Bank Risk and Firm Investment:

Evidence from Firm-Level Data

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Abstract

We examine how bank risk affects firm investment on a large sample of firms from nine European countries. Using firm-level and bank-level data, we find that bank risk has a positive effect on firm investment. This is consistent with the modern theory of financial intermediation: risk taking by banks enhances firm investment as banks become more willing to perform their key function in the economy. This effect is present for firms of all sizes. The positive effect of bank risk is stronger when banks are more efficient and weaker when banks face more competition. One implication of our work is that policies that reduce bank risk can hamper firm investment.

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1. Introduction

"A ship in harbor is safe, but that is not what ships are built for"

John A. Shedd

Understanding the factors that affect the willingness of banks to take risks is of primary importance. Too much bank risk-taking can lead banks to bankruptcy, potentially jeopardizing the stability of the financial system. Motivated by recent events – most notably the 2007-2008 financial crisis – a large literature has emerged to investigate the determinants of bank risk and to assist supervisory authorities in designing policies that impose limitations on bank risk-taking.[1]

While the existing literature has largely focused on the detrimental consequences of bank risk-taking for financial stability, its potential benefits for the economy have been mostly neglected. Banks play a central role in financial intermediation. They facilitate transformation of securities with short maturities (deposits) into securities with long maturities (loans), financing firm investments and the economy in general. This maturity transformation function, one of the most important functions performed by banks, therefore exposes banks to liquidity risk through the maturity mismatch between bank liabilities and bank assets. Another important function performed by banks is solving asymmetric information problems associated with lending. As observed by Diamond (1984), banks have a comparative advantage in the ex post monitoring of borrowers, compared to investors. They act as delegated monitors and thus produce the information required for an efficient allocation of financial resources. This role of banks as delegated monitors generates credit risk. Consequently, while banks help reduce transaction costs and informational asymmetries in the economy, performing these functions also exposes them to risk.

These functions performed by banks obviously facilitate firm investment. For example, the absence of maturity transformation combined with asymmetric information

[1] Among many others, the influence of bank governance and regulation (Laeven and Levine, 2009; Pathan, 2009), bank competition (Berger, Klapper and Turk-Ariss, 2009), creditor rights and information sharing (Houston et al., 2010), executive board composition (Berger, Kick and Schaeck, 2014) has been studied.

problems would result in lower corporate lending, deteriorating firm investment. The modern theory of financial intermediation therefore suggests that bank risk should be beneficial for firm investment.

At the same time, a high level of bank risk can be detrimental to firm investment. First, excessive risk-taking by banks may lead to loan losses, lower equity ratios and consequently greater bank failures, which in turn could diminish the ability of banks to supply corporate loans. Second, a high level of bank risk can reduce the ability of banks to attract securities with short maturities. This reduced ability to transform maturity will result in lower corporate lending.

A final possibility is that bank risk may have no effect on firm investment. Firm investment is financed by banks through long-term loans to companies. If bank risk increases because banks provide more short-term corporate loans or household loans, this greater propensity of banks to take risks may not translate into more firm investment.

The present paper examines the relationship between bank risk and corporate investment in nine Western European countries. To the best of our knowledge, this is the first study to examine this relationship. We advance the understanding of the effects of banks on the real economy through a cross-country investigation of the effects of bank risk-taking on firm investment using micro-level data.

A central challenge in studying these effects is to obtain firm-level information on the lending banks so that risk-taking at the bank level and investment at the firm level can be linked. The last wave of the Amadeus database provides such information, allowing us to identify which banks lend to each borrowing firm. Thus, we can combine firm-level data from the Amadeus database with bank-level data from the Bankscope database to build a large sample of more than 400,000 firms from nine European countries. To answer our research question, we then measure the impact of bank risk ratios computed at the bank level on investment measures computed at the firm level. We first model firm investment as a function of bank risk and a set of firm- and country-specific control variables. We also investigate whether the effect of bank risk on firm investment is contingent on firm size, bank efficiency, and bank competition. We finally examine the robustness of our findings to different specifications of key variables and samples. We also pay special attention to endogeneity concerns.

This work has therefore major implications for authorities monitoring banks. Evidence of a positive impact of bank risk on firm investment would challenge the common view that the reduction of bank risk should be put at the top of the policy agenda. It would suggest the existence of a trade-off between the benefits of greater firm investment and the costs of higher financial instability. Reversely, the absence of evidence of any beneficial effect of bank risk on firm investment would give additional arguments to design policies diminishing bank risk.

Our paper contributes to two debates in the literature. Firstly, we augment the vast literature on bank risk by investigating the effects of bank risk on real economy. Secondly, we improve our understanding of how banks' behavior shapes firm investment. Several works have investigated how firm investment is influenced by bank competition (e.g., Zarutskie, 2006), bank health (e.g., Gibson, 1995), or the behavior of bank CEOs (Ho et al., 2016). Our work departs significantly from the existing empirical literature by focusing on the role of bank risk.

The paper proceeds as follows. Section 2 presents the data and the methodology. Section 3 reports the results. Section 4 concludes.

2. Data and methodology

2.1. Data and sample description

To empirically investigate the relationship between bank risk and corporate investment we develop a new dataset containing firms and their banks in nine countries of Western Europe. The firm-level data come from the Amadeus database maintained by Bureau van Dijk, which contains comprehensive financial information on public and private companies across Europe. We focus on unconsolidated financial statements in our analysis for two reasons. First, the vast majority of firms in Amadeus report unconsolidated financial statements only. Second, we want to avoid double counting firms and subsidiaries or operations abroad and exclude firms for which unconsolidated statements are not

available. Following the literature, we also exclude firms operating in the financial intermediation sector and insurance industries (NACE codes 64–66).

The bank-level data come from the Bankscope database. To match bank-level information to firm-level information we have developed a matching algorithm that takes advantage of the recent Amadeus update, which includes information about lending banks for each firm. The name of each bank in Bankscope is textually matched to the list of firm lending banks in Amadeus. We further manually check the identity of lending banks to ensure the quality of the match.

The sample consists of the firms from nine countries of Western Europe. The choice of countries is driven by the availability of firm-level information on the lending banks. These are Austria, France, Germany, Greece, Ireland, the Netherlands, Portugal, Spain, and the United Kingdom. As the information on the lending banks became available in Amadeus only recently, our final sample is a cross-section of firms for the year 2015.

After excluding observations for which firm-level information or the identity of the lending bank(s) are not available, we have a sample of 413,005 firm-bank observations for about 300,000 firms. Descriptive statistics of all variables are presented in Table 1. Table 2 reports firm investment measures and sample composition by country. Overall, it is important to mention that the vast majority of firms use only a few banks: 42.6% of firms have only one bank, while 82.43% of firms have no more than three banks. The definitions of all variables are provided in the Appendix.

