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COSTS AND BENEFITS OF CREDITOR CONCENTRATION: AN EMPIRICAL APPROACH

by Amanda Carmignani* and Massimo Omiccioli*

Abstract

High concentration of creditors can have two beneficial effects on borrowers: i) by enhancing lenders' ability to monitor, it can reduce the likelihood of financial distress; ii) by reducing coordination failure among creditors, it can help a distressed firm to avoid bankruptcy. However, a strong probability of debt renegotiation can exert a feedback effect on the likelihood of financial distress, by generating perverse ex-ante incentives for borrowers (soft budget constraint). Moreover, high concentration of creditors can expose borrowers to greater liquidity risks. Using Italian data on manufacturing firms, we try to separate empirically these conflicting effects. Our results show that, if we control for the soft-budget-constraint and liquidity effects, high concentration of bank credit reduces the likelihood of financial distress and liquidation, as predicted by the literature on relationship banking. But these benefits do not come without costs: i) enhanced monitoring is offset by the soft-budget-constraint effect and ii) higher concentration of credit lines increases liquidity risks and thus makes both financial distress and liquidation more likely. Ultimately, the overall effect of more concentrated banking relations is a lower probability of liquidation but a higher probability of financial distress. This helps to explain the widespread existence of multiple but asymmetric banking relations in Italy.

JEL classification: G21, G33
Keywords: creditor concentration, financial distress, liquidation, monitoring, relationship lending, soft budget constraint.

Contents

* Bank of Italy, Economics and International Relations.

1. Introduction[1]

In this paper we empirically investigate the impact of creditor concentration on the probability that borrowers will incur financial distress and on the likelihood of liquidation in the event of distress.[2]

A large body of theoretical literature has analyzed the impact of closer and more concentrated credit relationships on borrowers' performance. The literature on financial intermediation as developed by Diamond (1984) and others (see Gorton and Winton, 2003, for a review) posits that higher concentration of creditors facilitates monitoring and screening, leading to a lower *ex-post* probability of default. This higher concentration is normally deemed to facilitate the renegotiation of debt (due to lower coordination costs) when the borrower is in financial distress (Bolton and Scharfstein, 1996).

Although the literature often emphasizes the benefits of close banking relationships, it also highlights at least two possible drawbacks (Boot, 2000): the soft-budget-constraint problem and the liquidity risk. Realizing that they can easily renegotiate their debt contracts *ex post*, borrowers may have perverse incentives *ex-ante*, leading to opportunistic behaviour or excessive risk-taking (Bolton and Scharfstein, 1996; Dewatripont and Maskin, 1995). This can increase the *ex-ante* probability of financial distress. On the other hand, single lending relationships can expose the borrower's investment project to the risk of termination due to liquidity problems that the lender is experiencing and that cannot be distinguished from an individual borrower's credit problem (Detragiache et al., 2000).

These conflicting forces can prompt firms to establish multiple but asymmetric banking relations (Elsas et al., 2004; Bannier, 2005), where the presence of a "main" bank

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[2] By financial distress we mean a situation where the firm fails to meet one or more conditions of the financial agreement associated with its borrowing activities (Weston, 1994). In this paper we use "distress" and "financial distress" interchangeably.

would allow the borrower to retain some of the benefits of relationship lending, while the presence of less informed "arm's-length" banks can be viewed as insurance against liquidity risks.

While a growing number of empirical studies have investigated the role of creditor concentration as a determinant of success in formal reorganization procedures or out-of-court workouts,[3] the impact of closer lending relationships, through enhanced monitoring ability, on borrowers' *ex-post* probability of financial distress has not received attention. A voluminous empirical literature analyzes the impact of close bank relationships on the availability of credit, loan contract terms and cash flow constraints and investment, while earlier papers studied the announcement effect of bank loan agreements on the stock prices of borrowing firms.[4] Most of the results are consistent with the idea that less dispersed creditors are in a better position to screen and monitor borrowers, but they fall short of offering direct evidence on the matter. To the best of our knowledge, only two studies have tried to test the impact of multiple banking relationships on the probability of default (Foglia et al., 1998; Jiménez and Saurina, 2004).[5]

Our analysis improves on the existing empirical literature in three respects. First, in line with the theoretical literature, we distinguish two different effects of creditor concentration: 1) the effect on the probability of incurring financial distress, as concentration increases lenders' monitoring ability; 2) the effect on the probability of a financially distressed firm being forced into liquidation, as concentration reduces coordination failure among creditors. Separating these different effects is crucial. On the basis of the evidence that firms with closer lending relationships have a lower probability of liquidation, we are

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[3] While earlier papers were almost exclusively based on the U.S. experience (Gilson, 1989; 1990; Gilson et al., 1990; Betker et al., 1993; Asquith et al., 1994; Franks and Touros, 1994; James, 1995; 1996; Gilson 1997), more recent studies also offer evidence for some European countries (Elsas and Krahnen, 2002; Brunner and Krahnen, 2004; Franks and Sussman, 2005).

[4] See Gorton and Winton (2003), Boot (2000), Ongena and Smith (2000a), and Berger and Udell (1998) for an extensive survey of this literature.

[5] Due to the lack of information on firms' characteristics, Jiménez and Saurina (2004) fail to control for borrowers' *ex-ante* observed probability of default. Thus, the result they obtain (a higher probability of default for firms with fewer banking relations) may suffer from serious selection bias if observably riskier firms choose or are forced to rely on fewer banking relations. Foglia et al. (1998), on the other hand, while carefully controlling for borrowers' risk by many balance sheet indicators, do not make a clear distinction between the effects of multiple lending on financial distress and liquidation.

unable to assert whether this happens because of the more intensive and effective monitoring by lenders (which lowers the probability of financial distress) or because more concentrated lenders are less likely to trigger liquidation when borrowers are in financial distress. While better monitoring can in general be considered as welfare-improving,[6] avoiding liquidation is an efficient outcome only when the net present value of the firm as a going concern is higher than its liquidation value.[7]

Second, in order to identify the monitoring effect of closer bank relationships, it is necessary to control for the feedback effect arising from a more lenient renegotiation in the event of financial distress. While the soft-budget-constraint problem is well known in the theoretical literature, we are not aware of any empirical study that seeks to take this phenomenon into account. This is the second original contribution of our paper. We estimate the probability of liquidation, conditional on financial distress, and we include its predicted value in the regression for the probability of (future) financial distress. This allows us to disentangle the effect of creditor concentration due to lenders' monitoring ability from the soft-budget-constraint effect.

Finally, in order to capture the liquidity effect of more concentrated banking relations, we measure concentration in two different ways: *i*) on bank credit *granted* to the borrower, where a low concentration is expected to reduce firm's exposure to liquidity risks, as the firm can more easily switch to another bank to handle a request for repayment by any one lender or any other liquidity shock;[8] *ii*) on bank credit actually *used* by the borrower, where high concentration is expected to increase both the monitoring ability of "main" banks and the likelihood of debt renegotiation under financial distress.

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[6] For a discussion of the potential for overmonitoring, see Pagano and Roell (1998), Burkart et al. (1997) and Tirole (2006, pp. 359-361).

[7] The liquidation of inefficient or, even worse, opportunistic or fraudulent firms is essential for the proper functioning of a market economy. It prevents inefficient firms from getting further financing to the detriment of lenders, competitors and potentially alternative investment projects. For an analysis of the negative macroeconomic consequences of Japanese banks' widespread practice of continuing to lend to otherwise insolvent firms, see Peek and Rosengren (2005), Hoshi (2006), Caballero et al. (2006).

[8] From this perspective, fringe banks play the same role as loan commitments (Houston and Venkataraman, 1996; Shockley and Thakor, 1997), although in the specific Italian context credit lines are usually revocable and banks do not apply fees on the amount of credit granted. The cost of this kind of insurance against liquidity risk usually consists in a partial use of such credit lines, whose interest rates are higher than those applied by main banks (D'Auria et al., 1999).

We use a detailed and unique data set on Italian manufacturing firms and their lenders. Firms are observed in the period 1997-2003 (around 42,600 observations as a whole). We match individual information on bank loans, firms' state of activity and balance sheet data. Creditor-concentration effects are investigated by directly examining the concentration of bank financing and controlling for many characteristics of firms, banks and bank-firm relations.

