first wave of EIBIS.

[4]The dates correspond to the years in which the two waves of the EIBIS used in the paper were conducted.

[5]In some parts of the paper, the EU economies are split into three regions. Periphery countries are the countries which have suffered a downgrade of at least two notches during the sovereign debt crisis. Cohesion countries consist of the countries that joined the EU after 2003. The rest of the countries belong to Core - or other - countries. More specifically, *Core countries (COR)*: Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Sweden, United Kingdom; *Cohesion countries (COH)*: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia; *Periphery countries (PER)*: Cyprus, Greece, Ireland, Italy, Portugal, Spain.

financing conditions compared to core countries. Banks in periphery countries likely faced tighter financial constraints that impacted credit conditions. This is in line with the idea of a continuing effect of the financial fragmentation observed in Europe after the sovereign debt crisis. These results could also partly be explained by a higher capacity of firms to switch between banks in core countries compared to periphery countries. If firms are able to switch easily, we expect banks' financial constraints to have a limited impact on credit conditions.[6]

The most important policy implication from our study is that strengthening the banking system is of utmost importance for access to finance and real activity in several countries and should be a policy priority. Our results are suggestive of a lasting effect of the European debt crisis in these areas. Our analysis also shows that financial weakness of firms remains a key determinant of satisfaction with credit conditions in both core and periphery countries.

The rest of the paper consists of four sections and concluding remarks. Section 2 reviews the literature. Section 3 describes the data. Section 4 details the empirical results. Robustness checks are presented in section 5. Section 6 concludes.

2   Related Literature

Small and transitory events may have large and persistent effects on the economy because of the presence of financial constraints on non-financial firms (Bernanke & Gertler 1989, Bernanke et al. 1996, Kiyotaki & Moore 1997). Effects are not only persistent but also amplify initial shocks through borrowers' balance sheets and asset prices. This occurs because asymmetric information between borrowers and lenders generates agency costs that raise the cost of external finance and decrease borrowing limits. Their fluctuation over the business cycle reinforce the effects of the initial financial shock (Gilchrist & Zakrajšek 2012).

Holmstrom & Tirole (1997) argue that banks are also borrowers and are also subject to agency costs. Changes in their net worth or the market value of their assets can affect the non-financial sector through shifts in their supply of credit. Banks mitigate the agency problems with the amount of capital that they hold. Loss of capital that typically occurs during economic downturns, due to falling asset prices and deteriorating asset quality, means that banks limit loan supply in an attempt to preserve their capital base. [7]

Gertler & Kiyotaki (2010) combine credit constraints of non-financial borrowers and of financial intermediaries so that the net worth of both financial and non-financial companies has effects on availability of credit and on real activity. The authors find that the endogenous disruptions to financial intermediation substantially magnify economic downturns.

The liquidity squeeze following the financial crisis in 2008 (Ippolito et al. 2016, Iyer et al. 2014), low capital ratios (Jiménez et al. 2012, Acharya et al. 2018) and excessive exposure to debt securities issued by governments in financial distress (Acharya

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[6]However, the literature provides evidence that bank-firm relationships are sticky (Giannetti & Ongena 2012, Chodorow-Reich 2014, Kalemli-Ozcan et al. 2018).

[7]Declining supply of loans raises the demand for bond financing that, in turn, increases market risk premiums in order to attract risk-averse investors to buy risky corporate bonds. Higher risk premiums intensify the effects of the credit shock.

et al. 2018, Popov & Van Horen 2015) created an asymmetric transmission of the financial shock to the real economy as different banks were affected to different degrees by these problems. More affected banks reduced credit by more than the rest of the banking sector. At the same time, given the overall tightening in credit standards, borrowers could not compensate for this reduction by obtaining credit from less affected banks or other alternative sources of external finance. These mechanisms contribute to amplify the reduction in investment and employment.

The impact was also asymmetric across the size distribution of non-financial firms. Consistent with earlier empirical findings of Gertler & Gilchrist (1994) and theoretical arguments that financial constraints deriving from asymmetric information are more relevant for smaller and less transparent firms, Bottero et al. (2015) find that credit for smaller and riskier firms with high exposure to affected banks was reduced more than for those with low exposure. Moreover, the authors find that this had a significant negative effect on their investment and employment decisions. At the same time, investment and employment of large firms were not significantly affected. This asymmetry is also related to the fact that smaller firms are more dependent on their main partner bank. Many studies find that firms whose initial loan application was rejected could not compensate for the decline in external finance availability by obtaining a loan from elsewhere (Albertazzi & Marchetti 2010, Jiménez et al. 2012, Bottero et al. 2015, Iyer et al. 2014).

An extensive literature aims at evaluating the impact of banks' financial weakness on credit supply while controlling for borrowers' effects (Khwaja & Mian 2008, Albertazzi & Marchetti 2010, Jiménez et al. 2012, Iyer et al. 2014, Bottero et al. 2015). The rationale is that banks with weaker balance sheets (e.g. lower capital ratios) are likely to face higher funding costs because of a higher credit risk and can pass these higher costs on to their customers or cut back on loan supply. These studies generally use loan-level data in order to link banks to firms.

In a seminal paper, Khwaja & Mian (2008) focus on a sample of firms' borrowing from multiple banks to identify how negative bank liquidity shocks impact lending. More specifically, they compare how the same firm's loan growth from one bank changes relative to another bank which is more affected by a given exogenous liquidity shock. Another strategy employed by Hubbard et al. (2002) and Schwert (2018) is to control for borrowers' effects with a set of firm specific variables, including financial ratios. Controlling for firms' effects, both papers then evaluate whether there are bank effects in borrowers' loan rates. In particular, they look at the impact of the heterogeneity in the level of capitalization of banks. In a related analysis, Jiménez et al. (2017) investigate the influence of both firm's and bank's financial weakness on credit availability using detailed Spanish loan application data merged with balance sheet information.

Drawing from the literature surveyed, this paper aims at evaluating the relative importance of firms' and banks' financial weakness on bank lending conditions. Financial weakness of borrowers is important because banks base their loan-granting decisions on information from corporate balance sheets and income statements, while banks' financial situation has an impact on their ability to supply credit. To the best of our knowledge, our paper is among the first to use qualitative information on firms' bank financing conditions and link it to both firms' and banks' financial characteristics. Compared to loan-level data, EIBIS allows us to assess firms' difficulties to access

bank lending along several dimensions, including non-price terms of loans such as maturity and collateral requirements.

Given the cross-country coverage of EIBIS, we are also able to investigate whether there are asymmetric effects of banks' and firms' financial weakness across different country groups in Europe. This analysis is motivated by several studies providing evidence of the fragmentation of European financial markets after the European sovereign debt crisis. This fragmentation is visible in the increased dispersion of prices across countries particularly in the interbank (Garcia-de-Andoain et al. 2014) and the sovereign bond markets (Ehrmann & Fratzscher 2015). Disrupted interbank markets in stressed countries had, in turn, an impact on banks' funding costs and on corporate lending (Oztürk & Mrkaic 2014, de Haan et al. 2017, Bremus & Neugebauer 2017). Theoretical and empirical studies have investigated the sovereign-bank nexus and its impact on bank lending in Europe (Popov & Van Horen 2015, Brunnermeier et al. 2017, Farhi & Tirole 2018). Because of banks' exposure to sovereign debt, increases in sovereign bond yields generate concerns about the solvency risk of the banking system, which feeds back into higher solvency risk of the sovereign. Altavilla et al. (2017) show that there was a differential impact of sovereign risk on banks' credit provision and lending rates in stressed countries and non-stressed countries.

3   Data and estimated relation

This section details the construction of the matched sample as well as the methodology implemented to synthesize characteristics of non-financial firms and their banks into indices.

3.1   Matched Sample

We compile information on credit conditions of non-financial firms along with data from financial balance sheets and income statements of these firms and of their lending banks. The three main databases that we use are the EIBIS, Orbis and Orbis Bank Focus of Bureau van Dijk. The EIBIS is an annual survey of non-financial firms in the EU that aims at monitoring investment and investment finance activities and capturing potential barriers to investment. The survey includes some 12,500 completed interviews every year. The first wave of the survey took place in 2016. In our analysis, we stack data from the first two vintages of the survey.

Using a stratified sampling methodology, the EIBIS is representative across all 28 EU Member States. The representativeness relates to four firm size classes (micro, small, medium and large) and four broad sector groupings (manufacturing, services, construction and infrastructure) within countries.[8] EIBIS respondents are sampled from the Orbis database of Bureau van Dijk and, as a result, survey answers can be matched to firm balance sheet and profit-and-loss data provided in Orbis. We focus on a sub-sample of firms that used bank financing for their most recent investment.