2.2. Methodology

In line with the former literature, we consider three different measures to assess bank risk. We first measure insolvency risk with the z-score (*Z-score*), which is commonly used in empirical studies as a proxy for bank stability (Laeven and Levine, 2009; Berger, Klapper and Turk-Ariss, 2009). The z-score is computed as follows:

$$Z\text{-}score_{it} = [ROA_i + CAR_i]_t / [SD(ROA_i)] \quad (1)$$

where ROA is the return on assets measured by the ratio of net income to total assets and CAR is the ratio of equity capital to assets of bank *i* at time *t.* SD(ROA) is the standard deviation of ROA over the period of three years — from 2013 to 2015— and refers to

return volatility. The z-score is inversely related to the probability of bankruptcy of the bank, meaning that a higher z-score is associated with greater stability.

In addition to the z-score, we consider two alternative risk measures. Both measures are backward-looking proxies for credit risk: the ratio of impaired loans to loans (*Impaired loans*), and the ratio of loan loss provisions to loans (*Loan loss provisions*). Loan loss provisions refer to the costs that banks have to pay when writing off a loan; the impaired loan ratio increases when banks classify a loan as non-performing. Both these indicators consider the quality of bank loans. These risk measures are commonly used in the literature to measure bank risk (e.g., Abedifar, Molyneux and Tarazi, 2013).

To estimate the effect of bank risk on corporate investment, we augment the investment equation by Erel, Jang, and Weisbach (2015), who examine the investment decisions of private companies.

$$Gross\ Investment_{it} = \alpha + \beta Bank\ Risk_{it} + \gamma X_{it-1} + \delta Macro_{ct-1} + \theta_j + \vartheta_c + \varepsilon_{it} \quad (2)$$

where *Bank Risk* is either z-score, impaired loans or loan loss provisions of lending bank of firm *i* at time *t* (year 2015). Gross Investment is defined by the ratio of the sum of fixed assets and depreciation for year t minus fixed assets in year t-1 divided by total assets in year t. Vector X_{it-1} contains firm-specific control variables for firm *i* at time *t-1*, such as firm size, cash flow, number of employees, leverage and sales growth. *Macro* denotes a set of country-level variables, specifically, total private credit to GDP and nominal GDP growth, to control for variation in external financing availability. We further control for the country fixed effects (ϑ_c) and also include industry fixed effects (θ_j) to capture unobservable country and industry heterogeneity. Standard errors (ε_{it}) are robust to arbitrary heteroskedasticity.

3. Results

This section presents the results of the estimations. We first report the main estimations. We continue by showing results by firm size. We then investigate how the

relation between bank risk and firm investment is moderated by bank competition and bank efficiency. We complete the analysis with several robustness tests.

3.1 Main estimations

We start by estimating the firm investment equation augmented to account for bank risk. We consider alternatively the three measures of bank risk (*Z-score*, *Impaired loan share*, *Loan loss share*). Following Erel, Jang, and Weisbach (2015), we use two specifications for the base investment equation since some firm-level variables are missing for some countries due to differences in reporting requirements. The first specification controls for total assets, total assets squared and firm's cash flow to total assets as firm-level variables. The second specification also includes the number of employees, leverage and sales growth because these variables are related to firm growth opportunities. All specifications include two country-level variables, namely, total private credit to GDP and nominal GDP growth.[2] This approach helps to assess the sensitivity of our results to the specification used. The estimation results are reported in Table 3. Note that higher values of risk measures are associated with higher risk for *Impaired loan share* and *Loan loss share*, but with lower risk for *Z-score*.

We observe that the coefficients of interest are significant and positive for *Impaired loan share* and *Loan loss share*, but significant and negative for *Z-score*. The positive relation between bank risk and firm investment is not conditional on the set of control variables. Overall, our results support the view that greater risk taken by banks is associated with the increase in firm investment. This is consistent with the modern theory of financial intermediation: banks taking risk contribute to the increase in firm investment by performing their key functions in the economy. Our conclusion is of importance to policymakers because policies designed to reduce bank risk can hamper firm investment.

The estimated coefficients of the control variables are consistent with our expectations. We observe a nonlinear relationship between firm size and investment: the linear term is significantly positive while the quadratic term is significantly negative. This

[2] Stock market capitalization to GDP is not included because it is not available for the UK in 2014 or 2015. We re-estimate our main model excluding the UK firms and controlling for stock market capitalization to GDP. Our results stay unchanged. They are available upon request.

supports the view of a reverse U-shaped curve for the relationship between firm size and investment. Firms tend to increase investment when they become larger until a certain size above which the effect is reversed. Firm leverage is negative and significant, suggesting that greater indebtedness would be negatively linked to investment. The ratio of cash flow to total assets is positive and significant in line with the intuition that greater profitability contributes to favor investment. Growth of sales is significantly positive as expected in the sense that high-growth firms are more prone to launch investment. Staff size is significantly positive corroborating the view that firms with higher labor force have higher incentives to enhance their stock of capital. As expected, financial development and economic growth tend to be positively associated with firm investment. Their coefficients are significant in the estimations with *Impaired loan share* and *Loan loss share* but not significant with *Z-score*.

3.2 Estimations by firm size

Our main estimations show that bank risk has a positive impact on firm investment. We further investigate whether the effect of bank risk on firm investment varies with the size of the firm. Small companies are more dependent on bank credit than large ones to finance their investment (Berger and Udell, 1995; Casey and O'Toole, 2014). In addition, they have on average lower number of bank relationships than larger firms (Bonfim, Dai and Franco, 2018). As a consequence, we can question whether the effect of bank risk on firm investment is stronger for small firms.

To this end, we re-estimate our regressions by considering separately the following groups of firms: micro companies, SMEs, and large companies. For space reasons, we only provide estimations with the largest set of control variables. Table 4 reports the results.

We find that the beneficial impact of bank risk on firm investment is observed for all types of firms. The estimated effect is significant in all subsamples. Coefficients are positive for *Impaired loan share* and for *Loan loss share* and negative for *Z-score* for micro companies, SMEs, and large companies.

The analysis of the coefficients does not show that the economic impact of bank risk on firm investment is higher for smaller firms: the coefficient (in absolute value) is greater

for micro companies with *Impaired loan share*, for SMEs with *Z-score*, for large companies with *Loan loss share*.

We therefore do not find support to the hypothesis that bank risk would have a greater impact on investment of smaller companies. In terms of policy implications, this result suggests that the effect of bank risk is not limited to investment of small firms, corroborating the view that bank risk has beneficial effects for the economy in whole.

3.3 The effect of efficiency

We demonstrate that higher bank risk benefits firms by increasing investment. This relationship between bank risk and firm investment could potentially be mediated by bank efficiency. Bank efficiency provides information on the quality of bank management. We would expect that better-managed banks have a better appraisal of risk, which leads to higher firm investment.

To test whether the impact of bank risk on firm investment is greater for high-efficiency banks, we augment our models to account bank efficiency. We measure bank efficiency by estimating a cost frontier with a stochastic frontier approach, commonly adopted in works on bank efficiency (Bonin, Hasan and Wachtel, 2005; Berger, Hasan and Zhou, 2009). Cost efficiency is the most common measure of efficiency used in the literature to appraise quality of bank management since it measures the ability of a bank to minimize costs for a given bundle of outputs. Unlike profit efficiency, it is therefore not influenced by market power which can be exogenous to bank managers. In addition, cost minimization is a common objective for all banks whatever their ownership in opposition to profit maximization.