We report four main results. First, higher concentration of *disbursed bank credit* reduces the probability of a financially distressed firm being forced into liquidation. Second, if we control for the soft-budget-constraint effect, higher concentration of *disbursed bank credit*, fostering lenders' monitoring ability, also reduces the probability that the borrower enters financial distress. This evidence lends new and more direct support to the predictions of the literature on relationship banking. However, the benefits of relationship banking do not come without costs. Our third (and most novel) result is that the soft-budget-constraint effect offsets the lower probability of financial distress due to banks' greater monitoring ability. Finally, we find that higher *concentration of credit lines*, by increasing liquidity risks for borrowers, enhances the likelihood of both financial distress and liquidation. As for financial distress, moreover, the liquidity effect is quantitatively stronger than the monitoring effect. In the end, we find that the overall effect of more concentrated banking relations is a lower probability of liquidation for firms under financial distress, accompanied by a higher probability of incurring financial distress. These results can help to explain why multiple but asymmetric banking relations are so common in Italy and many other European countries (Ongena and Smith, 2000b). They also point to a suggestion for future empirical research. Since the efficiency of banks' decisions whether or not to liquidate financially distressed firms appears to be crucial in assessing the overall benefits of more concentrated banking relationships, more efforts should be devoted to studying this issue (Chemmanur and Fulghieri, 1994). [9]

Since our study has access to an extremely rich dataset, we also document and discuss the impact of other variables. Consistently with the predictions (Diamond, 1991; 2004),

[9] The efficiency of the bankruptcy system in encouraging the reorganization of viable firms and the liquidation of unviable ones is one of the key elements shaping creditors' incentives (Franks and Loranth,

short-term debt increases the probabilities of liquidation and financial distress. The results are mixed and less clear-cut for the effect of collateral: a higher share of collateralized debt tends to increase the probability of liquidation for financially-distressed firms, since it probably makes it more difficult to reconcile the conflicting claims of debt holders (Bolton and Scharfstein, 1996), while the negative effect on the probability of financial distress is weaker and only marginally significant. The most interesting result is that, contrary to the prevailing view, the presence of debt held by dispersed creditors (such as trade creditors and bondholders) is negatively correlated with both financial distress and liquidation. Concerning financial distress, our results are consistent with the hypotheses that trade creditors have an informational advantage in screening and monitoring their customers (Mian and Smith, 1992; Petersen and Rajan, 1997) and that the rules and institutions designed for publicly-traded companies work like a centralized monitoring mechanism (Khalil et al., 2007). As for liquidation, our evidence lends support to the hypotheses that highly dispersed creditors are unable to be proactive in the event of borrowers' financial distress (Bris and Welch, 2005) and that bank lenders are tougher than other creditors in their bargaining with distressed firms (Park, 2000; Franks and Sussman, 2005).

The rest of the paper is organized as follows. Section 2 illustrates in more detail the hypotheses we want to test, the data we use and our empirical strategy. Section 3 describes and discusses the econometric results for our baseline specification. Section 4 presents a large set of robustness checks and extensions. Section 5 concludes.

2. Hypotheses, methodology and data description

2.1 Specification of the hypotheses

We focus on the effects that the concentration of bank relationships exerts on the probability that the borrower will incur financial distress and on the likelihood of liquidation in this event. Table 1 summarizes our main hypotheses.

Concerning the probability of financial distress, the literature on financial intermediation highlights the role of banks as information producers. From this point of

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2005; Giné and Love, 2006; Hart, 2000; White, 1989).

view, the presence of multiple bank lenders can reduce the amount of monitoring for two different reasons: *i*) by increasing the incentives to engage in free riding (Diamond, 1984) and *ii*) by reducing the amount of information that each bank can extract from its relations with the borrower (Nakamura, 1993; Mester et al., 2007). In both cases, when the task of monitoring is delegated to a single agent, information asymmetries are reduced and a lower *ex post* probability of default should follow.

Bolton and Scharfstein (1996) show that a larger number of creditors complicates renegotiation (as coordination costs are higher) and fosters liquidation. If *ex post* renegotiation of a loan agreement is too easy, a borrower may exert insufficient effort in preventing a bad outcome (Dewatripont and Maskin, 1995; Bolton and Scharfstein, 1996). The loss of efficiency *ex post* (inefficient liquidation) may turn out to be beneficial *ex ante*, as it represents a device disciplining managers against opportunistic behaviour. Detragiache et al. (2000) show that multiple banking can reduce the firm's exposure to liquidity risks. It will lower both the probability of the firm incurring financial distress due to an unexpected contraction of credit and the probability of liquidation in the event of distress, as the firm may easily increase its credit or substitute lenders who are willing to withdraw.

Table 1

EFFECTS OF BANK DEBT CONCENTRATION

VARIABLES	PROBABILITY OF LIQUIDATION UNDER FINANCIAL DISTRESS	PROBABILITY OF FINANCIAL DISTRESS
CONCENTRATION OF BANK CREDIT USED	REDUCTION (COORDINATION FAILURE ↓) BOLTON AND SCHARFSTEIN (1996)	REDUCTION (MONITORING ↑) DIAMOND (1984); NAKAMURA (1993)
CONCENTRATION OF BANK CREDIT GRANTED	INCREASE (LIQUIDITY RISK ↑) DETRAGIACHE ET AL. (2000)	INCREASE (LIQUIDITY RISK ↑) DETRAGIACHE ET AL. (2000)
PROBABILITY OF LIQUIDATION UNDER FINANCIAL DISTRESS	–	REDUCTION (COORDINATION FAILURE ↓) BOLTON AND SCHARFSTEIN (1996)

The literature shows that other features of debt contracts may be used to deter firms from default and enhance lenders' monitoring.[10] In order to correctly identify the effects of debt concentration, it is crucial to control for other factors influencing the probabilities of financial distress and liquidation. Table 2 summarizes the main theoretical predictions on these issues.

Table 2

EFFECTS OF DEBT STRUCTURE ON THE PROBABILITIES OF LIQUIDATION AND FINANCIAL DISTRESS

VARIABLES	PROBABILITY OF LIQUIDATION UNDER FINANCIAL DISTRESS	PROBABILITY OF FINANCIAL DISTRESS
SHORT-TERM CREDIT	INCREASE (LIQUIDITY RISK ↑) DIAMOND (1991; 2004)	INCREASE (LIQUIDITY RISK ↑) DIAMOND (1991; 2004)
COLLATERALIZATION	INCREASE (COORDINATION FAILURE ↑) BOLTON AND SCHARFSTEIN (1996)	INCREASE (MONITORING ↓) MANOVE ET AL. (2001) REDUCTION (MONITORING ↑) RAJAN AND WINTON (1995)
TRADE CREDIT VS. SHORT-TERM BANK LOANS	REDUCTION (CREDITOR INACTIVITY ↑) BRIS AND WELCH (2005)	INCREASE (MONITORING ↓) DIAMOND (1984) REDUCTION (MONITORING ↑) PETERSEN AND RAJAN (1997)
BONDS VS. LONG-TERM BANK LOANS	REDUCTION (CREDITOR INACTIVITY ↑) BRIS AND WELCH (2005)	INCREASE (MONITORING ↓) DIAMOND (1984) REDUCTION (MONITORING ↑) KHALIL ET AL. (2007)

Debt maturity is the first factor to be considered. Diamond (2004) shows that, like the presence of dispersed creditors, short-term credit can be used to discipline managerial behaviour, especially in legal systems with ineffective or costly contract enforcement.[11] Encouraging "firm runs", short-term debt can increase the probability of liquidation of firms in financial distress. On the other hand, it can also expose borrowers to the risk of financial distress due to an unexpected contraction of credit. From this point of view, higher shares of

[10] See for example Diamond (1993), Berglöf and von Thadden (1994), Hart and Moore (1995).

[11] In case of bad news about the debtor, short-term debt can be subject to "firm runs" that can serve to

short-term debt should increase the probabilities of financial distress and liquidation. However, when we examine the effects of different debt structures, we should also consider other characteristics, like the presence of collateral and the dispersion of debt holders.

Bolton and Scharfstein (1996) argue that coordination among creditors may be more difficult when some creditors have security interests, as conflicts may arise among different classes of lenders. Since it is more difficult to reconcile the conflicting claims of debt holders when the degree of collateralization is higher, this can increase the probability of liquidation. The presence of collateral can also have an effect on bank monitoring. Manove et al. (2001) posit that unrestricted reliance on (outside) collateral can weaken banks' incentive to carefully evaluate the profitability of investment projects (thus increasing the probability of financial distress), while Rajan and Winton (1995) argue that the presence of (inside) collateral can represent an incentive to monitor.

As regards the dispersion of debt holders, while Bolton and Scharfstein (1996) show that multiple creditors make debt renegotiation more difficult, Bris and Welch (2005) emphasize that dispersed creditors are at a disadvantage when they must act to enforce their claims (for instance, when active opposition to a management's relief plan is required). This disadvantage is increased by legal and administrative costs that each creditor has to sustain in order to negotiate with the borrower. As a consequence, a firm with a large number of dispersed creditors can be in a stronger bargaining position than one with more concentrated creditors. Bolton and Scharfstein (1996) and Bris and Welch (2005) offer opposite theoretical predictions, but their results seem to apply to different empirical situations. Bris and Welch (2005) emphasize that their model applies to situations – such as trade payables or bonds – where the dispersion of creditors is much greater than in the case of bank debt,[12] while Bolton and Scharfstein (1996) interpret their findings as describing the effects of different levels of concentration in bank lending or in public debt.[13] Consequently, our

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commit multiple lenders to enforce their claims.