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[8]The infrastructure sector in EIBIS comprises firms from NACE Rev.2 sectors Electricity, gas, steam and airconditioning supply (D); Water supply; sewerage, waste management and remediation activities (E); Transportation and storage (H); Information and communication (J).

In the EIBIS, those firms are asked to identify their main lender.[9] This provides a correspondance between firms and banks. We collect the financial statements of each lender using Orbis Bank Focus to obtain a matched bank-firm dataset with financial data of both borrowers and lenders.

In order to assess credit conditions of non-financial firms, we use the information provided in the EIBIS regarding firms' satisfaction with bank finance along several dimensions: amount, cost, collateral requirements and maturity.[10]

Table 1: **Distribution firms across country groups, sectors and sizes (%)**

	Sector				Size				Total	
	Man	Con	Ser	Inf	Micro	Small	Medium	Large	N	%
Cohesion	36	19	25	20	14	32	39	15	1,116	39
Core	29	23	21	27	17	34	33	17	922	32
Periphery	31	22	26	21	12	32	36	20	847	29
EU	32	21	24	23	14	32	36	17	2,885	100

Note: "Man": Manufacturing, "Con": Construction, "Ser": Services, "Inf": Infrastructure. Size refers to the number of employees. Due to rounding effects, the sum across components may not add up to 100.

Source: EIBIS for the years 2016 and 2017.

Overall, our matched sample consists of 3184 firm-year observations (2885 unique firms) matched with 537 bank-year observations (367 unique banks in the sample).[11] Table 1 describes the distribution of firms across regions, sectors and sizes. The sectors covered are Manufacturing (32% of the sample), Services (24%), Construction (21%) and Infrastructure (23%). Small and medium-sized enterprises (SME) represent 68% of the sample, large firms represent around 17% of the sample (unweighted statistics). 32% of non-financial firms are located in core countries, 29% in cohesion and 39% in periphery countries. For banks, the distribution is 42, 30, and 28% in core, cohesion and periphery countries, respectively.

Table 2 shows the distribution of firms' satisfaction with the amount, cost, maturity and collateral requirements of their bank credit. At the aggregated level, firms tend to be relatively satisfied with the loans received, with only between 5% and 15% of them reporting being disatisfied. Looking across the dimensions of the loan contract, cost and collateral demand appear the least satisfying dimensions. Pairwise correlation coefficients across the different dimensions range from 0.27 to 0.35, suggesting weak relationships (Table A4).

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[9]Surveyed firms provide only the name of their main lender, which prevents us from identifying firms with mutiple-bank relationships. Previous studies provide mixed evidence regarding the impact of multiple-bank relationships on credit conditions (Ongena & Smith 2000*a*). Using survey data, Ongena & Smith (2000*b*) show that the share of firms with multiple banks varies significantly across European countries. Using Orbis data, Kalemli-Ozcan et al. (2018) conclude that having relationships with more than one bank is not very common for firms in several euro area countries with the exception of Greece.

[10]Table A1 in the appendix provides a description of the variables used in our analysis.

[11]The number of observations varies depending on the dependent variable used in the different regressions presented in the next sections. A third wave of the EIBIS has become available since this work was conducted.

Table 2: **Degree of satisfaction with external finance: summary statistics**

	Amount	Cost	Maturity	Collateral
Dissatisfied	165	352	143	449
	(5.2)	(11.2)	(4.5)	(14.6)
Neutral	274	451	273	394
	(8.6)	(14.3)	(8.6)	(12.8)
Satisfied	2728	2348	2752	2243
	(86.1)	(74.5)	(86.9)	(72.7)
Total	3167	3151	3168	3086
	(100.0)	(100.0)	(100.0)	(100.0)

Note: Answer to the question "thinking about all of the external finance you obtained, how satisfied or dissatisfied are you with it in terms of amount, cost, maturity, collateral and type" (Number of firms and *percentages shown in brackets*).
Source: EIBIS for the years 2016 and 2017.

3.2 Financial weakness indices for firms and their banks

As evidenced by the studies mentioned in the previous section, a number of financial characteristics of borrowers and lenders influence credit conditions. We aim at disentangling the effects of firms' and banks' financial weakness. There is no unanimous definition of this concept as it relates to many channels among which, liquidity and associated roll-over risk, profits and performance, loss-absorbing capacity and leverage. Given limited data availability, as well as possible correlation across these characteristics, it is difficult to consider many of them separately.[12] Consequently, in our baseline specification, we build a parsimonious model that use multi-dimensional financial weakness indices. This approach is related to the literature on financial stress indices (Illing & Liu 2006). Building on these studies, we use a variance-equal weights methodology to aggregate the different financial dimensions included in the indices.[13] With this approach, the index gives the same importance to each variable. To test the robustness of our results and relax this last assumption, we also provide in the appendix the results obtained when using indices based on the first components of principal component analyses.

Empirical studies on financial constraints of non-financial corporates show that leverage has a negative impact on access to external finance, because firms with higher leverage ratios are usually perceived as riskier by lenders (Lamont et al. 2001, Whited & Wu 2006, Ferrando & Mulier 2015, Kalemli-Ozcan et al. 2018). Profitability is expected to have a positive impact on the access to external funds. Profitable firms generate larger cash flows that are positively associated with their ability to repay loans (Musso & Schiavo 2008, Ferrando & Mulier 2015). Several important empirical studies, including the seminal contribution of Kaplan & Zingales (1997), show that liquidity is negatively correlated with the financial constraints of the firm (see also Chirinko & Schaller 1995). The non-financial firm financial weakness index is a sim-

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[12]This is one of the robustness exercise conducted in Section 5.
[13]Indices built using variance-equal weights are defined as averages of standardized variables (i.e. variables demeaned and scaled by their standard deviation).

ple average of the leverage, profitability and liquidity ratios of the firm, assigning a positive sign to the first ratio and a negative sign to the last two ratios. Table A2 presents descriptive statistics of these variables. Higher values of this index, resulting from higher leverage, lower profitability and liquidity, indicate weaker firms.

The composition of banks' index is motivated by the work of Andrews & Petroulakis (2017) and Storz et al. (2017).[14] Higher capital and profitability ratios are associated with greater loan availability, especially in crisis times (Jiménez et al. 2012, Kapan & Minoiu 2018, Jiménez et al. 2017). A higher on-balance sheet liquidity mismatch may force banks to reduce loan origination when facing negative liquidity shocks. Non-performing loans reduce profitability and increase the cost of borrowing of banks, which in turn reflects on loan pricing and credit supply. Similarly, the bank financial weakness index is a simple average of the non-performing loans ratio, a measure of balance-sheet liquidity mismatch, capitalization and profitability. The first two ratios are associated negatively with financial weakness of banks, while the last two ratios are positively associated with financial weakness. Descriptive statistics are displayed in Table A2. By construction, as for corporates, a higher value reflects lower resilience.

3.3 Baseline specification

We employ a linear probability model to estimate the impact of banks' and firms' financial weakness indices on firms' satisfaction with bank lending. The baseline model specifies:

$$Pr(Satis_{isc,t}^{D} = 1) = \beta_0^D + \beta_1^D FW_{isc,t-1} + \beta_2^D BW_{isc,t-1}$$
$$+ \beta_3^D Growth_{sc,t-1} + \beta_4^D SovSpr_{c,t-1} + X_{ics,t-1}\Theta^D \tag{1}$$

Observations are indexed by corporation (i), sector (s), country (c) and year (t). The variable $Satis_{isc}^{D}$ is a dummy variable that equals one when firms declare being satisfied (or neutral) with one of the four dimensions D of bank finance - amount, cost, maturity or collateral requirements - and zero otherwise.[15] FW_{isc} and BW_{isc} are the financial weakness indices described in the previous section.[16] To control for sector-level growth opportunities, we introduce the variable $Growth_{sc}$ which is the growth rate of gross value added of sector s in country c minus the growth rate of economy-wide European gross value added. Moreover, we control for heterogeneity of macro-financial conditions by including $SovSpr_c$, the 10-year government bond spread between the local and the German security. The choice of this control is motivated by several empirical studies that investigate the impact of sovereign spreads on bank credit conditions (Albertazzi et al. 2014, Pancrazi et al. 2015). $X_{ics,t-1}$ includes firm age, firm size and bank size, where age is a categorical variable with five categories and sizes are defined as the logarithm of total assets.[17] These are standard contols in the corporate finance literature. Firm age and size are shown to be important predictors of access to external finance (Hadlock & Pierce 2010). Cook et al.