We compute a translog cost frontier following Berger, Hasan and Zhou (2009). The cost frontier includes two outputs (loans, and investment assets) and three input prices. The price of funds is calculated as the interest rate paid on borrowed funds, the price of labor is defined as personnel expenses divided by total assets, and the price of physical capital is calculated as the ratio of other operating expenses to fixed assets. Total cost is the sum of the costs incurred for borrowed funds, labor, and physical capital.

Once we have estimated cost efficiency scores for each bank, we create a dummy variable *High Efficiency* equal to one if bank efficiency is higher than the median

efficiency. We then add this dummy variable and its interaction term with bank risk in the regressions. Table 5 reports these estimations.

We observe that the interaction term between bank risk and *High Efficiency* is significantly positive with *Impaired loan share* and *Loan loss share* and significantly negative with *Z-score*. These results indicate that greater efficiency increases the positive influence of bank risk on firm investment. This is in line with the view that better-managed banks are able to appraise lending risk better and therefore their increase of bank risk further contributes to increase in firm investment. This result emphasizes the importance of bank efficiency for firm investment and provides an additional motive to foster bank efficiency for policy authorities.

Interestingly, while the estimated effect of the interaction between bank risk and bank efficiency is consistent across all three risk measures, there are some differences to be pointed out. With *Impaired loan share*, the coefficient of the risk measure is significantly negative. Combined with the significantly positive coefficient for the interaction term with *High Efficiency*, it implies that bank risk exerts a beneficial effect on firm investment only if the bank is efficient. Namely we observe that the overall effect of bank risk on firm investment, which is the sum of the coefficient for bank risk and the coefficient for the interaction term between bank risk and *High Efficiency*, is negative for low-efficiency banks (-0.0081 in the first specification, -0.0071 in the second specification) and positive for high-efficiency banks (respectively 0.0161 and 0.0146). With *Loan loss share*, the coefficient of the risk measure is not significant. All positive effect of bank risk on firm investment is generated by efficient banks. With *Z-score*, both coefficients of the risk measure and the interaction term are negative and significant. Thus bank risk is positively related to firm investment but its impact is stronger for highly efficient banks. We remind that the three risk measures capture different aspects of bank risk-taking behavior, which can explain the observed differences. These comments made, we conclude that the positive effect of bank risk on firm investment is greater for high-efficiency banks.

3.4 The effect of competition

Our main estimations indicate that greater bank risk favors firm investment, while the analysis of bank efficiency shows its beneficial impact on the relation between bank risk and firm investment. We further question the impact of bank competition on the link between bank risk and firm investment.

The information hypothesis provided by Petersen and Rajan (1995) suggests that increased bank competition reduces incentives for banks to invest in relationship lending. As a consequence, banks have lower soft information on borrowers leading to a higher degree of information asymmetries. Thus, higher bank competition reduces bank incentives to invest in relationship lending for a given level of bank risk, which would contribute to decrease in firm investment.

We test this hypothesis by investigating whether bank competition mediates the relation between bank risk and firm investment. We measure bank competition with the Lerner index in line with recent works (Carbo-Valverde, Rodriguez Fernandez and Udell, 2009; Fungacova, Shamshur and Weill, 2017).

The Lerner index is defined as the difference between price and marginal cost, divided by price. It measures bank market power and as such a greater value of the Lerner index is associated with lower competition. To compute the Lerner index, we measure the price as the average price of bank production defined by the ratio of total revenues to total assets following Carbo et al. (2009). The marginal cost is estimated with a translog cost function including one output (total assets) and three input prices (price of labor, price of physical capital and price of borrowed funds, defined above).

We then create a dummy variable *High Competition* equal to one if the Lerner index is lower than the median and to zero otherwise. We redo the estimations by adding *High Competition* and the interaction term between the risk measure and *High Competition*. We display the estimations in Table 6.

We find that the interaction term is significantly negative with *Impaired loan share* and *Loan loss share*, and significantly positive with *Z-score*. Therefore these findings show that greater bank competition reduces the positive impact of bank risk on firm investment. Thus, we find support for the view that bank competition reduces incentives for banks to

invest in relationship lending, which hampers the beneficial impact of bank risk on firm investment.

3.5 Robustness tests

We check the robustness of our main findings in several different ways.

Endogeneity. We address the potential endogeneity concern by re-estimating our main models using an instrumental variable strategy. We use ratios of bank equity to total assets and of deposits to total assets as instruments since they are both correlated with bank risk but not correlated with firm investment. The results of the instrumental variables estimations are presented in Table 7. All the risk measures are significant and have the sign consistent with our main estimations. To ensure that our instruments are valid we conduct required statistical tests. We also test whether the instrumental variables are correlated with the endogenous variable using an F-test. The F-statistic should be higher than 10 for a single endogenous regressor. In all our models, the F-statistic is well above recommended threshold of 10. To test the second requirement for an instrumental variable of being orthogonal to the error process, we perform a test of overidentifying restriction. Hansen J statistic is not significant for any of the models. We therefore conclude that the instruments are uncorrelated with the error process and that the structural equation is correctly specified. We thus provide additional support for our key findings.

In addition to instrumental variable estimation, we also take advantage of matching analysis that allows us to compare the investment of matched firms linked to high and low risk banks. Using the subsample of one-bank firms to have clean identification, we first assign banks in two groups by their risk level. The top quartile of banks (high risk) form the treated group and the bottom quartile of banks form the control group. Combining the exact matching with nearest neighbor matching algorithm, we find similar pairs of firms linked to banks in different risk groups and then compare their investments.

Specifically, we use the exact matching on country and industry (2-digit NACE) in the same year and then apply a nearest neighbor matching procedure accounting for a set of firm-specific characteristics. We assume that firm size and cash flow availability would

be important determinants of firm investment levels.[3] Table 8 reports the results of the matching analysis. Panel A shows that the average effect on the treatment group is about 0.004 when bank risk is measured by impared loan share, 0.001 for the specification with loan loss share, and -0.014 for z-score (standard error is 0.001 in all cases). The estimated effect is highly statistically significant and robust across all bank risk measures.

To ensure the quality of matching, distributions of baseline covariates between treatment and control groups in the matched sample need to be assessed (Austin 2009, 2011). The covariance balance summary for matched and unmatched samples is reported in Panel B of Table 8 and appears to indicate a good balance. Matching has significantly diminished systematic differences in means and variances – balance is achieved for all covariates as they fall within a 10% window, which has been used in the literature to indicate a negligible difference (Austin, 2009). All the kernel density plots (Figure 1) using matched data appear to be balanced supporting this conclusion.