[12] "Our model posits that, given a fixed level of debt, a distressed firm with *a million uncoordinated small creditors* is less likely to be forced to pay its obligations than a firm with one creditor or a firm with creditors that have a coordinating organ" (authors' italics). And they add: "The strongest application of our model applies to idiosyncratic, small credit such as small trade credit (…). To a lesser extent, our model could also apply to highly dispersed public debt that is not fully coordinated" (p. 2194).

[13] "Our results on the number of creditors could be interpreted as suggesting a trade-off between bank debt

hypothesis is that the predictions of Bris and Welch apply to the distinction between bank debt on the one hand and trade credit payable and bonds on the other, while those of Bolton and Scharfstein describe the effects of bank credit concentration.

As regards trade creditors' monitoring ability, the theoretical literature shows that suppliers can have some comparative advantage in this field. Suppliers would benefit from relatively low screening and monitoring costs (Mian and Smith, 1992; Petersen and Rajan, 1997) and would be less subject to moral hazard problems (Burkart and Ellingsen, 2004).[14] As for bonds, the existence of a set of rules and institutions (such as disclosure rules, auditing firms, rating agencies) could represent an implicit form of coordination or centralization to perform monitoring. Thus, in both circumstances reduced monitoring ability due to the dispersion of creditors could be offset by these specific effects.

2.2 Methodology

In order to identify the monitoring effect that creditor concentration exerts on the probability of financial distress, we must control for the soft-budget-constraint effect, as a lower probability of liquidation can give rise to perverse incentives *ex-ante* for borrowers, thereby affecting the likelihood of financial distress. We apply the following empirical strategy. Using a *probit* model, equation (1) describes the determinants of the probability of the firm incurring financial distress at time $(t + 1)$:

$$(1) \qquad \Pr(d_{(t+1)} = 1) = \Phi\left(\alpha_0 + \mathbf{x}_{1t}\boldsymbol{\alpha}_1 + \mathbf{x}_{2t}\boldsymbol{\alpha}_2 + z_t\alpha_3\right),$$

where $d_{(t+1)} = 1$ if firm i is in financial distress at time $(t + 1)$, 0 otherwise.

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and public debt since firms often have many public debt holders but few banks. (…) However, it would be misleading to put too much weight on this interpretation. Bank debt can be syndicated to many banks and some public debt instruments are held by only a few investors. Thus we would prefer to interpret the results as suggesting when bank debt is syndicated and when public debt is widely held." (pp. 3-4).

[14] Suppliers' comparative advantage in information acquisition might come from direct dealings with customers, deep knowledge of the buyers' industrial sector, frequent visits for commercial purposes and the opportunity to compare customers' behaviour with the behaviour of other agents in the same industry. Burkart and Ellingsen (2004), moreover, underline that trade credit is linked to the purchase of inputs, which are illiquid and so are likely to be less easily diverted than cash.

Variable z_t in equation (1) represents the probability of liquidation in the event of financial distress. Since it is unobservable, we estimate z_t by equation (2):

$$(2) \qquad \Pr(l_{(t+1)} = 1 \mid d_t = 1) = \Phi(\beta_0 + \mathbf{x}_{1t}\boldsymbol{\beta}_1 + \mathbf{x}_{3t}\boldsymbol{\beta}_3),$$

where $l_{(t+1)} = 1$ if firm i is liquidated at time $(t+1)$, 0 otherwise; $d_t = 1$ if firm i is in financial distress at time t, 0 otherwise.[15] We use a bivariate probit model with sample selection to estimate equation (2). Hence the probability of liquidation is estimated jointly with the selection equation for firms that are in financial distress at time t:

$$(3) \qquad \Pr(d_t = 1) = \Phi(\delta_0 + \mathbf{x}_{1t}\boldsymbol{\delta}_1 + \mathbf{x}_{2t}\boldsymbol{\delta}_2 + \mathbf{x}_{3t}\boldsymbol{\delta}_3).$$

All variables used to estimate equation (2) are also used for equation (3), as the probability that the firm is liquidated, in case of financial distress, should in turn influence the probability of the firm running into financial distress.

Vector $\mathbf{x}_{3t}$ in equation (2) is needed in order to achieve identification of equation (1), while vector $\mathbf{x}_{2t}$ in equation (3) is needed in order to achieve identification of equation (2). Vector $\mathbf{x}_{3t}$ must contain variables that only influence the probability of liquidation of financially distressed firms, while vector $\mathbf{x}_{2t}$ refers to the variables that only have an impact on the probability of the firm entering financial distress.

2.3 Data description

Our analysis is based on a sample of Italian manufacturing firms observed from 1997 to 2003. We use a large database with information drawn from different sources. Variable sources and definition are described in detail in the statistical appendix. Our final sample has 42,533 observations for 13,597 firms. Most of the firms in the sample are small and medium-size companies: the median firm has 57 employees; values for the first and third

[15] Standard errors obtained by the probit regression of equation (1) should be adjusted to take into account that z_t is an estimated regressor. Although z_t is a control variable in our model (and we are not interested in testing its statistical significance) and the effect on the standard errors of the remaining variables is negligible, we will address this issue by means of a block bootstrap procedure.

quartiles are, respectively, 33 and 106. Firms with at least 250 employees represent only 8.0 per cent of the sample, those with at least 500 employees are just 3.0 per cent.

A firm is defined as in liquidation if it enters one of the bankruptcy procedures or a procedure of forced liquidation within two years (voluntary liquidation is excluded). Overall, the number of observations for firms that were liquidated between 1998 and 2003 is 502, equal to 1.2 per cent of the total number of observations. A firm is defined as financially distressed if its interest coverage ratio (the ratio of earnings before interests, taxes and depreciation to interest charges) is lower than one.[16] On this definition, the observations of financially distressed firms number 2,639, or 6.2 per cent of the sample. The share of financially distressed firms that run into liquidation within two years is equal to 9.1 per cent.

The explanatory variables used to test the theoretical predictions summarized in Tables 1 and 2 are: the Herfindahl-Hirschman index computed both on credit granted (*HHI_GRANTED*) and on credit used (*HHI_USED*); the ratios of debt composition (*ST_DEBT*, *TRADE_DEBT/ST_DEBT*, *BONDS/LT_DEBT*, *OTHER_DEBT*); a dummy variable for the presence of bonds[17] (*DUMMY_BONDS*); and the degree of collateralization (*COLLATERAL*). [18]

Table A1 shows that in our sample the main source of financing is short-term debt and that nearly two thirds of short-term debt is in the form of trade debt. The share of bonds in long-term debt, on the contrary, is very low, averaging 5.2 per cent (the number of observations for firms with bonds is equal to only 14.6 per cent of the sample). With regard to bank-firm relationships, the descriptive analysis shows that multiple but asymmetric lending prevails: the average number of relationships is 9, but if we take into account the

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[16] In the empirical literature several different proxies are used for financial distress. Hoshi et al. (1990), Asquith et al. (1994) and Hall and Weinstein (2000) use an interest coverage ratio of less than one to classify firms as in financial distress. Other studies use ratings assigned by specialized rating agencies (Betker et al., 1993) or internal ratings assigned by lending banks (Brunner and Krahnen, 2004; Elsas and Krahnen, 2002). Firms are also classified as in financial distress when the price of shares records a deep fall (Gilson, 1989; 1990) or when the borrower is placed in the bank's specialised head-office unit for distressed companies (Franks and Sussman, 2005).

[17] We include this dummy variable to check if it is the share or the simple presence of bonds to affect the outcomes. This is especially relevant for the probability of financial distress, since disclosure rules and other factors affecting monitoring are not tied to the share of bonds over total debt.

[18] While we have information on the share of bank loans backed by collateral, we do not have similar information for other forms of debt. Since trade credit and bonds are usually unsecured, we measure the degree of collateralization as the ratio of collateralized bank loans to total debt.

degree of concentration the number-equivalent decreases to 4.7 for credit granted and to 3.2 for credit used.[19] Finally, the share of collateralized bank loans in total debt averages 10.3 per cent.

Variables influencing only the probability of liquidation include a dummy for full liability firms (*FULL_LIABILITY*) and the ratio of total assets to the number of employees (*LOG_ASSETS_EMPL*). *Ceteris paribus*, the probability of liquidation should be higher for limited liability companies (since in this case the entrepreneurs' liability is limited to their capital contributions) and lower when the company's obligations are met with both corporate assets and members' assets.[20] Since employees are preferred creditors under Italian bankruptcy law, a low level of assets per employee signals that a smaller fraction of total assets will be available to satisfy the claims of other creditors, triggering the liquidation of distressed firms.[21]

Variables that should only influence the probability of financial distress, through their effect on lenders' monitoring ability, include: the log of firm's age (*LOG_AGE*) and its squared value (*LOG_AGE_SQ*);[22] the share of tangible assets over total assets (*TANGIBLES*);[23] the ratio of bank loans secured by accounts receivable to total debt (*AR_SECURED_LOANS*) and the ratio of accounts receivable to total assets (*RECEIVABLES*);[24] the geographical proximity between banks and firms (*BANK_PROXIMITY*).[25] Except for *LOG_AGE_SQ*, all the remaining variables should reduce the probability of financial distress.