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[14]Both papers exploit time-series and use principal component analyses to measure bank health.

[15]Throughout the paper we do not distinguish between "neutral" and "satisfied" observations.

[16]As described in the preceding subsection, these indices are constructed so that higher values indicate weaker firms or banks.

[17]The five categories of the firm age variable are: less than two years, two years to less than five years, five years to less than ten years, ten years to less than twenty years, twenty years or more.

(2003) show that bank size has a significant impact on lending rates and Jiménez et al. (2017) provide evidence that it may have an effect on loan granting. All the explanatory variables are lagged by one year.

4   Main results

Estimated parameters of the baseline specification in equation (1) are presented in Table A5. Both firm and bank financial weakness have an impact on the satisfaction of non-financial firms with bank finance. The impact of the firm index is significant in all dimensions of satisfaction with bank finance. In absolute terms, the effects are stronger for cost and collateral.[18] A one standard deviation increase of this index leads to a decrease of 3.7 percentage points in the probability of the firm being satisfied with the cost of bank finance. As the probability of being satisfied with the cost equals 89% in the sample, this represents a decrease of 4.2% of the probability of being satisfied when evaluated at the sample mean (i.e. -3.7 divided by 89).[19]

The bank index has a negative and significant impact on the satisfaction with cost, maturity and collateral. A one standard deviation increase in the bank index means a decrease of 2.4 percentage points in the probability of the firm being satisfied with the cost, implying a semi-elasticity of -2.8%. The impact of bank financial weakness on cost is statistically more important when compared to the effect on the maturity of the loan, but not when compared to the effect on the collateral requirements.[20] Statistical tests show no significant difference between coefficients on firm and bank indices in the regressions where both coefficients are significant (i.e. cost, maturity and collateral requirements).[21]

Firm size matters for firm satisfaction with bank finance. Larger firms are more likely to be satisfied with their credit conditions along all studied dimensions and particularly for the cost of finance. Bank size is mostly not significant. It has a significant positive impact only on the likelihood of being satisfied with bank finance for collateral requirements.

4.1   Macroeconomic factors

Macroeconomic factors, as measured by industry growth opportunities and by ten-year government bond spreads, have also some limited negative impact on the satisfaction of non-financial firms with their bank finance. Government bond spreads have a significant impact on the satisfaction with the cost of finance. This is in line with the literature showing that higher sovereign bond yields have a negative impact on the cost of finance of domestic banks, which in turn affects their loan pricing. Government bond yields have also a negative impact on satisfaction with the maturity of

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[18]All the pairwise differences of the coefficients associated with the firm index are statistically significant with a p-value below 10%. It means for instance that the impact on cost satisfaction of the firm index is statistically more important than the impact of the same index on collateral satisfaction.

[19]This ratio represents a semi-elasticity, defined as $\frac{d[E(Y|X)]}{dX}\frac{1}{E(Y|X)}$.

[20]All other cross-equation differences of the effect of the bank index are not significant at the 10% level, except the one between the cost and the amount.

[21]The p-values of the wald tests for the three equations (i.e. cost, maturity and collateral requirements) are: 0.16, 0.96 and 0.43 respectively.

bank finance. Industry growth opportunities have a marginally significant effect only on the satisfaction of non-financial firms with the maturity of their bank loans.

Another way to account for unobservable macroeconomic factors is to use time and location dummies, instead of the two variables in the baseline specification. Table A5 contains the estimates obtained with an alternative specification where we introduce country, sector and time dummies instead of the $Growth$ and $SovSpr$ variables. Estimated coefficients of the non-financial firm index are similar to those of the baseline model. Estimated coefficients for the bank weakness index are slightly different, however, in particular regarding the satisfaction with maturity, where the coefficient becomes statistically insignificant, and collateral requirements, where the negative impact of the bank index is higher than the one in the baseline specification.

4.2   The effects of the financial weakness of banks

To investigate further the impact of bank financial weakness on credit conditions, we compare two models: the baseline model with both indices and an alternative model with the firm index only (Table A5). Introducing the bank index reduces the effect of the firm index on satisfaction with the amount, cost, maturity and collateral requirements by 1.6%, 4.8%, 6.4% and 4.2%, respectively.[22] This implies that 1.6% to 6.4% of the impact of firms' financial weakness on their satisfaction is due to the matching with a weak bank.

The linear probability model (LPM) used in the baseline specification has the advantage of providing direct estimates of marginal effects in the probabilty scale, but its main drawback is that predicted probabilities are not restricted to the unit inverval. A logistic regression addresses this problem and allows to conduct further tests. The average marginal effects in equation (1) using the logistic regression are very close to the estimates generated using the linear model (Table A6).

Using the logistic regression estimates, we evaluate the relevance of bank financial weakness for the satisfaction of non-financial firms with their bank finance. To this end, we compare the fit of the model with both firm and bank financial weakness indices with that of the model without the bank index. The first measure of the goodness of fit that we use is the Akaike Information Criterion (AIC). For the three dimensions for which both indices are significant, the AIC suggests that the baseline model with both indices provides a better fit.

A second measure that we use is the the degree of accuracy of predicted outcomes. Predicted probabilities are computed for the models with and without the bank index. In order to compare these fitted values to the actual binary outcomes (i.e. satisfied, coded as 1, and dissatisfied, coded as 0), we set a threshold, above which predicted probabilities can be classified as one, and below which they can be classified as zero. Usually this threshold is 0.5, but this standard cutoff value is not suited for unbalanced binary dependent variables.[23] An alternative methodology is to investigate the predictions of the models for each possible cutoff between 0 and

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[22]These numbers are the percentage changes in the coefficient of the firm index between the specification without the bank index and the one with the bank index (Table A5).

[23]Table 2 shows that the share of dissatisfied firms is below 15% for all dimension. Due to this imbalance, it is likely that all the estimated probabilities in equation 1 are higher than 0.5. In this case, all observations would be classified as a one, which is why this threshold is not suited for unbalanced binary dependent variables (Cameron & Trivedi 2005, p.474).

1. Subsequently, the receiver operating characteristics (ROC) curve plots the fraction of ones correctly classified against the fraction of zeros incorrectly classified for the different cutoff values (Cameron & Trivedi 2005). If the ROC curve is a 45-degree line, then the model has no predictive power (i.e. same fraction of correctly and incorrectly specified outcomes for all cutoff values). The predictive ability of the model increases when the ROC curve is above the 45-degree line (i.e. a higher fraction of correctly specified outcomes relative to incorrectly specified ones). The comparison of the ROC curves of the model with and without the bank index suggest that the model with the bank index has a significantly better predictive power when considering satisfaction with the cost of bank finance (Figure A1). Regarding the other dimensions, the differences are not statistically significant.
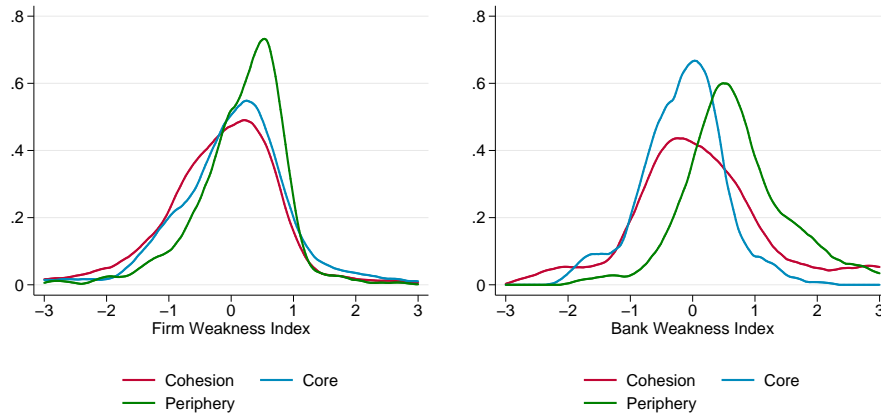
4.3   Country-group heterogeneity

The post-crisis years were marked by fragmentation of financial markets in Euope and, more specifically, the interbank and sovereign debt markets. This had an impact on banks' funding cost and, ulitmately, on their lending terms. EIB (2017, Chapter 6) shows the increased dispersion of bank lending rates on short-term business loans and of rates of growth of bank loans after the financial crisis across core, cohesion and periphery countries. While the sovereign debt crisis ended in 2012, stigmas can still affect banks' access to funding and therefore their provision of credit to non-financial corporates. Motivated by studies of financial market fragmentation in Europe in the wake of the sovereign debt crisis and its lasting effects, we test for differential effects between periphery and core countries of the bank financial weakness index on the satisfaction of non-financial firms with external finance. We also test for a differential effect of the non-financial firm financial weakness index on satisfaction with bank finance across country groups.