One-bank firms. We redo the estimations on the sub-sample of firms with only one bank. A potential criticism of our work is the absence of information on the decomposition of loans by bank for each borrowing firm. We thus consider all banks granting loans to a firm. This concern is however reduced by the fact that the vast majority of firms in the sample have a small number of lending banks.

Nonetheless we can perform the estimations only for firms with one bank to check if our main findings stand. These estimations come however at the cost of reducing the sample size. One-bank firms represent about 40% of our original sample, which is large enough to perform relevant estimations. The results are reported in Table 9. We find again that greater bank risk is associated with greater firm investment: the coefficient of the risk measure is significantly positive for *Impaired loan share* and *Loan loss share*, and significantly negative for *Z-score*. These results are therefore consistent with those obtained on the full sample and thus support our key findings.

Alternative measure for the firm investment. In the main estimations we follow Erel, Jang and Weisbach (2015) and employ *Gross investment* measure. To test the robustness of our results to the investment measure used, we consider *Net investment*, calculated as

[3] We apply Abadie and Imbens' (2006, 2011) procedure to correct for bias associated with matching on more than one continuous covariate using the nearest neighbour matching approach.

the ratio between net fixed capital stock increase and the initial net fixed capital stock, following Kalemli-Oczan, Laeven and Moreno (2018). Table 10 displays these estimations. The results are in line with the main results: the estimated coefficients for all bank risk measures are significant and positive for *Impaired loan share* and *Loan loss share*, but negative for *Z-score*. Thus a positive relationship between bank risk and firm investment is not dependent on the investment measure used.

Sample composition. Firms in our sample operate in nine different countries. However, our sample is rather unbalanced as Spanish firms represent about 42% of the observations in the sample. To ensure that our results are not driven by Spanish firms and in general are not determined by sample composition, we exclude Spain and re-estimate our main specification. The results are summarized in Table 11. The results are consistent with our main estimations, a positive and significant coefficient *for Impaired loan share* and *Loan loss share* and a negative and significant coefficient for *Z-score*.

Non-linearity. We also consider possible nonlinearity in the relationship between bank risk and firm investment. Table 12 reports these estimations. We observe some differences across risk measures. With *Impaired loan share*, we observe that the coefficient of the squared term is significantly positive while the coefficient of the linear term is no longer significant. We therefore find no evidence of a nonlinear relationship with *Impaired loan share*. With *Loan loss share*, we also find a significantly positive coefficient for the squared term but no significant coefficient for the linear term in the specification with a full set of firm-level variables. So this specification rejects the view of a nonlinear relationship. However, in the specification with a limited set of firm-level variables, the coefficient of the linear term is significantly negative, while the coefficient of the squared term is significantly positive. This latter result provides some evidence for a nonlinear relationship. Greater bank risk is associated with lower firm investment up to a threshold of 0.051. Bank risk above this threshold is associated with greater firm investment. The inflection point for bank risk is below the sample mean. We therefore find a limited evidence of a nonlinear relationship for *Loan loss share*. With *Z-score*, we observe that the coefficient of the linear term is significantly negative, while the coefficient of the squared term is significantly positive in both specifications. We thus find support for a nonlinear relationship. Since higher z-score is associated with lower bank risk, these results suggest

that greater bank risk would favor firm investment until a certain value, above which it would hamper firm investment.

4. Conclusion

In this paper we investigate the impact of bank risk on firm investment. While there is a common view that bank risk should be fought, we test the possibility that bank risk could benefit the economy by enhancing firm investment. To this end we combine firm-level data with bank-level data so that we can identify the level of risk for each bank granting a loan to each firm. We then do estimations on a large sample of about 400,000 firms from nine European countries.

Our main finding is that bank risk exerts a positive influence on firm investment. This conclusion accords with the modern theory of financial intermediation: banks taking risk contribute to enhance firm investment by performing their key functions in the economy. We also conclude that the influence of bank risk on firm investment does not vary with firm size: it is observed for all types of firms. This impact is however influenced by the degree of bank efficiency and bank competition. We find that greater efficiency enhances the beneficial impact of bank risk on firm investment, but greater competition contributes to diminish this effect.

The normative implications of our findings are that taking measures to diminish bank risk could have a detrimental influence on firm investment. A trade-off would exist between the benefits of greater firm investment and the costs of higher financial instability. Our work is the first investigation on the impact of bank risk on firm investment. It may be extended in a number of ways to check the general applicability of these findings. Further research would also be of particular interest to determine the optimal level of bank risk for the economy.

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Table 1.
Descriptive statistics

This table provides descriptive statistics for the variables used in the estimations. Definitions of variables are provided in the Appendix.

	Obs	Mean	Std. Dev.	Min	Max
Bank-level					
Impaired loan share	427 519	0.094	0.117	0.000	0.785
Loan loss share	438 119	0.058	0.064	0.000	0.581
Z-score	370 768	8.560	11.475	0.019	133.908
Firm-level					
Investment	458 963	-0.003	0.076	-0.315	0.375
Ln(total assets)	475 397	15.012	1.799	9.225	26.085
Cash flow/total assets	475 397	0.056	0.189	-1.004	1.730
Ln(employees)	402 654	2.954	1.605	0.000	12.522
Sales growth	415 784	-0.080	0.213	-0.905	1.101
Total debt/total assets	475 397	0.221	0.214	0.000	1.000
Country-level					
Private credit/GDP	475 397	119.478	21.166	79.740	144.960
GDP growth	475 397	1.323	0.684	0.740	8.328

Table 2.
Firm investment and sample composition by country

The table provides the descriptive statistics for firm investment by country. Definitions of variables are provided in the Appendix.

	Investment		Obs
	Mean	Std. dev.	
Austria	0.011	0.076	8,396
Germany	0.010	0.072	38,854
Spain	-0.014	0.081	193,349
France	0.009	0.065	104,200
United Kingdom	0.024	0.077	20,301
Greece	-0.012	0.065	17,452
Ireland	-0.017	0.094	1,901
Netherlands	0.005	0.083	98
Portugal	-0.006	0.077	74,412

Table 3.
Main estimations

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*					
	Impaired loan share		Loan loss share		Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Risk	0.0261***	0.0199***	0.0450***	0.0338***	-0.0004***	-0.0005***
	(0.0015)	(0.0017)	(0.0031)	(0.0034)	(0.0000)	(0.0000)
Ln(Total Assets)	0.0236***	0.0074***	0.0242***	0.0077***	0.0246***	0.0076***
	(0.0008)	(0.0010)	(0.0008)	(0.0010)	(0.0009)	(0.0010)
Ln(Total Assets)²	-0.0008***	-0.0005***	-0.0008***	-0.0005***	-0.0008***	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Cash Flow/Total Assets	0.0343***	0.0310***	0.0346***	0.0314***	0.0310***	0.0288***
	(0.0007)	(0.0009)	(0.0007)	(0.0009)	(0.0008)	(0.0010)
Ln(Number of Employees)		0.0122***		0.0122***		0.0120***
		(0.0002)		(0.0002)		(0.0002)
Sales Growth		0.0248***		0.0245***		0.0232***
		(0.0007)		(0.0007)		(0.0007)
Leverage		-0.0232***		-0.0233***		-0.0234***
		(0.0007)		(0.0007)		(0.0007)
Private Credit/GDP	0.0014***	0.0011***	0.0013***	0.0011***	-0.0008	-0.0004
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0006)	(0.0007)
GDP Growth	0.0079***	0.0073***	0.0080***	0.0075***	-0.0053	-0.0023
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0035)	(0.0045)
Constant	-0.3761***	-0.1877***	-0.3786***	-0.1850***	-0.0794	0.0244
	(0.0081)	(0.0096)	(0.0082)	(0.0097)	(0.0799)	(0.1032)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.077	0.101	0.077	0.102	0.082	0.107
N	413,005	312,471	423,253	318,168	370,768	272,684