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[19] The Herfindahl-Hirschman index is, in fact, equal to 0.213 when computed on credit granted and equal to 0.310 when computed on credit used.

[20] In our sample full-liability firms consist in companies limited by shares with one shareholder and by private limited liability companies with one member, since Italian law generally provides that for these firms, in case of default, the single shareholder or member has unlimited liability for the company's obligations. For more details, see Campobasso (2002).

[21] When we separately introduce in the regression the log of total assets and the log of the number of employees, the two variables have exactly the same coefficients but with opposite signs.

[22] Informational asymmetries between lenders and borrowers should be lower when the borrowing firm is older and with a longer track record.

[23] We use the share of tangible assets on total assets as a proxy for the transparency of the firm's balance sheet structure (Bonaccorsi and Dell'Ariccia, 2004).

[24] These two variables measure the bank's monitoring ability arising from the observation of the borrower's transactions and from the access to a continuous flow of information on the borrower's commercial and financial relationships (Mester et al., 2007; Nakamura, 1993).

[25] Proximity between the borrowing firm and the lending bank should enhance the bank's ability to collect

To control for the possibility that debt structure variables might simply reflect firm risk, we also include in the model the variable used to classify firms as financially distressed (*COVERAGE*) and a dummy variable for observations where the bank debt owed by the borrower exceeds the amount granted by the bank (*OVERDRAWN_CREDIT*). Finally, we include a set of dummy variables to control for other sources of heterogeneity among firms: size, industry, geographical location and affiliation with a corporate group.

3. Empirical results

In this section we set out the results for our baseline specification, leaving possible extensions to the next section, where we present a large set of robustness checks.

3.1 Liquidation

The first column in Table A2 reports the results for the probability of liquidation of financially distressed firms. Consistently with the prediction of the literature on relationship banking, higher concentration of bank credit used reduces the probability of liquidation of financially distressed firms. However, in accordance with the assumption that multiple lending helps a financially distressed firm to increase its credit or to substitute lenders who are willing to withdraw, high concentration of bank credit granted is associated with higher probability of liquidation for distressed firms.

As for the other factors, we find that higher proportions of long-term debt are associated with lower probabilities of liquidation, consistently with theoretical predictions that longer maturities reduce liquidity risks for borrowers (Diamond 1991; 2004).[26] If we

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and use soft information to assess the creditworthiness of borrowers, especially for small firms (Berger et al., 2001; Petersen and Rajan, 1994; Carling and Lundberg, 2005). Our proximity index is equal to 1 if the bank and the firm are located in the same province, 0.5 if they are located in the same region, and 0 otherwise. On the assumption that geographical proximity is not relevant for large banks and large firms, the index is equal to 0 if the bank is classified as a national bank or the firm has at least 250 employees. The index is then weighted by each bank's share of the firm's total bank debt.

[26] The share of long-term bank loans in total debt could be considered as potentially endogenous. A higher share may simply reflect the decision already taken by the banks to renegotiate debt maturity in order to help the firm to recover from financial distress. To address this issue we re-estimated our model on the sub-sample of firms that are for the first time in financial distress at time *t*. The results (not reported) show no significant difference.

contrast financing sources with similar maturities, we find that a higher share of trade credit (compared with short-term bank loans) is associated with a lower probability of liquidation,[27] while we do not find any significant difference between bonds and long-term bank loans. However, the presence of bonds reduces the probability of liquidation of distressed firms. Our results are consistent with the prediction set forth by Bris and Welch (2005) that a financially distressed firm with a large number of small creditors lacking a coordinating organ has a lower probability of being liquidated than a firm with a small number of creditors.

Finally, our results show that a higher share of debt secured by collateral increases the probability of liquidation of distressed firms, as predicted by Bolton and Scharfstein (1996).

3.2 Financial distress

Having estimated the probability that a financially distressed firm will run into liquidation, we can obtain its predicted value (*PROB_LIQUIDATION*) [28] and use it in the regression of the probability that borrowers will be in financial distress in the following two years. [29] As noted earlier, by including the predicted value in the model we control for the soft-budget-constraint effect and disentangle it from the monitoring effect.

3.2.1 The impact of closer bank relationships

The specification of column [2] in Table A2 controls for the soft-budget-constraint effect (*PROB_LIQUIDATION*). The marginal effect is negative and quite strong (-15.6 per cent), supporting the theoretical prediction that a high probability of liquidation under financial distress represents a strong incentive for firms to avoid risky and opportunistic behaviour.

The results concerning creditor concentration are consistent with theoretical predictions. When the lines of credit are concentrated in a few banks, the probability of

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[27] Wilner (2000) and Cuñat (2007) show that trade creditors, desiring to maintain an enduring product market relationship, may make more concessions to a customer in financial distress than would banks, which are less dependent on any of their customers.

[28] To obtain the predicted value for firms that are not currently in financial distress we impute the average value of *COVERAGE* that we observe in the sample of financially distressed firms.

financial distress is higher, due to higher liquidity risks. On the other hand, high concentration of bank credit drawn lowers the probability of financial distress by enhancing monitoring ability. However, the liquidity effect turns out to be stronger than the monitoring effect, as is evident by comparing the two marginal effects (0.134 as against -0.041). The same result is obtained by removing one of the two variables from the regression: in each case the impact of the remaining variable is positive and statistically significant.

Column [3] in Table A2 reports the results when we do not control for the soft-budget-constraint effect. The aim of this exercise is twofold: *i*) to assess the bias introduced in estimating the monitoring effect when the soft-budget-constraint effect is neglected, and *ii*) to estimate the impact that is jointly determined through both channels. Compared with the previous specification, the coefficient of the concentration of bank credit used (*HHI_USED*) is no longer significant. This shows that the effect of enhanced monitoring is offset by the soft-budget-constraint effect. By contrast, the liquidity effect is still positive and significant. We conclude that the overall effect of bank credit concentration is an increase in the probability of financial distress. Moreover, close banking relationships lower the probability of liquidation by reducing the chances of bankruptcy for distressed firms and not by helping to prevent states of financial distress.

3.2.2 The impact of other variables

Higher shares of short-term debt are associated with higher probabilities of financial distress, consistently with theoretical predictions that shorter maturities increase liquidity risks for borrowers (Diamond 1991; 2004). On the other hand, higher shares of short-term debt held by trade creditors are associated with lower probabilities of financial distress. This result provides some empirical support for the hypothesis that trade creditors have some specific monitoring advantages over banks, which outweigh the disadvantages of higher dispersion. As for financing sources with longer maturity, the explanatory variables related to bonds aim at disentangling the effect of creditor dispersion from the effect of firm transparency. The results show that the presence of bonds (*DUMMY_BONDS*) is associated with a lower probability of financial distress, while the share of bonds in long-term debt

[29] At this stage we exclude from the analysis the firms that will be liquidated in the following two years.

(*BONDS/LT_DEBT*) is not statistically significant. Our findings lend support to the hypothesis that the existence of a set of rules and institutions (such as disclosure rules, auditing firms, rating agencies) could represent an implicit form of coordination or centralization to perform monitoring, and this channel seems to outweigh the disadvantages arising from the higher dispersion of creditors.

The ratio of bank loans secured by collateral to total debt only has a marginally significant negative effect on the probability of financial distress. Our empirical evidence rejects the hypothesis that a high level of collateral weakens the bank's incentive to perform screening and monitoring, but neither does it strongly support the alternative that collateral increases the bank's monitoring ability.

Finally, we find evidence that all the variables included to measure different factors that can affect lenders' ability to monitor are highly significant and with the expected sign.

4. Robustness checks and extensions

In this section we present a large series of robustness checks for the results reported above: *i*) we check our identification strategies; *ii*) we use a block bootstrap procedure to take into account that in the equation for financial distress the probability of liquidation is a generated regressor; *iii*) we check the robustness of our results to the possible endogeneity of the concentration of bank relations; *iv*) we use different explanatory variables to measure the double effect of the concentration of bank credit; *v*) we test whether higher concentration of bank credit really affects the probability of financial distress by enhancing banks' monitoring ability. This also gives us the opportunity to present some extensions of our previous results.

Since the Wald test reported in Table A2 shows that equation for the probability of liquidation and the selection equation for the probability of being in financial distress are independent, in the rest of the paper we use a simple probit model to estimate the probability

of liquidation under financial distress.[30] The results, reported in Table A3, confirm those in Table A2.[31]

4.1 Checking the identification strategies

First, we test that the group of variables that we suppose have an influence only on the probability of financial distress should not also be included in the equation for the probability of liquidation. This is required for the identification of the model with sample selection. As can be seen in Table A4, these variables are not statistically significant either individually or as a group.

Second, we check the identification of the equation for financial distress. In this case we rely on two variables (the dummy for full liability firms and the log of assets per employee), which are only included in the equation for the probability of liquidation. A possible objection is that these two variables should also be included in the equation for financial distress. As regards the log of assets per employee, in order to check our identification strategy we re-estimate the regression for the probability of financial distress including *LOG_ASSETS_EMPL* among the explanatory variables. The coefficient of the variable is not statistically significant, confirming our hypothesis that the level of assets per employees does not have a direct effect on the probability of financial distress.