The distribution of the indices constructed for non-financial firms and banks, by region, are shown in Figure 1. This figure suggests compositional differences across the three groups of countries. In particular, banks in periphery countries appear weaker than those in cohesion and even more so than those in the core countries. This could be a tentative explanation for the slightly higher number of dissatisfied firms with amount, cost and maturity in periphery countries shown in Table A3. In the following, we consider possible asymmetric effects across regions.

Figure 1: **Distribution of Firm and Bank Financial weakness Indices**

Starting from equation (1), we interact the indices for firms and banks with dummies for cohesion and periphery country groups, core countries being the reference group (Table A7). The focus is on the coefficient associated with the interaction between the dummy for periphery countries and the bank index (*PER x Bank Weakness*). We find a significantly different impact of the bank index in periphery countries compared to core countries, for which the bank index is only significant for one dimension. A one standard deviation increase in the bank index generates an additional decrease of 5.5 percentage points of the probability that a firm is satisfied with the cost of its loan in periphery countries, compared to core countries. The coefficient on the bank index is also significant for the likelihood of satisfaction with amount and maturity of external finance. The effect of bank weakness is also somewhat stronger in cohesion, albeit less than in the periphery. Indeed, some banking sectors in cohesion, such as those of Slovenia, Cyprus and Bulgaria, have also come across a major crisis.

Fewer differences exist across country groups in the impact of the financial weakness of non-financial firms on their satisfaction with bank finance. Weak financial position of a firm reduces significantly the probability of satisfaction with bank finance to a similar extent in core and periphery countries, while its negative impact is weaker in cohesion countries. This may be due to the ownership structure of corporations. Some being owned by foreign and possibly stronger corporations may benefit from mother's company guaranties.

Thus, in core countries, these results suggest that financing conditions of non-financial firms are more impacted by the risk management practices of their bank rather than by that bank's financial constraints, i.e. credit conditions differ across firms mostly due to their different riskiness as perceived by lenders. Our analysis reveals that banks address borrower risk through different dimensions: the loan amount, prices and also non-price terms of loans such as collateral requirements.

Conversely, the financial weakness of banks in periphery and, to some extent, cohesion countries had a negative impact on financing conditions. This is consistent with the idea that weaker banks may face significantly tighter financial constraints in these countries (e.g. face higher funding costs), which in turn impacts credit conditions. These results suggest that banks in periphery countries still experience the

ramifications of the last crisis.[24] Using different model and data, Oztürk & Mrkaic (2014) find similar conclusions for the euro area.[25]

5 Robustness Checks

We evaluate the robustness of our results along two dimensions. First, we analyse alternative ways of capturing bank and firm financial strength. Second, we investigate the issues of sample selection bias and endogenous bank-firm matching.

5.1 Alternative measurement of financial weakness

In order to consider the robustness of our results to the proxy for firms' and banks' financial weakness, we consider two variants of the baseline model. In the first one, each variable entering the computation of the index is considered separately. In the second one, instead of using weights that are arbitrarily fixed, we build indices as the first principal components from a principal component analysis of the underlying variables.

5.1.1 Components of financial weakness indices

We estimate a model where all the financial variables included in the indices of financial weakness enter separately the regression. First, we only include financial ratios of non-financial firms (Table A9). The results show that profitability and leverage are significant determinants of the satisfaction of firms with their bank finance, with expected signs. One standard deviation increase in profitability (0.09) leads to an increase of 2.2 percentage points in the probability that the firm is satisfied with the cost of external finance (0.09 times 24.616), implying a semi elasticity of 2.47 per cent. Similarly, one standard deviation increase in firm leverage (0.26) leads to a decrease in the probability that a firm is satisfied with the cost of 1.6 percentage points (semi-elasticity of -1.8%) and a decrease in the probability of satisfaction with collateral requirements of 3.1 percentage points (semi-elasticity of -2.6%). We then estimate the model with financial positions of both firms and banks to investigate the impact of the financial positions of banks on firm satisfaction (Table A9). These results show that the non-performing loans ratio is a significant determinant of bank lending conditions, when controlling for financial weakness of non-financial firms. One standard deviation increase in the non-performing loans ratio of a bank (0.11) leads to a decrease of 3 percentage points in the probability that a firm is satisfied with the cost of external finance (semi-elasticity of -3.4%).

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[24]As an alternative specification to test for differential effects across country groups, we also estimate the baseline equation separately for the three subsamples – core, cohesion and periphery countries. Results are displayed in Table A8 and Figure A2, and are broadly in line with those obtained with the interaction terms.

[25]Oztürk & Mrkaic (2014) use the Survey on the Access to Finance of SMEs in the Euro Area (SAFE) conducted jointly by the European Central Bank (ECB) and the European Commission (EC). This survey does not provide a bank-firm matching. Consequently, authors have to rely on country-level data to measure the financial health of the banking sector.

5.1.2   Alternative specification for the financial weakness indices

In order to assess the relevance of our methodology for constructing the two indices, we use principal component analysis (PCA) to build alternative financial weakness indices. The loadings of the first principal component for the firm index are negative for the profitability ratio (-0.48) and the liquidity ratio (-0.58), and positive for the leverage ratio (0.65). Regarding the bank financial index, the loadings are negative for the capital ratio (-0.26) and profitability (-0.67), and positive for the non-performing loans (0.64) and liquidity mismatch ratios (0.24). The signs are in line with the idea that weaker firms have lower profitability and liquidity ratios, and higher leverage ratio. Similarly, stressed banks have lower capital and profitability ratios, and a higher non-performing loan ratio and balance-sheet liquidity mismatch.

Table A10 presents the results for our baseline model when firm and bank indices are PCA first component scores, instead of simple unweighted averages. The results confirm those obtained with the baseline specification. The estimated coefficients are broadly in line with our baseline specification. Financial weakness of firms has a significant, albeit smaller impact on three of the four dimesions of satisfaction with bank finance. Financial weakness of banks is significant only for satisfaction with the cost of finance and the impact is lower than in the baseline specification.

5.2   Endogenous matching and sample selection

Recent studies investigate the determinants of the matching of banks and firms in the loan market. Understanding the determinants of the matching patterns of banks and firms in Europe is important for the identification of the determinants of bank lending conditions. Using data on the US loan market, Chen & Song (2013) and Schwert (2018) provide evidence of endogenous matching patterns. They show in particular that large firms tend to match with large banks and that bank-dependent firms borrow from well capitalized banks. Chen & Song (2013) also suggest that switching costs, i.e. the costs born by the borrower to switch to a different lender, may play a significant role in the observed patterns. Focusing on Europe, Andrews & Petroulakis (2017) highlight the importance of the so called zombie lending, i.e. the matching of weak banks with non-viable firms, and the impact of this phenomenon on the real economy. If the matching of banks and firms is endogenous, i.e. dependent on a set of explanatory variables, it must be accounted for in our model to address omitted variable bias. A problem may arise when some of these determinants are unobservable. Chen & Song (2013) and Schwert (2018) use a semi-parametric matching model to overcome this issue.

In order to evaluate whether banks and firms are endogenously matched in our sample, we plot in Figure 2 the conditional distribution of the average level of the borrower weakness index for each bank in the sample. It shows a slightly significant positive correlation: banks with more fragile balance sheets tend to lend to fragile firms. But the relationship is weak with a correlation coefficient equal to 0.15. When looking at the same correlation across the different country groups, the coefficients are 0.13, 0.08 and -0.02 in cohesion, core and periphery countries, respectively. These relationships suggest limited endogenous matching in our sample.