Table 4.
Estimations by firm size

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*								
	Micro			SME			Large		
	Impaired loan share	Loan loss share	Z-score	Impaired loan share	Loan loss share	Z-score	Impaired loan share	Loan loss share	Z-score
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Bank Risk	0.0226***	0.0312***	-0.0005***	0.0173***	0.0307***	-0.0006***	0.0210***	0.0413***	-0.0003***
	(0.0034)	(0.0060)	(0.0000)	(0.0022)	(0.0045)	(0.0000)	(0.0077)	(0.0158)	(0.0000)
Ln(Total Assets)	-0.0144***	-0.0139***	-0.0147***	0.0064**	0.0068***	0.0085***	0.0022	0.0004	0.0000
	(0.0026)	(0.0025)	(0.0026)	(0.0025)	(0.0025)	(0.0026)	(0.0066)	(0.0065)	(0.0066)
Ln(Total Assets)²	0.0003***	0.0003***	0.0003***	-0.0005***	-0.0005***	-0.0006***	-0.0004**	-0.0003*	-0.0003*
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
Cash Flow/Total Assets	0.0245***	0.0249***	0.0218***	0.0745***	0.0749***	0.0771***	0.5245***	0.4669***	0.3871***
	(0.0010)	(0.0010)	(0.0011)	(0.0033)	(0.0032)	(0.0035)	(0.1192)	(0.1142)	(0.1035)
Ln(Number of Employees)	0.0127***	0.0126***	0.0126***	0.0129***	0.0129***	0.0124***	0.0110***	0.0109***	0.0112***
	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0009)	(0.0008)	(0.0009)
Sales Growth	0.0175***	0.0173***	0.0165***	0.0308***	0.0304***	0.0286***	0.0359***	0.0354***	0.0323***
	(0.0009)	(0.0009)	(0.0010)	(0.0010)	(0.0010)	(0.0010)	(0.0044)	(0.0043)	(0.0044)
Leverage	-0.0296***	-0.0294***	-0.0302***	-0.0191***	-0.0193***	-0.0186***	-0.0119***	-0.0124***	-0.0184***
	(0.0010)	(0.0010)	(0.0011)	(0.0010)	(0.0010)	(0.0010)	(0.0032)	(0.0031)	(0.0033)
Private Credit/GDP	0.0011***	0.0009***	0.0014***	0.0011***	0.0011***	-0.0006	0.0014***	0.0014***	-0.0014**
	(0.0001)	(0.0001)	(0.0004)	(0.0001)	(0.0001)	(0.0009)	(0.0001)	(0.0001)	(0.0006)

GDP Growth	0.0057***	0.0052***	0.0072***	0.0068***	0.0071***	-0.0033	0.0116***	0.0120***	-0.0061
	(0.0009)	(0.0009)	(0.0026)	(0.0003)	(0.0003)	(0.0052)	(0.0009)	(0.0010)	(0.0039)
Constant	-0.0324	-0.0145	-0.0657	-0.1712***	-0.1721***	0.0397	-0.1883***	-0.1752***	0.2349**
	(0.0241)	(0.0232)	(0.0604)	(0.0212)	(0.0212)	(0.1212)	(0.0658)	(0.0654)	(0.1076)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.108	0.108	0.117	0.089	0.089	0.092	0.121	0.120	0.125
N	110,843	112,844	96,644	182,486	185,762	158,788	19,142	19,562	17,252

Table 5.
The influence of efficiency

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*					
	Impaired loan share		Loan loss share		Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Risk	-0.0081**	-0.0071*	-0.0042	-0.0022	-0.0003***	-0.0003***
	(0.0035)	(0.0037)	(0.0048)	(0.0051)	(0.0000)	(0.0000)
High Efficiency	-0.0007	-0.0006	-0.0009*	-0.0006	-0.0001	0.0005
	(0.0004)	(0.0005)	(0.0005)	(0.0006)	(0.0003)	(0.0004)
Bank Risk × High Efficiency	0.0242***	0.0217***	0.0487***	0.0387***	-0.0002***	-0.0003***
	(0.0051)	(0.0055)	(0.0098)	(0.0107)	(0.0000)	(0.0000)
Ln(Total Assets)	0.0230***	0.0070***	0.0233***	0.0070***	0.0245***	0.0075***
	(0.0009)	(0.0010)	(0.0008)	(0.0010)	(0.0009)	(0.0010)
Ln(Total Assets)²	-0.0008***	-0.0005***	-0.0008***	-0.0005***	-0.0008***	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Cash Flow/Total Assets	0.0340***	0.0309***	0.0343***	0.0313***	0.0307***	0.0286***
	(0.0007)	(0.0009)	(0.0007)	(0.0009)	(0.0008)	(0.0010)
Ln(Number of Employees)		0.0123***		0.0123***		0.0121***
		(0.0002)		(0.0002)		(0.0002)
Sales Growth		0.0247***		0.0243***		0.0232***
		(0.0007)		(0.0007)		(0.0007)
Leverage		-0.0231***		-0.0231***		-0.0236***
		(0.0007)		(0.0007)		(0.0007)
Private Credit/GDP	-0.0004	0.0002	-0.0005	-0.0002	-0.0008	-0.0003
	(0.0005)	(0.0007)	(0.0005)	(0.0007)	(0.0006)	(0.0007)
GDP Growth	-0.0048	0.0014	-0.0060*	-0.0013	-0.0075**	-0.0020
	(0.0033)	(0.0044)	(0.0033)	(0.0044)	(0.0035)	(0.0045)
Constant	-0.1146	-0.0478	-0.1094	0.0065	-0.0720	0.0193
	(0.0754)	(0.0986)	(0.0754)	(0.0986)	(0.0800)	(0.1032)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.077	0.101	0.078	0.102	0.083	0.108
N	410,981	311,408	421,203	317,085	367,252	270,843