As for the *FULL_LIABILITY* variable, one could argue that unlimited liability may lower the level of risk entrepreneurs are willing to bear, thus reducing the probability of financial distress. We posit, on the contrary, that the entrepreneur who is willing to undertake riskier projects has a stronger incentive to choose full liability in order to reduce the probability of liquidation in case of financial distress. Under this hypothesis, full liability should be associated with a higher probability of financial distress (instead of a lower probability)[32] and should be considered as endogenous in the equation for financial distress. Since we

[30] This is computationally less burdensome especially for the bootstrap procedure.

[31] To check the robustness of our results we also estimated the probability of liquidation by using a seemingly unrelated bivariate probit model. The results (not reported) are similar to the ones in Tables A2 and A3.

[32] In our model this effect works through the probability of liquidation: full liability lowers the probability of liquidation, which in turn increases the probability of distress.

cannot formally test these conflicting hypotheses, we rely on some simple empirical evidence, which supports our hypothesis. As a matter of fact, in our sample the probability of financial distress is higher for full-liability firms (19.5 per cent) than for other borrowers (12.2 per cent) and the difference is statistically significant at the 1 per cent level.

4.2 Block bootstrap estimation

To take into account that the probability of liquidation is a generated regressor in the equation for financial distress, we perform a block bootstrap estimation at the firm level. From the whole sample we draw 1,000 bootstrap samples drawing blocks of data from the units of observation. In any sample we replicate the two-stage estimation procedure: we estimate the probability of liquidation, obtain the predicted value and use it in the estimation for the probability of financial distress. The results presented in Table A5 show that the significance level of the observed coefficients does not change when we correct the standard errors, using either normal, percentile or bias-corrected confidence intervals. Moreover, for all but two explanatory variables the estimated bias is lower than 25 per cent of the standard error and therefore it should not represent a problem (Efron, 1982). The two exceptions are the variables *PROB_LIQUIDATION* and *OVERDRAWN_CREDIT*. In both cases, however, the sign of the bias is opposite to that of the observed coefficient, implying that the bias-corrected coefficient is larger in absolute value than the observed coefficient.[33]

4.3 Endogeneity of the concentration of bank relations

Firms with higher probability of financial distress may choose to keep fewer banking relations in order to enhance their chances of debt renegotiation in the event of distress. If this is true, creditor concentration should be considered as endogenous in the equation for financial distress. In this section we address this potential reverse causality issue by using a

[33] We also performed a two-stage block bootstrap estimation as follows. In the first stage we performed 100 replications of the estimation of the equation for the probability of liquidation and obtained the predicted probability of liquidation for all firms. In the second stage, for any set of predicted values from the first-stage regression we performed 100 replications of the estimates concerning the probability of financial distress. We thus obtained 10,000 replications of the second-stage regression. The results (not reported) are similar to those in Table A5.

two-stage instrumental-variable procedure with the following instruments: (1) the Herfindahl-Hirschman index of total bank credit concentration (lagged by one year) in the province where the firm is located;[34] (2) the effect of bank mergers on bank credit concentration for individual firms;[35] (3) the degree of co-movement between the sales of the firm and the sales of other firms in the same industry.[36] Table A6 reports the results of the two-stage procedure for both the least squares and the probit models. These results confirm our previous findings that higher concentration of credit lines raises the probability of financial distress, by increasing liquidity risks for borrowers, while higher concentration of bank credit actually used reduces the likelihood of distress after controlling for the soft-budget-constraint effect. Table A7 focuses on the results of the 2SLS estimation. As regards the first-stage equation for both the endogenous variables, it shows that *HHI_PROV*, *BANK_MERGERS* and *COMOVEMENT* are significant determinants of firms' creditor concentration and have the expected signs. The Cragg-Donald F statistic exceeds the critical value of 8.18, implying a bias relative to OLS of less than 0.15 (Stock and Yogo, 2005) and indicating that we can reject the null hypothesis of weak instruments. The Sargan statistic fails to reject the overidentifying restrictions, suggesting that the use of all three variables as instruments is appropriate.

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[34] The variable measures the degree of concentration by including the loans granted to manufacturing firms excluded from our sample and to sectors other than manufacturing (households and government, for example).

[35] If in year *t* a merger takes place between bank *A* and bank *B*, we re-compute the Herfindahl-Hirschman index for year *t-1* by considering the two banks as one. We use the difference between this value and the actual one as our measure of the merger's effect on bank credit concentration; this measure is then used as an instrumental variable for the Herfindahl-Hirschman index in year *t*. For a different use of bank mergers as an instrument for bank credit concentration, see Garriga (2006).

[36] If the co-movement is high, banks will be less interested in knowing the economic performance of individual firms; furthermore, the redeployability of firms' assets is likely to be low, since the best potential buyers are the firms in the same industry (Shleifer and Vishny, 1992; Guiso and Minetti, 2004). As a consequence, the advantage of having a close relationship with the firm is less valuable for the bank. To compute the co-movement of sales, we use the same method as in Guiso and Minetti (2004). We use data from Company Accounts Database over the period 1997-2003 for a total of 139,537 firm-year observations. We group firms into 23 industries using a two-digit classification and then, for each industry, regress the standardized annual rate of growth of firms' sales on a full set of year dummies. If firms within an industry co-move significantly, the year dummies will explain a large part of sales variability. We thus retain the R^2 of these regressions and use it as a measure of co-movement of firms in the industry.

4.4 The double effect of the concentration of bank credit

The opposite effects of our two measures of bank credit concentration could be suspected to be the artificial outcome of introducing two highly correlated variables in a nonlinear regression.[37] We check the robustness of our results by separating factors which are common to the two variables from factors which characterize each single variable. We follow two different approaches. First, since in general only for credit lines is there a difference between the amount of credit granted and the amount of credit actually disbursed, only for credit lines do we use two different indexes of concentration.[38] Second, since the Herfindahl-Hirschman index (*H*) summarizes information on the number of banks (*N*) and on the distribution of banks' shares, we include among the explanatory variables the (log of the) number of banking relationships (which is an element common to both of the indexes of concentration) and a measure of the variance of banks' shares, computed both for credit granted and for credit used. [39] Controlling for the number of banks, a greater degree of asymmetry between banks' shares will result in higher concentration.

Table A8 reports the results for the first experiment. Concentration of credit *granted* under lines of credit increases both the probability of liquidation and that of financial distress. This result confirms the existence of liquidity risks associated with more concentrated banking relationships (Detragiache et al., 2000). Concentration of credit *disbursed* under lines of credit reduces both the probability of liquidation and that of financial distress. By contrast, while the concentration of fixed-term loans reduces the likelihood of liquidation, it has no effect on the probability of financial distress. As we already noted in the baseline regression, this result lends support to the hypothesis that the monitoring effect of closer banking relationships essentially works through the flows of information on borrowers that banks are able to obtain by observing transactions on

[37] In our sample the correlation between the two variables is 0.72. As a direct check, we also fit a linear probability model, since both variables should tend to be non significant, if there is a multicollinearity problem. The results (not reported) show no significant difference with respect to the probit models.

[38] In this case the correlation between the two variables falls to 0.63.

[39] We measure the variance of banks' shares as: $\log(N) - \log(N^*)$, where $N^* = 1/H$ is the numbers-equivalent which translates the measure of concentration into the number of equally sized banks constituting the same level of concentration (Adelman, 1969). The correlation between the indexes computed on credit granted and on credit used is 0.55.

customers' accounts (Mester et al., 2007; Nakamura, 1993). However, there is no evidence that creditor concentration enhances monitoring by reducing free riding in monitoring efforts.

Table A9 reports the results for the second experiment. A high number of banking relationships increases the probability of liquidation but lowers the probability of financial distress. The variance of banks' shares lowers both probabilities when it is measured on credit disbursed, while it increases both probabilities when it is measured on credit granted. Furthermore, the results confirm that the effect of multiple lending relations in reducing liquidity risks outweighs the effect due to a lower monitoring ability.

4.5 Does relationship banking really enhance monitoring?

Finally, we want to test whether higher concentration of bank credit really affects the probability of financial distress by enhancing the ability of banks to monitor borrowers. First of all, since the literature suggests that relationship banking should be more valuable for younger, smaller and less transparent firms, we select those firms which are below the median in terms of age, size and ratio of tangibles to total assets and we test the hypothesis that the effect of *HHI_USED* is stronger in this sub-sample of firms. Second, since the ability of the "main banks" to monitor borrowers should be enhanced when borrowers pledge accounts receivable as collateral,[40] we test the hypothesis that *AR_SECURED_LOANS* (the share of loans secured by accounts receivable in total debt) and *HHI_USED* have a mutually reinforcing effect. Both hypotheses are confirmed by the results reported in Table A10. Column [1] shows that for younger, smaller and less transparent firms the marginal effect of *HHI_USED* is significantly stronger in reducing the probability of financial distress than for other borrowers: while the effect for younger, smaller and less transparent firms (-7.3 per cent) is significant at the 1 per cent level, the effect for other borrowers (-3.5 per cent) is significant only at the 10 per cent level. Similarly, column [2] shows the reinforcing effect of the share of accounts-receivable-secured loans in total debt and the concentration of credit used. This result confirms our previous finding that the monitoring effect of closer banking

[40] Monitoring cash flows arising from the collection of accounts receivable on behalf of the borrower may provide more valuable information when most of the transactions are consolidated at one lender (Nakamura,

relationships essentially works through the flows of information on borrowers that banks are able to obtain by observing transactions on customers' accounts.