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Figure 2: **Relationship between firm and bank weakness indices**
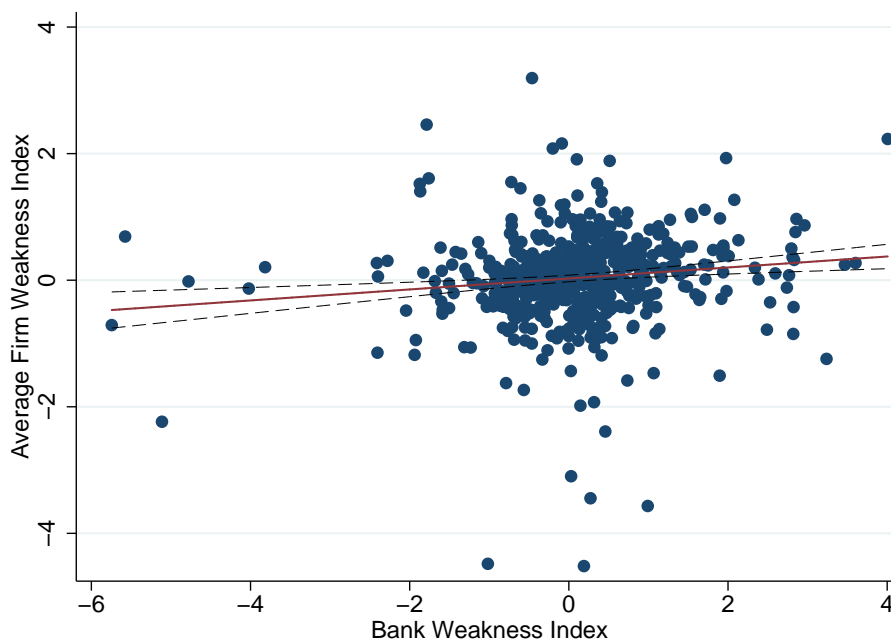
In addition to the endogeneity of observed matches, another concern is that only firms that were granted a loan are present in our sample. This may lead to a sample selection bias. Some unobservable characteristics, which may explain why firms use bank lending, may also be determinants of firms' satisfaction with credit. In this case, coefficients obtained with standard OLS or probit techniques are biased. It is possible to estimate a probit model that accounts for sample selection (Van de Ven & Van Praag 1981), i.e. a model that accounts for the fact that we observe firms' satisfaction with bank lending only when they are granted a loan. The idea is to model both a selection equation, i.e. the probability of using a bank loan, and an outcome equation, i.e. the probability of being satisfied with the loan. Given that firms without loans are not associated with banks, we can only test the impact of sample selection on the model that includes firms' financial characteristics only. [26]

Table A12 displays the average marginal effects obtained for the variables of interest. The coefficients obtained for the effect of the firm index on the amount and collateral requirements are similar to those obtained in the regressions without selection correction. The magnitude of the effect is larger regarding satisfaction with the cost.

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[26]Ideally, this model requires that at least one variable be included in the selection equation but excluded from the outcome equation ("exclusion restriction"). In the absence of an obvious candidate to satisfy this restriction in our case, we run the model with the same regressors in both equations, meaning identification is due to the assumption of normally distributed errors in both equations (Cameron & Trivedi 2005).

6 Concluding remarks

This paper adds to the literature on the impact of financial weakness of borrowers and lenders on credit conditions. Its main contribution is that it assesses this impact along several dimensions of the loan contract, including price and non-price terms. These are valuable insights because they provide further detail on the margins along which lenders adjust their lending conditions and on the relative importance of the financial health of borrowers and lenders.

The paper finds that banks use several financial characteristics to assess borrower risk and adjust loan contract terms accordingly: loan pricing, collateral requirements, amount granted and maturity of the loan. The main results confirm the view that borrower's credit risk is the main determinant of the conditions in the bank loan contract, at least when the overall banking sector is financially strong (Jiménez et al. 2017).

This leads us to the other important finding of this paper: that financial weakness of banks matters, especially when a large share of the banking sector is affected, as for example in periphery countries. The negative effects of banks' financial weakness on loan conditions are significant years after the end of the sovereign debt crisis, suggesting that banking crises may have a long-lasting impact on the real economy.

Overall, our analysis provides new evidence supportive of the bank lending channel in Europe as well as of some stigmas. The effects of the bank lending channel may be asymetric across asset classes. The financing of some assets, such as intangibles which cannot be collateralized, could even be more adversely impacted. This is left for further research.

References

Acharya, V. V., Eisert, T., Eufinger, C. & Hirsch, C. (2018), 'Real effects of the sovereign debt crisis in europe: Evidence from syndicated loans', *The Review of Financial Studies* **31**(8), 2855–2896.

Albertazzi, U. & Marchetti, D. J. (2010), Credit supply, flight to quality and evergreening: an analysis of bank-firm relationships after Lehman, Temi di discussione (Economic working papers) 756, Bank of Italy, Economic Research and International Relations Area.

Albertazzi, U., Ropele, T., Sene, G. & Signoretti, F. M. (2014), 'The impact of the sovereign debt crisis on the activity of italian banks', *Journal of Banking & Finance* **46**, 387–402.

Altavilla, C., Pagano, M. & Simonelli, S. (2017), 'Bank exposures and sovereign stress transmission', *Review of Finance* **21**(6), 2103–2139.

Andrews, D. & Petroulakis, F. (2017), Breaking the Shackles: Zombie Firms, Weak Banks and Depressed Restructuring in Europe, OECD Economics Department Working Papers 1433, OECD.

Bernanke, B. & Gertler, M. (1989), 'Agency costs, net worth, and business fluctuations', *The American Economic Review* **79**(1), 14–31.

Bernanke, B., Gertler, M. & Gilchrist, S. (1996), 'The financial accelerator in a quantitative business cycle framework', *Review of Economics and Statistics* **78**(1), 1–15.

Bottero, M., Lenzu, S. & Mezzanotti, F. (2015), Sovereign debt exposure and the bank lending channel: impact on credit supply and the real economy, Temi di discussione (Economic working papers) 1032, Bank of Italy, Economic Research and International Relations Area.

Bremus, F. & Neugebauer, K. (2017), Don't stop me now: the impact of credit market fragmentation on firms' financing constraints, Discussion paper 1650, DIW Berlin.

Brunnermeier, M. K., Pagano, M., Langfield, S., Nieuwerburgh, S. V. & Vayanos, D. (2017), 'Esbies: Safety in the tranches', *Economic Policy* .

Cameron, A. & Trivedi, P. (2005), *Microeconometrics: Methods and Applications*, Cambridge University Press.

Chen, J. & Song, K. (2013), 'Two-sided matching in the loan market', *International Journal of Industrial Organization* **31**(2), 145–152.

Chirinko, R. S. & Schaller, H. (1995), 'Why does liquidity matter in investment equations?', *Journal of Money, Credit and Banking* **27**(2), 527–548.

Chodorow-Reich, G. (2014), Effects of unconventional monetary policy on financial institutions, Technical report, National Bureau of Economic Research.

Cook, D. O., Schellhorn, C. D. & Spellman, L. J. (2003), 'Lender certification premiums', *Journal of Banking & Finance* **27**(8), 1561–1579.

de Haan, L., van den End, J. W. & Vermeulen, P. (2017), 'Lenders on the storm of wholesale funding shocks: saved by the central bank?', *Applied Economics* **49**(46), 4679–4703.

Ehrmann, M. & Fratzscher, M. (2015), Euro area government bonds: Integration and fragmentation during the sovereign debt crisis, Working paper 2015-13, Bank of Canada.

EIB (2016), *Investment and Investment Finance in Europe: Financing Productivity Growth*, European Investment Bank, chapter 3.

EIB (2017), *Investment Report 2017/2018: From Recovery to Sustainable Growth*, European Investment Bank, chapter 6.

Farhi, E. & Tirole, J. (2018), 'Deadly embrace: Sovereign and financial balance sheets doom loops', *The Review of Economic Studies* **85**(3), 1781–1823.

Ferrando, A. & Mulier, K. (2015), 'Firms? financing constraints: Do perceptions match the actual situation?', *The Economic and Social Review* **46**(1, Spring), 87–117.

Garcia-de-Andoain, C., Hoffmann, P. & Manganelli, S. (2014), 'Fragmentation in the euro overnight unsecured money market', *Economics Letters* **125**(2), 298–302.

Gertler, M. & Gilchrist, S. (1994), 'Monetary policy, business cycles, and the behavior of small manufacturing firms', *The Quarterly Journal of Economics* **109**(2), 309–340.

Gertler, M. & Kiyotaki, N. (2010), Chapter 11 - Financial Intermediation and Credit Policy in Business Cycle Analysis, Vol. 3 of *Handbook of Monetary Economics*, Elsevier, pp. 547 – 599.

Giannetti, M. & Ongena, S. (2012), '"lending by example": Direct and indirect effects of foreign banks in emerging markets', *Journal of International Economics* **86**(1), 167–180.

Gilchrist, S. & Zakrajšek, E. (2012), 'Credit spreads and business cycle fluctuations', *American Economic Review* **102**(4), 1692–1720.