Table 6.
The influence of competition

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*					
	Impaired loan share		Loan loss share		Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Risk	0.0284***	0.0212***	0.0465***	0.0353***	-0.0005***	-0.0006***
	(0.0016)	(0.0019)	(0.0031)	(0.0034)	(0.0000)	(0.0000)
High Competition	0.0012***	0.0009	0.0019***	0.0016***	-0.0001	-0.0003
	(0.0004)	(0.0005)	(0.0005)	(0.0006)	(0.0003)	(0.0004)
Bank Risk x High Competition	-0.0163***	-0.0086*	-0.0356***	-0.0231**	0.0003***	0.0003***
	(0.0043)	(0.0048)	(0.0084)	(0.0096)	(0.0000)	(0.0000)
Ln(Total Assets)	0.0235***	0.0074***	0.0241***	0.0076***	0.0244***	0.0075***
	(0.0008)	(0.0010)	(0.0008)	(0.0010)	(0.0009)	(0.0010)
Ln(Total Assets)²	-0.0008***	-0.0005***	-0.0008***	-0.0005***	-0.0008***	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Cash Flow/Total Assets	0.0342***	0.0309***	0.0346***	0.0314***	0.0311***	0.0288***
	(0.0007)	(0.0009)	(0.0007)	(0.0009)	(0.0008)	(0.0010)
Ln(Number of Employees)		0.0122***		0.0122***		0.0120***
		(0.0002)		(0.0002)		(0.0002)
Sales Growth		0.0248***		0.0245***		0.0232***
		(0.0007)		(0.0007)		(0.0007)
Leverage		-0.0232***		-0.0233***		-0.0235***
		(0.0007)		(0.0007)		(0.0007)
Private Credit/GDP	0.0014***	0.0012***	0.0013***	0.0011***	-0.0008	-0.0003
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0006)	(0.0007)
GDP Growth	0.0080***	0.0073***	0.0080***	0.0075***	-0.0051	-0.0021
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0035)	(0.0045)
Constant	-0.3799***	-0.1903***	-0.3788***	-0.1860***	-0.0828	0.0201
	(0.0082)	(0.0098)	(0.0082)	(0.0097)	(0.0799)	(0.1032)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.077	0.101	0.077	0.102	0.083	0.108
N	413,005	312,471	423,253	318,168	370,768	272,684

Table 7.
Robustness check: IV estimation

This table presents the results of IV estimations examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*					
	Impaired loan share		Loan loss share		Z-score	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)
Instrumented variable						
Bank Risk		0.0289***		0.0609***		-0.0004***
Instruments		(0.0099)		(0.0207)		(0.0001)
Bank Equity/Total Assets	0.3534***		0.2481***		78.9462***	
	(0.0034)		(0.0021)		(0.7702)	
Bank Deposits/Total Assets	0.0930***		0.0194***		2.4222***	
	(0.0008)		(0.0005)		(0.1720)	
Controls						
Ln(Total Assets)	-0.0023***	0.0070***	-0.0014***	0.0071***	0.7688***	0.0074***
	(0.0006)	(0.0009)	(0.0003)	(0.0009)	(0.1276)	(0.0010)
Ln(Total Assets)²	0.0001***	-0.0005***	0.0000***	-0.0005***	-0.0229***	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0040)	(0.0000)
Cash Flow/Total Assets	-0.0039***	0.0309***	-0.0014***	0.0313***	0.2809**	0.0287***
	(0.0005)	(0.0009)	(0.0003)	(0.0008)	(0.1216)	(0.0009)
Ln(Number of Employees)	0.0002*	0.0122***	0.0000	0.0122***	-0.0278	0.0120***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0200)	(0.0002)
Sales Growth	0.0005	0.0247***	-0.0004*	0.0244***	-0.3068***	0.0232***
	(0.0004)	(0.0006)	(0.0002)	(0.0006)	(0.0865)	(0.0006)
Leverage	0.0042***	-0.0231***	0.0010***	-0.0230***	-0.1035	-0.0234***
	(0.0004)	(0.0007)	(0.0002)	(0.0007)	(0.0913)	(0.0007)
Private Credit/GDP	-0.0009***	0.0001	-0.0005***	-0.0001	0.0894***	-0.0003
	(0.0000)	(0.0008)	(0.0000)	(0.0008)	(0.0030)	(0.0008)
GDP Growth	0.0118***	-0.0001	0.0064***	-0.0008	-0.4357***	-0.0021
	(0.0002)	(0.0049)	(0.0001)	(0.0049)	(0.0482)	(0.0050)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
F-statistics for weak identification	13437***		8069***		5559***	
Hansen J statistic		0.247		1.124		1.547
R^2	0.870	0.101	0.838	0.101	0.142	0.107
Observations	312,330	312,330	318,027	318,027	272,631	272,631

Table 8.
Robustness check: Nearest Neighbor Matching

The table presents the results of the nearest neighbor matching procedure to estimate the effect of bank risk on firm investment in the sample of one-bank firms. The top quartile of banks (high risk) form the treated group and the bottom quartile of banks (low risk) form the control group. We then analyze the effect of bank risk on the firm investment by estimating the Average Treatment Effect on Treated (ATT). Panel A presents matching results and Panel B provides a covariate balance summary. In addition to reported covariates, we use exact matching of firms on country and industry. Definitions of variables are provided in the Appendix. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

Panel A. Nearest Neighbor Matching

	Average Treatment Effect on Treated		
	Impaired loan share	Loan loss share	Z-score
Difference (Treated - Control)	0.004***	0.001**	-0.014***
	(0.001)	(0.001)	(0.001)

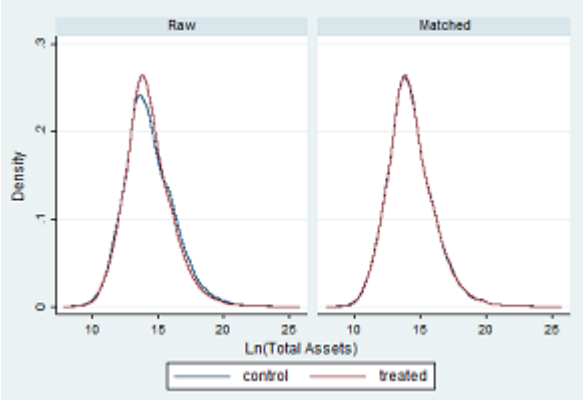
Panel B. Covariate Balance Summary

	Standardized differences		Variance ratio	
	Raw	Matched	Raw	Matched
Impaired loan share				
Ln(Total Assets)	-0.046	0.002	0.891	1.025
Cash Flow/Total Assets	-0.038	-0.002	0.900	1.047
Loan loss share				
Ln(Total Assets)	-0.131	0.001	0.847	1.029
Cash Flow/Total Assets	-0.044	-0.001	0.822	1.043
Z-score				
Ln(Total Assets)	-0.208	-0.004	0.751	1.027
Cash Flow/Total Assets	0.049	-0.002	0.908	1.032