5. Concluding remarks

In this paper we have empirically investigated the influence that the concentration of bank relationships has on the probability of the borrower entering into financial distress and on the likelihood of liquidation in this event.

Our results give new and more direct support to the predictions of the literature on relationship banking. First of all, our evidence confirms that higher concentration of *disbursed bank credit* reduces the probability that a financially distressed firm will be forced into liquidation. Secondly, we show that, controlling for the soft-budget-constraint and the liquidity effects, higher concentration of bank credit also reduces the probability of financial distress, by fostering lenders' ability to monitor borrowers. In accordance with theoretical predictions, we find that this effect is stronger for younger, smaller and less transparent firms. Moreover, our results suggest that the monitoring effect of closer banking relationships essentially works through the flows of information on borrowers that banks are able to obtain by observing transactions on customers' accounts (especially in the case of credit lines secured by accounts receivable), while there is no evidence that creditor concentration enhances monitoring by lowering free riding in monitoring efforts.

We also show, however, that the benefits of relationship banking do not come without costs. On the one hand, the soft-budget-constraint effect offsets the lower probability of financial distress stemming from the enhanced monitoring ability. On the other, higher *concentration of credit lines*, by increasing liquidity risks for borrowers, makes both financial distress and liquidation more likely. As for financial distress, moreover, the liquidity effect is quantitatively stronger than the monitoring effect. Ultimately, we find that the overall effect of more concentrated banking relations is a lower probability of liquidation for firms under financial distress, accompanied by a higher probability of incurring financial distress.

1993).

Finally, we also document and discuss the impact of other features of debt structure. The most interesting result is that, contrary to the prevailing view, the presence of debt held by highly dispersed creditors (such as trade creditors and bondholders) is negatively associated with both financial distress and liquidation. In general, this suggests that the difference between concentrated creditors (such as banks) and dispersed creditors (such as trade creditors and bondholders) lies not in more effective monitoring by banks, but in banks' greater severity in the event of borrowers' financial distress (Park, 2000).[41]

[41] Our results are consistent with the empirical evidence provided by Franks and Sussman (2005) for the UK: "while the banks' typical response to distress is an attempt to rescue the firm (rather than liquidate it automatically), they are very tough in their bargaining with the distressed firm. We find only one case of debt forgiveness in our sample. Additionally, the banks very rarely expand lending during distress; on the contrary, the typical response is a significant contraction of lending. (…) We find no evidence of asset grabbing or creditors' runs by dispersed trade creditors; rather, it is almost always the bank that takes the decision to place the company in bankruptcy" (p. 67).

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Statistical appendix

Sources

The Company Accounts Data Service (*Centrale dei Bilanci*) gathers yearly data on the balance sheets and income statements of a sample of about 40,000 Italian non-financial and non-agricultural firms. This information is collected and standardized by a consortium of banks. A firm enters the sample only if it borrows from at least one of the banks in the consortium. Cerved collects yearly data on balance sheets and income statements for all the Italian companies.

We draw balance-sheet and income-statement data from the Company Accounts Data Service, which offers more disaggregated balance-sheet items than Cerved, while firms' personal data are taken from Cerved and include date of establishment, geographical location of the head office, legal form and the state of activity, with particular attention to the type of liquidation in the event of business termination.

The Central Credit Register (*Centrale dei Rischi*) records the exposures of banks for which the amount of credit granted or drawn or the guarantee provided exceeds the threshold of €75,000. From the Central Credit Register we draw, for each borrowing firm, data on the number of banking relations, credit granted, credit used, and the geographical location of the lenders.

Banks' balance-sheet, income-statement and personal data are drawn from the Banking Supervision Reports and the Bank Register at the Bank of Italy.

Variable definition

Dependent variables

LIQUIDATION: binary variable equal to 1 if the firm runs into liquidation at time $(t + 1)$ or $(t + 2)$, equal to 0 otherwise. In this paper we refer to forced liquidation, as our aim is to investigate the outcome of situations of financial distress. In particular, firms are defined to be in liquidation if they are involved in one of the bankruptcy procedures (straight bankruptcy, preventive composition, controlled administration, administrative liquidation, special administration of large enterprises) or in court-ordered liquidation;

DISTRESS: binary variable equal to 1 if at time $(t + 1)$ or $(t + 2)$ the firm has an interest coverage ratio lower than one, equal to 0 otherwise.

Firm variables

FULL_LIABILITY: binary variable equal to 1 if the firm is a company limited by shares with a sole shareholder or a private limited company with one member;

LOG_AGE: logarithm of (1 + firm's age);

LOG_AGE_SQ: squared value of LOG_AGE;

LOG_ASSETS_EMPL: logarithm of the ratio of total assets to the number of employees;

COVERAGE: ratio of earnings before interests, taxes and depreciation to interest expenses;

TANGIBLES: ratio of gross tangible assets to gross total assets;

RECEIVABLES: ratio of accounts receivable to gross total assets;

ST_DEBT: ratio of short-term debt to total debt;

TRADE_DEBT/ST: ratio of trade debt to short-term debt;

LT_DEBT: ratio of medium and long-term debt to total debt;

BONDS/LT: ratio of bonds to medium and long-term debt;

DUMMY_BONDS: binary variable equal to 1 if the firm has bonds, equal to 0 otherwise;

OTHER_DEBT: ratio of debt without specified maturity to total debt.

Bank relationship variables

NUMBER_OF_BANKS: number of banks (in log);

HHI_GRANTED: Herfindahl-Hirschman index, computed on bank credit granted;

HHI_USED: Herfindahl-Hirschman index, computed on bank credit used;

COLLATERAL: ratio of collateralized loans to total debt;

AR_SECURED_LOANS: ratio of loans secured by accounts receivable to total debt;

OVERDRAWN_CREDIT: binary variable equal to 1 when bank credit used exceeds bank credit granted, equal to 0 otherwise;

BANK_PROXIMITY: weighted average of an index of bank-firm proximity that takes into account the firm's size and the degree of the bank's territorial spread. The proximity index, computed by bank, is equal to 1 if both the firm and the bank are located in the same province, 0.5 if they are located in the same region, 0 otherwise. The weights for the mean computation are represented by the ratio of each bank's loans to bank credit used by the firm;

PROB_LIQUIDATION: predicted value of the probability of liquidation (conditional on financial distress).

Tables

Table A1

SAMPLE STATISTICS

Variables	Mean	Std. Dev.	Median	1st quartile	3rd quartile
Dependent variables					
LIQUIDATION	0.012	0.108	0.000	0.000	0.000
DISTRESS	0.138	0.345	0.000	0.000	0.000
Firm variables					
FULL_LIABILITY	0.082	0.275	0.000	0.000	0.000
LOG_AGE	2.940	0.641	2.996	2.565	3.367
LOG_ASSETS_EMPL	5.283	0.671	5.223	4.830	5.673
TANGIBLES	0.349	0.182	0.345	0.207	0.481
RECEIVABLES	0.319	0.143	0.305	0.214	0.410
COVERAGE	5.591	21.578	3.301	2.062	5.802
ST_DEBT	0.660	0.174	0.678	0.545	0.793
TRADE_DEBT/ST_DEBT	0.644	0.194	0.637	0.503	0.792
LT_DEBT	0.224	0.157	0.197	0.101	0.319
BONDS/LT_DEBT	0.052	0.155	0.000	0.000	0.000
OTHER_DEBT	0.116	0.116	0.076	0.037	0.152
DUMMY_BONDS	0.147	0.355	0.000	0.000	0.000
Bank-relationship variables					
NUMBER_OF_BANKS	2.068	0.518	2.079	1.792	2.398
HHI_GRANTED	0.213	0.132	0.177	0.126	0.257
HHI_USED	0.310	0.199	0.250	0.170	0.387
COLLATERAL	0.103	0.120	0.066	0.000	0.167
AR_SECURED_LOANS	0.190	0.131	0.182	0.082	0.283
OVERDRAWN_CREDIT	0.031	0.174	0.000	0.000	0.000
BANK_PROXIMITY	0.512	0.309	0.542	0.279	0.760

Table A2

LIQUIDATION AND FINANCIAL DISTRESS

(probit regressions)