Hadlock, C. J. & Pierce, J. R. (2010), 'New evidence on measuring financial constraints: Moving beyond the kz index', *The Review of Financial Studies* **23**(5), 1909–1940.

Holmstrom, B. & Tirole, J. (1997), 'Financial intermediation, loanable funds, and the real sector', *The Quarterly Journal of Economics* **112**(3), 663–691.

Hubbard, R. G., Kuttner, K. N. & Palia, D. N. (2002), 'Are there bank effects in borrowers' costs of funds? evidence from a matched sample of borrowers and banks', *The Journal of Business* **75**(4), 559–581.

Illing, M. & Liu, Y. (2006), 'Measuring financial stress in a developed country: An application to canada', *Journal of Financial Stability* **2**(3), 243–265.

Ippolito, F., Peydró, J.-L., Polo, A. & Sette, E. (2016), 'Double bank runs and liquidity risk management', *Journal of Financial Economics* **122**(1), 135–154.

Iyer, R., Peydró, J.-L., da Rocha-Lopes, S. & Schoar, A. (2014), 'Interbank liquidity crunch and the firm credit crunch: Evidence from the 2007–2009 crisis', *The Review of Financial Studies* **27**(1), 347–372.

Jiménez, G., Ongena, S., Peydró, J.-L. & Saurina Salas, J. (2017), Do demand or supply factors drive bank credit, in good and crisis times?, Discussion Paper 2012-003, European Banking Center.

Jiménez, G., Ongena, S., Peydró, J. L. & Saurina, J. (2012), 'Credit supply and monetary policy: Identifying the bank balance-sheet channel with loan applications', *American Economic Review* **102**(5), 2301–2326.

Kalemli-Ozcan, S., Laeven, L. & Moreno, D. (2018), Debt overhang, rollover risk, and corporate investment: Evidence from the european crisis, Working Paper 24555, National Bureau of Economic Research.

Kapan, T. & Minoiu, C. (2018), 'Balance sheet strength and bank lending: Evidence from the global financial crisis', *Journal of Banking & Finance* **92**, 35–50.

Kaplan, S. N. & Zingales, L. (1997), 'Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?', *The Quarterly Journal of Economics* **112**(1), 169–215.

Khwaja, A. I. & Mian, A. (2008), 'Tracing the impact of bank liquidity shocks: Evidence from an emerging market', *American Economic Review* **98**(4), 1413–42.

Kiyotaki, N. & Moore, J. (1997), 'Credit cycles', *Journal of Political Economy* **105**(2), 211–248.

Lamont, O., Polk, C. & Saa-Requejo, J. (2001), 'Financial Constraints and Stock Returns', *Review of Financial Studies* **14**(2), 529–554.

Musso, P. & Schiavo, S. (2008), 'The impact of financial constraints on firm survival and growth', *Journal of Evolutionary Economics* **18**(2), 135–149.

Ongena, S. & Smith, D. C. (2000*a*), 'Bank relationships: a review', *Performance of financial institutions: Efficiency, innovation, regulation* **221**.

Ongena, S. & Smith, D. C. (2000*b*), 'What determines the number of bank relationships? cross-country evidence', *Journal of Financial intermediation* **9**(1), 26–56.

Oztürk, B. & Mrkaic, M. (2014), SMEs' Access to Finance in the Euro Area; What Helps or Hampers?, IMF Working Papers 14/78, International Monetary Fund.

Pancrazi, R., Seoane, H. D. & Vukotic, M. (2015), Sovereign Risk, Private Credit, and Stabilization Policies, Economic Research Papers 270214, University of Warwick - Department of Economics.

Popov, A. & Van Horen, N. (2015), 'Exporting sovereign stress: Evidence from syndicated bank lending during the euro area sovereign debt crisis', *Review of Finance* **19**(5), 1825–1866.

Schwert, M. (2018), 'Bank capital and lending relationships', *The Journal of Finance* **73**(2), 787–830.

Storz, M., Koetter, M., Setzer, R. & Westphal, A. (2017), Do we want these two to tango? On zombie firms and stressed banks in Europe, Working Paper Series 2104, European Central Bank.

Van de Ven, W. P. & Van Praag, B. M. (1981), 'The demand for deductibles in private health insurance: A probit model with sample selection', *Journal of econometrics* **17**(2), 229–252.

Whited, T. M. & Wu, G. (2006), 'Financial constraints risk', *The Review of Financial Studies* **19**(2), 531–559.

Annexes

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Table A1: **Variable definitions**

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Variable	Definition
<u>Firms</u>	
Age	categorical variable: age<2y, 2y≤age<5y, 5y≤age<10y, 10y≤age<20y, age>20y
Size	log (total assets)
Profitability	net income/total assets
Leverage	debt/total assets
Liquidity	current assets/current liabilities
Weakness Index*	(Leverage-Profitability-Liquidity)/3
Satisfaction with external finance	EIBIS question: "Thinking about all of the external finance you obtained, how satisfied or dissatisfied are you with it in terms of [*dimension*]? We defined as **satisfied** firms answering "Very satisfied", "Fairly satisfied", "Neither Satisfied or dissatisfied". **Dissatisfied** firms are those answering either "Very dissatisfied or "Fairly dissatisfied". Dimensions: amount, cost, collateral requirements, maturity.
<u>Banks</u>	
Size	log (total assets)
Capital Ratio	equity/total assets
Asset Quality	non-performing loans/gross loans
Profitability	net income/total assets
Liquidity Mismatch	(total deposits-liquid assets)/total assets
Weakness Index*	(AssetQuality+LiquidityMismatch-CapitalRatio-Profitabiltiy)/4
<u>Macro and sectoral factors</u>	
Sovereign spread	long-term (10y) bond yield (spread against Germany)
Sector-level growth rate	gross value added growth rate (spread against EU economy-wide gross value added growth rate)

Note: * Financial ratios included in the weakness indices are all standardized.

Table A2: **Summary statistics of the variables entering the indices**

	Mean	SD	Min	Max	N
Firm-specific variables					
Firm Size	15.21	2.03	10.16	20.64	3184
Firm Profitability	0.04	0.09	-0.37	0.45	3011
Firm Leverage	0.64	0.26	0.05	1.92	3167
Firm Liquidity	1.68	1.59	0.15	14.65	3177
Bank-specific variables					
Bank Size	23.22	2.01	18.89	27.92	537
Bank Capital Ratio	0.09	0.05	0.02	0.35	537
Bank NPL/Gross Loans	0.12	0.11	0.00	0.54	416
Bank Profitability	0.00	0.01	-0.07	0.03	522
Bank Liquidity Mismatch	0.55	0.24	-0.37	0.87	537

Note: Sample of 3184 firm-year observations (2885 unique firms) and 537 bank-year observations (367 unique banks) from 28 European countries for the years 2015 and 2016. Variables are defined in Table A1.

Source: EIBIS-Orbis, Orbis Bank Focus, Eurostat, IHS Markit.

Table A3: **Dissatisfaction with external finance by country group (%)**

Loan characteristic	Cohesion	Core	Periphery
Amount	5	4	6
Cost	11	8	15
Maturity	4	3	7
Collateral	17	12	13

Note: Each line reports the share of dissatisfied firms, in percentage, to each of the four dimensions of the loan contract considered in the EIBIS question.

Source: EIBIS for the years 2016 and 2017.

Table A4: **Correlation coefficients across satisfaction dimensions**

	Amount	Cost	Maturity	Collateral
Amount	1			
Cost	0.357	1		
Maturity	0.272	0.271	1	
Collateral	0.288	0.314	0.271	1

Note: Pearson correlation coefficients for the four dimensions of the loan contract considered in the EIBIS question.

Source: EIBIS for the years 2016 and 2017.