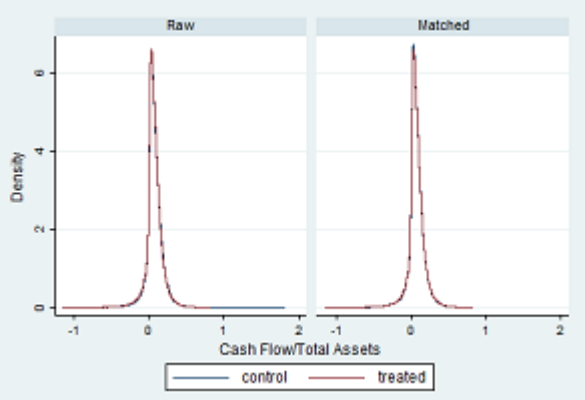
Figure 1.
The kernel density plots using the unmatched and matched data

Impared loan share

Ln(Total Assets)

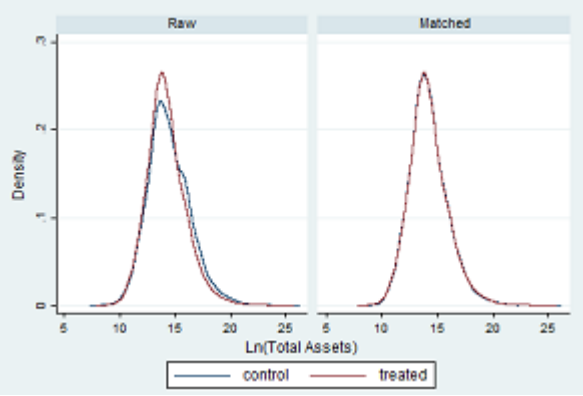


Cash Flow/Total Assets

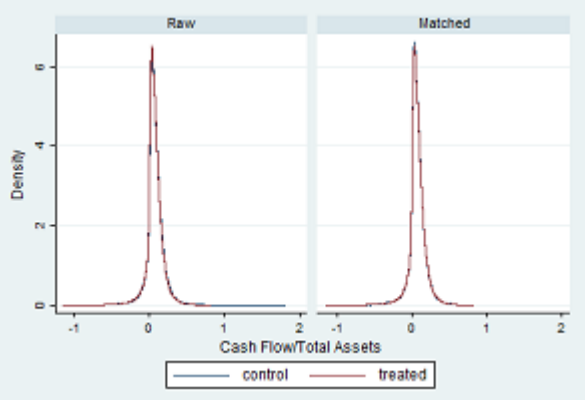


Loan loss share

Ln(Total Assets)

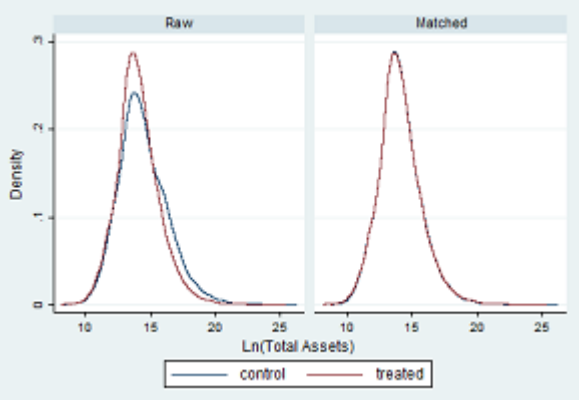


Cash Flow/Total Assets



Z-score

Ln(Total Assets)



Cash Flow/Total Assets

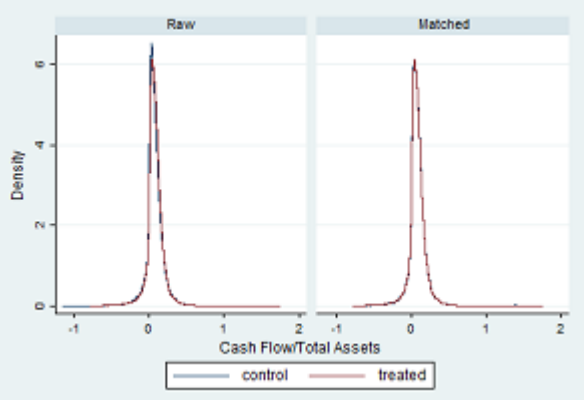


Table 9.
Robustness check: One-bank relationship firms only

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*					
	Impaired loan share		Loan loss share		Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Risk	0.0205***	0.0140***	0.0365***	0.0245***	-0.0004***	-0.0005***
	(0.0032)	(0.0036)	(0.0063)	(0.0071)	(0.0000)	(0.0000)
Ln(Total Assets)	0.0191***	0.0042***	0.0197***	0.0045***	0.0218***	0.0036**
	(0.0012)	(0.0015)	(0.0012)	(0.0015)	(0.0013)	(0.0015)
Ln(Total Assets)^2	-0.0006***	-0.0004***	-0.0006***	-0.0004***	-0.0007***	-0.0004***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Cash Flow/Total Assets	0.0281***	0.0260***	0.0285***	0.0264***	0.0246***	0.0229***
	(0.0009)	(0.0012)	(0.0009)	(0.0012)	(0.0009)	(0.0012)
Ln(Number of Employees)		0.0116***		0.0116***		0.0116***
		(0.0003)		(0.0003)		(0.0003)
Sales Growth		0.0176***		0.0174***		0.0161***
		(0.0011)		(0.0011)		(0.0012)
Leverage		-0.0214***		-0.0215***		-0.0241***
		(0.0012)		(0.0012)		(0.0013)
Private Credit/GDP	0.0013***	0.0011***	0.0014***	0.0011***	-0.0010	-0.0004***
	(0.0000)	(0.0001)	(0.0000)	(0.0001)	(0.0007)	(0.0000)
GDP Growth	0.0069***	0.0060***	0.0071***	0.0062***	-0.0068	-0.0027***
	(0.0003)	(0.0004)	(0.0003)	(0.0004)	(0.0043)	(0.0005)
Constant	-0.3382***	-0.1662***	-0.3472***	-0.1705***	-0.0316	0.0478***
	(0.0109)	(0.0133)	(0.0112)	(0.0136)	(0.0994)	(0.0122)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.086	0.112	0.085	0.112	0.092	0.120
N	175,912	109,267	182,572	112,306	165,632	99,565

Table 10.
Robustness check: Alternative measure of investment

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Net Investment*					
	Impaired loan share		Loan loss share		Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Risk	0.0171**	0.0148*	0.0716***	0.0556***	-0.0008***	-0.0009***
	(0.0076)	(0.0082)	(0.0091)	(0.0101)	(0.0000)	(0.0000)
Ln(Total Assets)	0.0601***	0.0432***	0.0614***	0.0441***	0.0573***	0.0432***
	(0.0023)	(0.0027)	(0.0023)	(0.0026)	(0.0023)	(0.0027)
Ln(Total Assets)²	-0.0016***	-0.0013***	-0.0017***	-0.0014***	-0.0016***	-0.0013***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Cash Flow/Total Assets	0.0385***	0.0342***	0.0392***	0.0348***	0.0257***	0.0234***
	(0.0027)	(0.0035)	(0.0027)	(0.0035)	(0.0028)	(0.0037)
Ln(Number of Employees)		0.0099***		0.0100***		0.0081***
		(0.0004)		(0.0004)		(0.0004)
Sales Growth		0.0473***		0.0470***		0.0417***
		(0.0020)		(0.0019)		(0.0020)
Leverage		-0.0270***		-0.0278***		-0.0253***
		(0.0018)		(0.0018)		(0.0019)
Private Credit/GDP	0.0039**	0.0067***	0.0020***	0.0019***	0.0032*	0.0059***
	(0.0016)	(0.0018)	(0.0001)	(0.0001)	(0.0017)	(0.0020)
GDP Growth	0.0254***	0.0417***	0.0150***	0.0139***	0.0216**	0.0372***
	(0.0096)	(0.0111)	(0.0007)	(0.0008)	(0.0103)	(0.0119)
Constant	-1.1618***	-1.3907***	-0.9171***	-0.7228***	-1.0436***	-1.2789***
	(0.2217)	(0.2551)	(0.0231)	(0.0277)	(0.2385)	(0.2753)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.013	0.019	0.013	0.019	0.014	0.018
N	382,167	291,285	391,766	296,714	343,266	254,381