All regressions also include 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group; the estimated coefficients or marginal effects are not shown. For dummy variables the marginal effect is computed for discrete change from 0 to 1. Standard errors are robust to heteroskedasticity and adjusted for clustering on firms. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variable	Liquidation (1)		Financial distress (controlling for the soft-budget-constraint effect)		Financial distress (without controlling for the soft-budget-constraint effect)	
	Coefficients	*Std. Err.*	Marginal effects	*Std. Err.*	Marginal effects	*Std. Err.*
HHI_USED	-2.431***	*0.527*	-0.041**	*0.021*	-0.019	*0.020*
HHI_GRANTED	1.948***	*0.597*	0.134***	*0.026*	0.116***	*0.026*
PROB_LIQUIDATION	-	-	-0.156***	*0.045*	-	-
COLLATERAL	0.864**	*0.387*	-0.034*	*0.019*	-0.046**	*0.019*
ST_DEBT	1.110***	*0.353*	0.122***	*0.018*	0.101***	*0.017*
TRADE_DEBT/ST_DEBT	-0.709**	*0.357*	-0.178***	*0.019*	-0.167***	*0.019*
BONDS/LT_DEBT	0.718	*0.692*	0.018	*0.020*	0.008	*0.020*
DUMMY_BONDS	-0.573**	*0.287*	-0.033***	*0.007*	-0.027***	*0.007*
OTHER_DEBT	0.845*	*0.491*	0.142***	*0.020*	0.128***	*0.020*
COVERAGE	-0.062***	*0.011*	-0.013***	*0.002*	-0.013***	*0.002*
OVERDRAWN_CREDIT	0.513***	*0.155*	0.092***	*0.014*	0.067***	*0.011*
LOG_ASSETS_EMPL	-0.220**	*0.086*	-	-	-	-
FULL_LIABILITY	-0.601***	*0.180*	-	-	-	-
LOG_AGE	-	-	-0.056***	*0.014*	-0.056***	*0.014*
LOG_AGE_SQ	-	-	0.020***	*0.005*	0.020***	*0.005*
TANGIBLES	-	-	-0.119***	*0.017*	-0.122***	*0.017*
RECEIVABLES	-	-	-0.139***	*0.018*	-0.139***	*0.018*
AR_SECURED_LOANS	-	-	-0.192***	*0.026*	-0.194***	*0.026*
BANK_PROXIMITY	-	-	-0.027***	*0.007*	-0.027***	*0.007*
Pseudo R^2			0.1130		0.1123	
Observations	42,533		42,031		42,031	
Wald test of indep. eqns.	Prob > χ^2 = 0.9134					

(1) Probit model with sample selection. The selection equation for financially distressed firms is not reported.

Table A3

LIQUIDATION AND FINANCIAL DISTRESS

(*probit regressions*)

Both regressions also include 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group; the estimated marginal effects are not shown. For dummy variables the marginal effect is computed for discrete change from 0 to 1. Standard errors are robust to heteroskedasticity and adjusted for clustering on firms. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variable	Liquidation		Financial distress (controlling for the soft-budget-constraint effect)	
	Marginal effects	*Std. Err.*	Marginal effects	*Std. Err.*
HHI_USED	-0.258***	*0.052*	-0.041**	*0.021*
HHI_GRANTED	0.209***	*0.058*	0.134***	*0.026*
PROB_LIQUIDATION	-	-	-0.156***	*0.045*
COLLATERAL	0.090**	*0.041*	-0.034*	*0.019*
ST_DEBT	0.116***	*0.038*	0.121***	*0.018*
TRADE_DEBT/ST_DEBT	-0.078***	*0.026*	-0.178***	*0.019*
BONDS/LT_DEBT	0.075	*0.073*	0.018	*0.020*
DUMMY_BONDS	-0.042**	*0.014*	-0.033***	*0.007*
OTHER_DEBT	0.091**	*0.045*	0.142***	*0.020*
COVERAGE	-0.007***	*0.001*	-0.013***	*0.002*
OVERDRAWN_CREDIT	0.077***	*0.021*	0.092***	*0.014*
LOG_ASSETS_EMPL	-0.023**	*0.009*	-	-
FULL_LIABILITY	-0.044***	*0.009*	-	-
LOG_AGE	-	-	-0.056***	*0.014*
LOG_AGE_SQ	-	-	0.020***	*0.005*
TANGIBLES	-	-	-0.118***	*0.017*
RECEIVABLES	-	-	-0.138***	*0.018*
AR_SECURED_LOANS	-	-	-0.192***	*0.026*
BANK_PROXIMITY	-	-	-0.026***	*0.007*
Pseudo R^2	0.1751		0.1130	
Observations	2,639		42,031	

Table A4

ROBUSTNESS CHECK # 1:
Checking the Identification Strategy
(*probit regression*)

The regression also includes a constant, 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group, whose estimated coefficients are not shown. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variable	Liquidation (*probit*)	
	Marginal effect	*Std. Err.* [1]
HHI_USED	-0.258 ***	*0.052*
HHI_GRANTED	0.208 ***	*0.058*
COLLATERAL	0.093 **	*0.042*
ST_DEBT	0.115 ***	*0.040*
TRADE_DEBT/ST_DEBT	-0.083 **	*0.032*
BONDS/LT_DEBT	0.071	*0.073*
DUMMY_BONDS	-0.042 **	*0.014*
OTHER_DEBT	0.089 **	*0.045*
COVERAGE	-0.007 ***	*0.001*
OVERDRAWN_CREDIT	0.076 ***	*0.021*
LOG_ASSETS_EMPL	-0.024 ***	*0.009*
FULL_LIABILITY	-0.045 ***	*0.009*
LOG_AGE	-0.014 [2]	*0.032*
LOG_AGE_SQ	0.005 [2]	*0.012*
TANGIBLES	-0.002 [2]	*0.030*
RECEIVABLES	0.017 [2]	*0.039*
AR_SECURED_LOANS	-0.012 [2]	*0.047*
BANK_PROXIMITY	-0.010 [2]	*0.018*
Pseudo R^2	0.1757	
Observations	2,639	

[1] Standard errors adjusted for clustering on firms.
[2] Test of joint significance: χ^2 (6) = 1.00; Prob > χ^2 = 0.9858

Table A5

ROBUSTNESS CHECK # 2:
Block Bootstrap Estimation
(*probit regressions*)

Regressions also include a constant, 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group, whose estimated coefficients are not shown. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variables	Financial distress (*probit*)		
	Observed Coefficient	Bias	*Bootstrap Std. Err.*
HHI_USED	-0.249 **	0.020	*0.119*
HHI_GRANTED	0.820 ***	-0.014	*0.146*
PROB_LIQUIDATION	-0.953 ***	0.164	*0.307*
COLLATERAL	-0.206 *	-0.014	*0.121*
ST_DEBT	0.741 ***	-0.022	*0.115*
TRADE_DEBT/ST_DEBT	-1.083 ***	0.010	*0.099*
BONDS/LT_DEBT	0.107	-0.013	*0.128*
DUMMY_BONDS	-0.226 ***	0.009	*0.057*
OTHER_DEBT	0.866 ***	-0.018	*0.123*
COVERAGE	-0.081 ***	-0.001	*0.011*
OVERDRAWN_CREDIT	0.437 ***	-0.018	*0.057*
LOG_AGE	-0.340 ***	-0.000	*0.087*
LOG_AGE_SQ	0.122 ***	0.000	*0.032*
TANGIBLES	-0.722 ***	-0.003	*0.091*
RECEIVABLES	-0.841 ***	-0.002	*0.101*
AR_SECURED_LOANS	-1.168 ***	-0.002	*0.148*
BANK_PROXIMITY	-0.161 ***	-0.001	*0.044*
Observations	42,031		
Replications	10,000		

Table A6

ROBUSTNESS CHECK # 3:
Controlling for the Endogeneity of the Concentration of Bank Credit
(*probit, 2SLS and ivprobit regressions*)

All regressions also include 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group; the estimated marginal effects are not shown. For dummy variables the marginal effect is computed for discrete change from 0 to 1. Standard errors are robust to heteroskedasticity and adjusted for clustering on firms. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variable	Financial distress (*probit*)		Financial distress (*2SLS*)		Financial distress (*ivprobit*)	
	Coefficients	*Std. Err.*	Coefficients	*Std. Err.*	Coefficients	*Std. Err.*
HHI_USED	-0.249 **	*0.123*	-1.363**	*0.574*	-5.290*	*2.954*
HHI_GRANTED	0.820 ***	*0.146*	1.613***	*0.622*	6.488**	*3.144*
PROB_LIQUIDATION	-0.953 ***	*0.283*	-1.320**	*0.615*	-6.261**	*3.171*
COLLATERAL	-0.206 *	*0.116*	0.264**	*0.134*	0.906	*0.695*
ST_DEBT	0.741 ***	*0.114*	0.279***	*0.085*	1.455***	*0.438*
TRADE_DEBT/ST_DEBT	-1.083 ***	*0.096*	-0.070	*0.108*	-0.163	*0.553*
BONDS/LT_DEBT	0.107	*0.121*	0.164**	*0.077*	0.722*	*0.402*
DUMMY_BONDS	0.226 ***	*0.055*	-0.101***	*0.038*	-0.526***	*0.195*
OTHER_DEBT	0.866 ***	*0.120*	0.384***	*0.110*	1.743**	*0.568*
COVERAGE	-0.081 ***	*0.013*	-0.000	*0.000*	-0.080***	*0.003*
OVERDRAWN_CREDIT	0.437 ***	*0.053*	0.170***	*0.038*	0.638***	*0.195*
LOG_AGE	-0.340 ***	*0.087*	-0.082***	*0.017*	-0.326***	*0.080*
LOG_AGE_SQ	0.122 ***	*0.032*	0.032***	*0.006*	0.130***	*0.028*
TANGIBLES	-0.722 ***	*0.091*	-0.171***	*0.025*	-0.542***	*0.131*
RECEIVABLES	-0.841 ***	*0.103*	-0.205***	*0.017*	-0.812***	*0.084*
AR_SECURED_LOANS	-1.168 ***	*0.150*	-0.288***	*0.037*	-1.138***	*0.181*
BANK_PROXIMITY	-0.161 ***	*0.044*	-0.017	*0.012*	-0.107*	*0.060*
Pseudo R^2	0.1130		-		-	
Wald chi2 (37)	1,242.84		-		2,737.77	
F (37, 41993)	-		53.91		-	
Wald test of exogeneity	-		-		χ^2 (2) = 3.67 Prob > χ^2 = 0.1594	
Observations	42,031		42,031		42,031	