Table A5: **Linear Probability Model (LPM): baseline and variants**

VARIABLES	Baseline				Variant: FE for country, sector, year				Variant: without bank index			
	Amount	Cost	Mat.	Col.	Amount	Cost	Mat.	Col.	Amount	Cost	Mat.	Col.
Firm Weakness	-2.04***	-3.70***	-0.73*	-2.30***	-2.01***	-3.45***	-0.78*	-2.52***	-2.08***	-3.87***	-0.78**	-2.40***
	(0.45)	(0.63)	(0.38)	(0.66)	(0.48)	(0.65)	(0.4)	(0.68)	(0.45)	(0.64)	(0.39)	(0.66)
Bank Weakness	-0.53	-2.47***	-0.76**	-1.54**	-0.72	-2.17***	-0.45	-2.56***				
	(0.4)	(0.59)	(0.38)	(0.73)	(0.5)	(0.7)	(0.42)	(0.84)				
Sov. spread	-0.12	-1.54***	-0.61*	-0.84					-0.29	-2.30***	-0.85***	-1.32***
	(0.32)	(0.5)	(0.33)	(0.53)					(0.31)	(0.49)	(0.33)	(0.49)
VA growth diff	0.04	0.02	0.11*	0.09					0.05	0.04	0.11*	0.10
	(0.09)	(0.12)	(0.06)	(0.13)					(0.09)	(0.12)	(0.06)	(0.13)
Bank Size	0.27	0.2	0.02	1.17***	0.39	0.4	0.2	0.03	0.25	0.07	-0.01	1.10***
	(0.22)	(0.32)	(0.2)	(0.33)	(0.32)	(0.44)	(0.30)	(0.47)	(0.22)	(0.32)	(0.2)	(0.33)
Firm Size	0.66***	1.63***	0.21	1.26***	0.57**	1.61***	0.2	0.96***	0.65***	1.60***	0.2	1.25***
	(0.21)	(0.29)	(0.18)	(0.31)	(0.22)	(0.32)	(0.2)	(0.34)	(0.21)	(0.29)	(0.19)	(0.31)
Observations	3,167	3,151	3,168	3,086	3,167	3,151	3,168	3,086	3,167	3,151	3,168	3,086
Adjusted R^2 (%)	1.4	3.9	0.5	1.8	1.8	5.5	0.6	3.2	1.3	3.4	0.5	1.6

Note: FE, Mat. and Col. respectively stand for fixed effect, maturity and collateral. Bond spread is the 10-year government bond spread with respect to Germany. Each column reports the estimation for the share of dissatisfied firms in each of the four dimensions of the loan contract considered in the EIBIS question. Indices standardised. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

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Table A6: **Variant: logistic regression**

VARIABLES	Amount Satisfied	Cost Satisfied	Maturity Satisfied	Collateral Satisfied
Firm Weakness	-1.84***	-3.51***	-0.76*	-2.21***
	(0.42)	(0.64)	(0.41)	(0.66)
Bank Weakness	-0.61	-2.56***	-0.74*	-1.54**
	(0.40)	(0.65)	(0.42)	(0.72)
Sov. spread	-0.10	-1.00***	-0.35	-0.72
	(0.28)	(0.38)	(0.22)	(0.45)
VA growth diff	0.06	0.03	0.10	0.09
	(0.09)	(0.11)	(0.07)	(0.13)
Bank Size	0.27	0.27	0.08	1.20***
	(0.22)	(0.32)	(0.20)	(0.33)
Firm Size	0.58***	1.58***	0.20	1.26***
	(0.22)	(0.31)	(0.19)	(0.33)
Observations	3,167	3,151	3,168	3,086
Pseudo R^2 (%)	3.9	5.7	2.0	2.5
AIC	1268	2101	1161	2518

Note: Bond spread is the 10-year government bond spread with respect to Germany. Indices standardised. Firm age dummies in all the regressions. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

Table A7: **Impact of weakness indices on firms' satisfaction: interaction effects**

	(1) Amount	(2) Cost	(3) Maturity	(4) Collateral
Firm Weakness	-2.88***	-4.36***	-0.95	-2.91***
	(0.86)	(1.09)	(0.62)	(1.05)
COH × Firm Weakness	2.13**	2.37*	1.59*	2.24
	(1.05)	(1.38)	(0.83)	(1.48)
PER × Firm Weakness	-0.66	-1.54	-2.18**	-2.74
	(1.34)	(2.00)	(1.10)	(1.69)
Bank Weakness	2.08**	1.56	0.61	-1.16
	(0.99)	(1.50)	(0.97)	(1.74)
COH × Bank Weakness	-2.46**	-3.46**	-0.83	-0.13
	(1.12)	(1.71)	(1.09)	(2.07)
PER × Bank Weakness	-3.76***	-5.45***	-2.25*	-2.88
	(1.31)	(1.89)	(1.26)	(2.14)
Sov. spread	0.34	-0.93	-0.17	-0.41
	(0.42)	(0.62)	(0.40)	(0.62)
VA growth diff	0.02	-0.04	0.07	0.08
	(0.09)	(0.12)	(0.07)	(0.14)
Observations	3167	3151	3168	3086
Adjusted R^2 (%)	1.7	4.3	1.1	2.1

Note: Base caterory is core countries. Bond spread is the 10-year government bond spread with respect to Germany. Indices standardised. Firm age as well as firm size and bank size dummies in all the regressions. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

Table A8: **Variant: LPM estimated for each region separately**

VARIABLES	Core				Cohesion				Periphery			
	Amount	Cost	Mat.	Col.	Amount	Cost	Mat.	Col.	Amount	Cost	Mat.	Col.
Firm Weakness	-2.76***	-4.26***	-0.96	-2.65**	-0.80	-2.12**	0.66	-0.98	-3.63***	-5.93***	-3.21***	-6.16***
	(0.85)	(1.08)	(0.62)	(1.04)	(0.61)	(0.85)	(0.57)	(1.04)	(1.04)	(1.71)	(0.93)	(1.35)
Bank Weakness	1.75*	1.11	0.67	-0.76	-0.24	-1.53*	-0.11	-1.17	-2.03**	-4.26***	-2.07**	-5.05***
	(1.04)	(1.56)	(1.02)	(1.80)	(0.55)	(0.80)	(0.52)	(1.13)	(0.96)	(1.24)	(0.84)	(1.28)
Sov. spread	4.31	7.25*	-0.21	-0.13	0.07	-1.48*	-0.53	-1.86*	0.42	-0.76	0.05	-0.34
	(2.94)	(3.88)	(2.54)	(3.96)	(0.66)	(0.89)	(0.53)	(1.05)	(0.61)	(0.94)	(0.60)	(0.85)
VA growth diff	-0.17	-0.56**	-0.05	0.44*	0.13	0.21	0.14	0.34	-0.17	-0.13	0.02	-0.46*
	(0.18)	(0.25)	(0.14)	(0.25)	(0.13)	(0.17)	(0.10)	(0.22)	(0.16)	(0.26)	(0.13)	(0.24)
Bank Size	-0.08	-0.10	0.36	1.19**	0.96	2.62**	0.54	1.59	0.63	0.21	-0.12	-0.50
	(0.42)	(0.58)	(0.37)	(0.60)	(0.73)	(1.04)	(0.52)	(1.11)	(0.49)	(0.66)	(0.53)	(0.62)
Firm Size	0.81**	0.97*	0.11	1.11**	1.25***	1.74***	0.73**	0.74	-0.12	2.49***	-0.06	1.19**
	(0.34)	(0.51)	(0.25)	(0.49)	(0.40)	(0.52)	(0.36)	(0.60)	(0.36)	(0.56)	(0.35)	(0.57)
Observations	1,005	998	1,006	992	1,196	1,189	1,196	1,178	966	964	966	916
R^2 (%)	4.1	3.8	0.8	4.0	1.9	3.8	1.3	1.7	3.0	7.4	2.2	5.9

Note: Mat. and Col. respectively stand for maturity and collateral. Bond spread is the 10-year government bond spread with respect to Germany. Indices standardised. Firm age dummies in all the regressions. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

Table A9: **Variant: LPM with each component of financials separately and fixed effects**

VARIABLES	Only firms' characteristics				Both banks and firms' characteristics			
	Amount	Cost	Maturity	Collateral	Amount	Cost	Maturity	Collateral
Firm Profitability	15.34**	24.62***	4.05	13.83*	14.98**	16.57*	0.73	16.78*
	(6.11)	(8.26)	(4.68)	(8.26)	(7.36)	(10.00)	(5.51)	(9.80)
Firm Liquidity	-0.2	0.34	-0.39	-0.55	-0.28	0.08	-0.04	-0.73
	(0.3)	(0.37)	(0.29)	(0.52)	(0.39)	(0.44)	(0.27)	(0.64)
Firm Leverage	-4.56**	-6.16*	-4.96***	-11.09***	-4.18	-5.06	-2.02	-11.23***
	(2.25)	(3.17)	(1.83)	(3.52)	(2.79)	(3.79)	(2.11)	(4.27)
Firm Size	0.50**	1.59***	0.12	0.88**	0.73***	1.80***	0.28	0.86**
	(0.24)	(0.34)	(0.22)	(0.36)	(0.27)	(0.39)	(0.26)	(0.42)
Bank Capital Ratio					4.72	-13.32	-8.02	-24.04
					(18.14)	(27.22)	(16.26)	(31.20)
Bank Profitability					-14.02	30.1	9.96	128.83
					(62.55)	(97.34)	(64.44)	(113.65)
Bank NPL/Gross Loans					-6.67	-27.86**	-11.75	-27.63*
					(8.55)	(13.68)	(8.34)	(15.13)
Bank Liquidity Mismatch					-0.56	-10.21**	0.77	-5.02
					(3.16)	(4.39)	(2.81)	(5.57)
Bank Size					0.82*	-0.2	0.38	0.35
					(0.48)	(0.61)	(0.43)	(0.70)
Observations	2,972	2,955	2,972	2,895	2,175	2,156	2,173	2,109
Adjusted R^2 (%)	1.4	4.7	0.7	3.2	1.6 5	0.2	4.0	3.6