Table 11.
Robustness check: Without Spain

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*					
	Impaired loan share		Loan loss share		Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Risk	0.0304***	0.0239***	0.0504***	0.0381***	-0.0003***	-0.0003***
	(0.0017)	(0.0019)	(0.0033)	(0.0037)	(0.0000)	(0.0000)
Ln(Total Assets)	0.0223***	0.0063***	0.0232***	0.0068***	0.0244***	0.0070***
	(0.0010)	(0.0012)	(0.0010)	(0.0012)	(0.0010)	(0.0013)
Ln(Total Assets)^2	-0.0007***	-0.0005***	-0.0008***	-0.0005***	-0.0008***	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Cash Flow/Total Assets	0.0286***	0.0252***	0.0290***	0.0256***	0.0243***	0.0219***
	(0.0008)	(0.0010)	(0.0008)	(0.0010)	(0.0008)	(0.0012)
Ln(Number of Employees)		0.0107***		0.0107***		0.0103***
		(0.0002)		(0.0002)		(0.0002)
Sales Growth		0.0208***		0.0205***		0.0170***
		(0.0009)		(0.0009)		(0.0011)
Leverage		-0.0208***		-0.0212***		-0.0208***
		(0.0010)		(0.0010)		(0.0012)
Private Credit/GDP	0.0014***	0.0012***	0.0014***	0.0012***	-0.0009	-0.0004
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0006)	(0.0007)
GDP Growth	0.0081***	0.0075***	0.0082***	0.0076***	-0.0057*	-0.0027
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0034)	(0.0044)
Constant	-0.3718***	-0.1925***	-0.3741***	-0.1877***	-0.0684	0.0309
	(0.0091)	(0.0111)	(0.0091)	(0.0111)	(0.0794)	(0.1015)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.065	0.092	0.065	0.092	0.063	0.088
N	230,029	151,647	237,782	155,263	191,523	115,224

Table 12.
Robustness check: Nonlinear relationship

This table presents the results of OLS regressions examining the relation between bank risk and firm investment. Definitions of variables are provided in the Appendix. Standard errors (in brackets) are robust to arbitrary heteroskedasticity. *, **, and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

	Dependent variable = *Investment*					
	Impaired loan share		Loan loss share		Z-score	
	(1)	(2)	(3)	(4)	(5)	(6)
Bank risk	0.0013	0.0038	-0.0190**	-0.0096	-0.0008***	-0.0009***
	(0.0040)	(0.0042)	(0.0074)	(0.0080)	(0.0000)	(0.0000)
Bank risk²	0.0407***	0.0266***	0.1878***	0.1289***	6.03e-06***	6.27e-06***
	(0.0058)	(0.0062)	(0.0195)	(0.0212)	(0.0000)	(0.0000)
Ln(Total Assets)	0.0234***	0.0073***	0.0239***	0.0074***	0.0246***	0.0076***
	(0.0008)	(0.0010)	(0.0008)	(0.0010)	(0.0009)	(0.0010)
Ln(Total Assets)²	-0.0008***	-0.0005***	-0.0008***	-0.0005***	-0.0008***	-0.0005***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Cash Flow/Total Assets	0.0342***	0.0309***	0.0345***	0.0313***	0.0311***	0.0288***
	(0.0007)	(0.0009)	(0.0007)	(0.0009)	(0.0008)	(0.0010)
Ln(Number of Employees)		0.0122***		0.0122***		0.0120***
		(0.0002)		(0.0002)		(0.0002)
Sales Growth		0.0248***		0.0245***		0.0231***
		(0.0007)		(0.0007)		(0.0007)
Leverage		-0.0231***		-0.0232***		-0.0235***
		(0.0007)		(0.0007)		(0.0007)
Private Credit/GDP	0.0014***	0.0012***	0.0013***	0.0011***	-0.0009	-0.0004
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0006)	(0.0007)
GDP Growth	0.0080***	0.0073***	0.0079***	0.0073***	-0.0058*	-0.0027
	(0.0002)	(0.0003)	(0.0002)	(0.0003)	(0.0035)	(0.0045)
Constant	-0.3749***	-0.1883***	-0.3740***	-0.1846***	-0.0679	0.0346
	(0.0081)	(0.0096)	(0.0082)	(0.0097)	(0.0799)	(0.1032)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.077	0.101	0.077	0.102	0.084	0.109
N	413,005	312,471	423,253	318,168	370,768	272,684

Appendix

Variable	Definition
Gross Investment	= (Fixed assets – Lagged fixed assets + Depreciation) / Total Assets. Source: Amadeus
Z-score	= (ROA + CAR_i) /SD(ROA), where ROA is the return on assets measured by the ratio of net income to total assets, CAR is the ratio of equity capital to assets. SD(ROA) is the standard deviation of ROA over the period of three years (2013-2015). Source: Bankscope
Impaired loans	= the ratio of impaired loans to loans. Source: Bankscope
Loan loss provisions	= the ratio of loan loss provisions to loans. Source: Bankscope
Ln(Total Assets)	= the natural logarithm of total assets in million USD. Source: Amadeus
Cash Flow/Total Assets	= Cash Flow/Total Assets
Ln(Number of Employees)	= the natural logarithm of the number of employees. Source: Amadeus
Sales Growth	= (Sales – Lagged Sales)/Lagged Sales. Source: Amadeus
Leverage	= (Long-term debt + Current liabilities)/Total Assets. Source: Amadeus
Private credit	Private credit by deposit money banks to GDP. Source: Global Financial Development Database, World Bank.
GDP Growth	The annual percentage nominal growth rate of GDP denominated in the local currency. Source: Global Financial Development Database, World Bank.
Lerner index	Lerner index is defined as the difference between price and marginal cost divided by price. Source: own computation.
Bank efficiency	Cost efficiency score. Source: own computation.
Net Investment	= (Fixed assets – Depreciation – Lagged fixed assets – Lagged depreciation)/ (Lagged fixed assets – Lagged depreciation). Source: Amadeus