Table A7

ROBUSTNESS CHECK # 3:
Controlling for the Endogeneity of the Concentration of Bank Credit
(*probit and 2SLS regressions*)

Standard errors are robust to heteroskedasticity and adjusted for clustering on firms. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variable	probit results		2SLS results	
	Coeff.	*Std. Err.*	Coeff.	*Std. Err.*
HHI_USED	-0.249**	*0.123*	-1.363**	*0.574*
HHI_GRANTED	0.820***	*0.146*	1.613***	*0.622*
Pseudo R^2	0.1130			
Cragg-Donald F statistic			10.109	
Chi2 (1) p-value			0.9987	
Observations	42,031		42,031	
	First stage for HHI_USED			
HHI_PROV			0.193***	*0.028*
BANK_MERGERS			0.456***	*0.044*
COMOVEMENT			-0.326***	*0.038*
F STATISTICS			75.10	
	First stage for HHI_GRANTED			
HHI_PROV			0.242***	*0.021*
BANK_MERGERS			0.424***	*0.033*
COMOVEMENT			-0.195***	*0.029*
F STATISTICS			115.76	

F statistics is F-test of excluded instruments. Chi2 (1) is the Sargan statistic testing the over-identifying restriction.

Table A8

ROBUSTNESS CHECK # 4a:
Separating Lines of Credit from Fixed-Term Loans

All regressions also include 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group; the estimated coefficients or marginal effects are not shown. For dummy variables the marginal effect is computed for discrete change from 0 to 1. Standard errors are robust to heteroskedasticity and adjusted for clustering on firms. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variable	Liquidation		Financial distress	
	Marginal effects	*Std. Err.*	Marginal effects	*Std. Err.*
HHI_FT_LOANS	-0.055***	*0.017*	0.001	*0.008*
HHI_L/C_USED	-0.157***	*0.038*	-0.030**	*0.013*
HHI_L/C_GRANTED	0.164***	*0.044*	0.113***	*0.018*
PROB_LIQUIDATION	-	-	-0.144***	*0.042*
COLLATERAL	0.095**	*0.041*	-0.030	*0.019*
ST_DEBT	0.155***	*0.040*	0.113***	*0.020*
TRADE_DEBT/ST_DEBT	-0.082***	*0.025*	-0.173***	*0.019*
BONDS/LT_DEBT	0.090	*0.072*	0.016	*0.020*
DUMMY_BONDS	-0.042**	*0.013*	-0.033***	*0.007*
OTHER_DEBT	0.123***	*0.047*	0.135***	*0.022*
COVERAGE	-0.006***	*0.001*	-0.013***	*0.002*
OVERDRAWN_CREDIT	0.084***	*0.021*	0.091***	*0.014*
LOG_ASSETS_EMPL	-0.025***	*0.008*	-	-
FULL_LIABILITY	-0.042***	*0.009*	-	-
LOG_AGE	-	-	-0.056***	*0.014*
LOG_AGE_SQ	-	-	0.020***	*0.005*
TANGIBLES	-	-	-0.120***	*0.017*
RECEIVABLES	-	-	-0.139***	*0.018*
AR_SECURED_LOANS	-	-	-0.187***	*0.026*
BANK_PROXIMITY	-	-	-0.025***	*0.007*
Pseudo R^2	0.1767		0.1133	
Observations	2,639		42,031	

Table A9

ROBUSTNESS CHECK # 4b:
Number of Bank Relationships and Asymmetry

All regressions also include 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group; the estimated coefficients or marginal effects are not shown. For dummy variables the marginal effect is computed for discrete change from 0 to 1. Standard errors are robust to heteroskedasticity and adjusted for clustering on firms. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variable	Liquidation		Financial distress	
	Marginal effects	*Std. Err.*	Marginal effects	*Std. Err.*
NUMBER_OF_BANKS	0.038 ***	*0.010*	-0.016***	*0.004*
VARIANCE_USED	-0.082 ***	*0.017*	-0.031***	*0.008*
VARIANCE_GRANTED	0.114 ***	*0.023*	0.072***	*0.012*
PROB_LIQUIDATION	-	-	-0.150***	*0.041*
COLLATERAL	0.047	*0.041*	-0.046**	*0.019*
ST_DEBT	0.108 ***	*0.037*	0.119***	*0.018*
TRADE_DEBT/ST_DEBT	-0.064 **	*0.026*	-0.166***	*0.018*
BONDS/LT_DEBT	0.091	*0.071*	0.022	*0.020*
DUMMY_BONDS	-0.043 **	*0.013*	-0.034***	*0.007*
OTHER_DEBT	0.098 **	*0.044*	0.143***	*0.021*
COVERAGE	-0.006 ***	*0.001*	-0.013***	*0.002*
OVERDRAWN_CREDIT	0.070 ***	*0.020*	0.086***	*0.013*
LOG_ASSETS_EMPL	-0.033 ***	*0.008*	-	-
FULL_LIABILITY	-0.042 ***	*0.009*	-	-
LOG_AGE	-	-	-0.056***	*0.014*
LOG_AGE_SQ	-	-	0.020***	*0.005*
TANGIBLES	-	-	-0.115***	*0.016*
RECEIVABLES	-	-	-0.134***	*0.018*
AR_SECURED_LOANS	-	-	-0.191***	*0.026*
BANK_PROXIMITY	-	-	-0.027***	*0.007*
Pseudo R^2	0.1893		0.1138	
Observations	2,639		42,031	

Table A10

ROBUSTNESS CHECK # 5:
Do Closer Banking Relationships Really Affect Monitoring?
(*probit regressions; marginal effects*)

Both regressions also include 3 geographical dummies, 7 industry dummies, 5 dummies for firm size (number of employees), 4 year dummies, and a dummy for firms belonging to a corporate group, whose estimated marginal effects are not shown. For dummy variables the marginal effect is computed for discrete change from 0 to 1. Standard errors are robust to heteroskedasticity and adjusted for clustering on firms. *** Significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level.

Variables	Financial distress		Financial distress	
	Marginal effects	Std. Err.	Marginal effects	Std. Err.
HHI_USED	-0.035*	*0.021*	-0.059***	*0.022*
HHI_USED*SUBSAMPLE	-0.038**	*0.015*	-	-
HHI_USED*AR_SECURED_LOANS	-	-	-0.005***	*0.002*
HHI_GRANTED	0.136***	*0.026*	0.146***	*0.026*
PROB_LIQUIDATION	-0.158***	*0.045*	-0.174***	*0.045*
COLLATERAL	-0.034*	*0.019*	-0.033*	*0.019*
ST_DEBT	0.122***	*0.018*	0.125***	*0.018*
TRADE_DEBT/ST_DEBT	-0.178***	*0.019*	-0.182***	*0.019*
BONDS/LT_DEBT	0.016	*0.020*	0.019	*0.020*
DUMMY_BONDS	-0.033***	*0.007*	-0.034***	*0.007*
OTHER_DEBT	0.141***	*0.020*	0.143***	*0.020*
COVERAGE	-0.013***	*0.002*	-0.013***	*0.002*
OVERDRAWN_CREDIT	0.093***	*0.014*	0.094***	*0.014*
LOG_AGE	-0.057***	*0.014*	-0.056***	*0.014*
LOG_AGE_SQ	0.020***	*0.005*	0.020***	*0.005*
TANGIBLES	-0.126***	*0.017*	-0.117***	*0.017*
RECEIVABLES	-0.138***	*0.018*	-0.137***	*0.018*
AR_SECURED_LOANS	-0.192***	*0.026*	-0.203***	*0.026*
BANK_PROXIMITY	-0.027***	*0.007*	-0.026***	*0.007*
Pseudo R^2	0.1133		0.1134	
Observations	42,031		42,031	

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