Note: Indices standardised. Firm age as well as country, sector, year dummies in all the regressions. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

Table A10: **Baseline model using PCA**

VARIABLES	Amount Satisfied	Cost Satisfied	Maturity Satisfied	Collateral Satisfied
Firm Weakness	-1.04***	-1.95***	-0.36	-1.41**
	(0.40)	(0.54)	(0.33)	(0.62)
Bank Weakness	-0.21	-1.93**	-0.78	-0.12
	(0.56)	(0.84)	(0.50)	(1.03)
Sov. spread	-0.23	-1.37**	-0.55	-1.58**
	(0.43)	(0.66)	(0.40)	(0.72)
VA growth diff	0.21**	0.28**	0.10	0.15
	(0.11)	(0.14)	(0.08)	(0.18)
Bank Size	0.78***	0.79**	0.22	1.63***
	(0.26)	(0.35)	(0.23)	(0.40)
Firm Size	0.82***	1.72***	0.32	1.26***
	(0.25)	(0.33)	(0.23)	(0.36)
Observations	2,175	2,156	2,173	2,109
Adjusted R^2 (%)	1.7	4.3	0.8	2.4

Note: Indices standardised. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

Table A11: **LPM on the EIBIS full sample: Firm index and macro-financial developments**

| VARIABLES	With macro-financial variables				With country, sector and year fixed effects			
	Amount	Cost	Maturity	Collateral	Amount	Cost	Maturity	Collateral
Firm Weakness	-2.43***	-3.75***	-1.32***	-2.46***	-2.42***	-3.45***	-1.31***	-2.61***
	(0.35)	(0.47)	(0.3)	(0.49)	(0.36)	(0.47)	(0.31)	(0.51)
Sov. spread	-0.38*	-1.81***	-1.03***	-1.38***				
	(0.20)	(0.30)	(0.21)	(0.30)				
VA growth diff	0.06	0.05	0.06	0.11				
	(0.05)	(0.07)	(0.05)	(0.08)				
Firm Size	0.62***	1.27***	0.31***	1.29***	0.54***	1.17***	0.29**	1.06***
	(0.13)	(0.18)	(0.12)	(0.18)	(0.13)	(0.19)	(0.12)	(0.20)
Observations	7,744	7,690	7,627	7,414	7,744	7,690	7,627	7,414
Adjusted R^2 (%)	1.2	2.2	0.8	1.2	1.6	3.9	1.3	2.5

Note: Indices standardised. Firm age as dummies in all the regressions. In the case of fixed effects estimation, firms country, sector and year dummies are included to account for macro-wide developments, both real and financial. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

Table A12: **Satisfaction (Probit model with sample selection)**

VARIABLES	Amount	Cost	Collateral
Firm Weakness	-2.78***	-5.02***	-2.73**
	(0.53)	(0.74)	(1.27)
Sov. spread	-0.34	-2.05***	-1.96***
	(0.25)	(0.40)	(0.53)
VA growth diff	0.05	0.07	0.06
	(0.08)	(0.12)	(0.12)
Firm Size	0.71***	1.62***	1.87***
	(0.21)	(0.31)	(0.33)
Observations	20,891	20,875	20,810

Note: Indices standardised. Firm age dummies. Robust standard errors in parentheses. Rejection probabilities indicated with asterisks: ***, **, and * denote significance at respectively 1, 5 and 10 %.

Figure A1: **ROC curve**
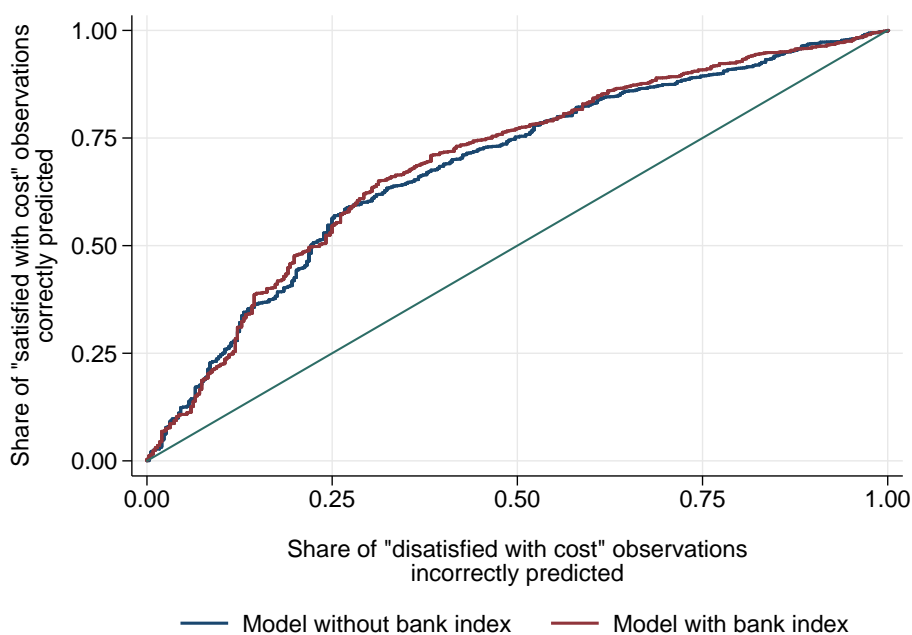
Note: The y-axis represents the share of observations satisfied with the cost of their credit that are correctly predicted by the model and the x-axis represents the share of observations disatisfied with the cost of their credit that are incorrectly predicted by the model. Each data point gives these two shares for a given cutoff value. A chi-squared test comparing the areas under the ROC curves of the models with and without the bank index shows a difference significant at the 10% level.

Figure A2: **LPM - Split Samples**
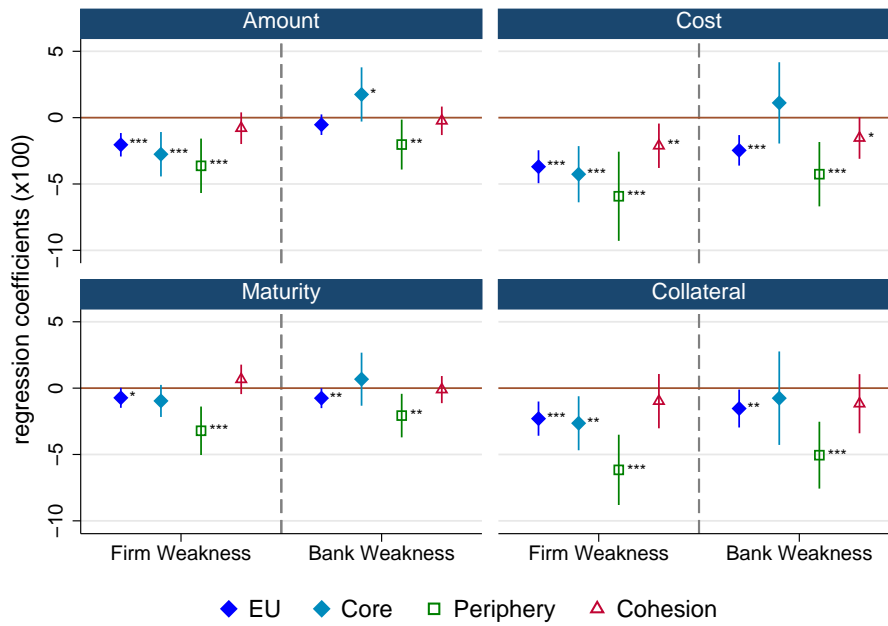
Note: Regression coefficients (x100) of the baseline equation, run separately for the different country groups. Lines indicate the 95% confidence interval. *** p<0.01, ** p<0.05, * p<0.1.

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