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EUROSISTEMA

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The series is available online at www.bancaditalia.it .

ISSN 1972-6627 (print)
ISSN 1972-6643 (online)

Printed by the Printing and Publishing Division of the Bank of Italy

THE ROLE OF LEVERAGE IN FIRM SOLVENCY: EVIDENCE FROM BANK LOANS

by Emilia Bonaccorsi di Patti*, Alessio D'Ignazio**, Marco Gallo♦ and Giacinto Micucci♦♦

Abstract

The two recessions that have hit Italy since the end of 2008 have raised the share of non-performing loans to businesses in banks' portfolios substantially. In this paper we evaluate to what extent the deterioration of credit quality was due not only to the decline in firms' sales during the contraction of economic activity, but also to the level of firms' financial debt at the onset of the first recession. Our results show that, other things being equal, a ten percentage point increase in leverage is associated with a higher probability of default of almost one percentage point. Moreover, the adverse impact of a fall in sales on a firm's solvency is almost four times greater for firms in the highest quartile of the leverage distribution than for firms in the first quartile. These findings confirm that firms' financial structure can be a powerful amplifier of macroeconomic shocks. A higher level of leverage reduces firms' resilience during a recession, and this in turn weakens the balance-sheets of banks and thus their ability to provide credit.

JEL Classification: G01, G21, G31, G33.
Keywords: economic and financial crisis, firms leverage, non-performing loans, insolvency.

Contents

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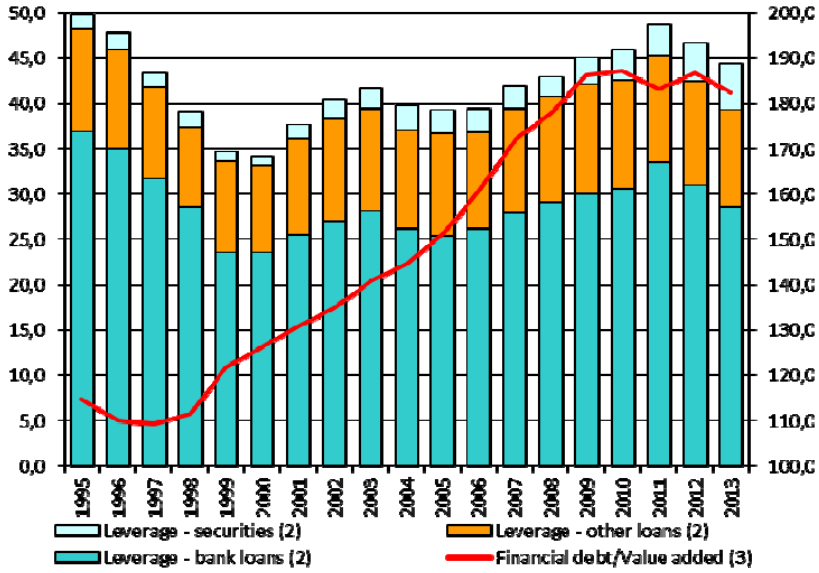
1. Introduction

The financial crisis of 2007-2008 erupted after a long expansionary cycle in advanced economies, characterized by rapid credit growth and in some countries by bubbles in asset and real estate markets. In Italy the sustained growth in bank lending reflected primarily the transformation of the banking industry following the reforms of the 1990s and the decline in spreads due to the creation of the euro. The ratio of bank credit to GDP increased from 40 per cent to 55 per cent between 2000 and 2007. In the same period the aggregate leverage ratio of nonfinancial corporations, defined as the ratio between financial debts and the sum of financial debts and equity at market value, went up from less than 35 per cent to about 42 per cent (Fig.1).

Figure 1: Corporate Debt(1)

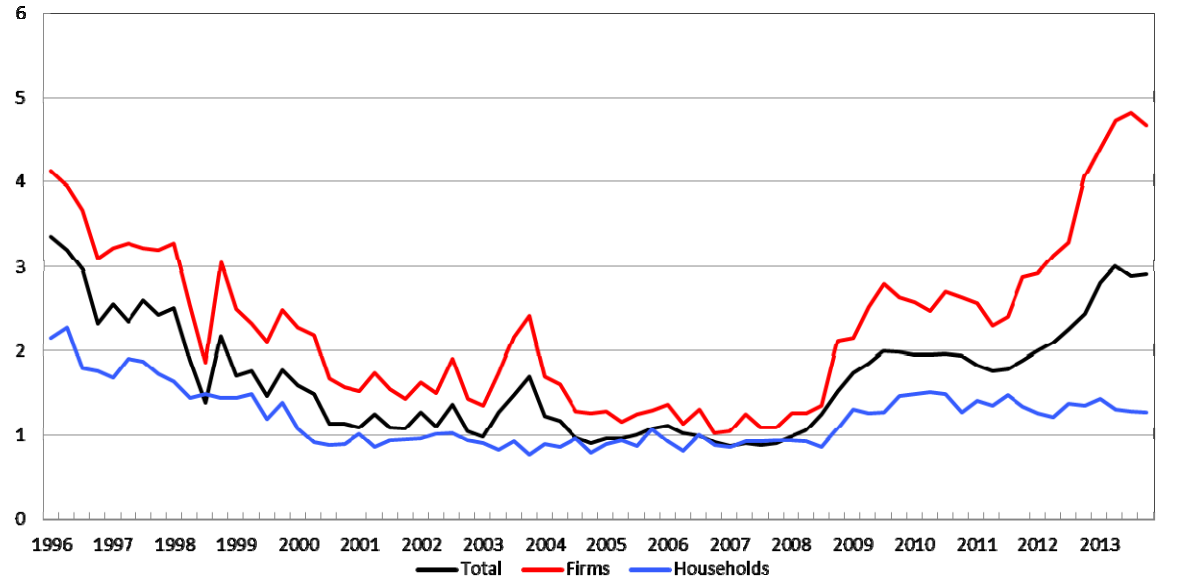


Note: Data from Bank of Italy and Istat. Data do not reflect SEC 2010 (Annual Report of the Bank of Italy, 2014). – (1) The data refer to the non-financial corporations sector. – (2) Left-hand scale. Leverage is calculated as the ratio of financial debt to the sum of financial debt and shareholders' equity at market prices. – (3) Right-hand scale.

In the second half of 2008, after the default of Lehman Brothers, the global recession was transmitted to the Italian economy. A weak recovery in 2010 was interrupted by the sovereign debt crisis, which triggered a second recession starting in the third quarter of 2011. As shown in Figure 2, the cyclical conditions had a severe impact on the solvency of nonfinancial firms and on the quality of bank loan portfolios, with the rate of newly defaulting loans climbing to historically high levels.

From a macroprudential policy perspective, an important question that arises is to what extent the financial structure of firms increases their fragility to shocks. We address this question by investigating the role of leverage in a reduced form statistical model of the probability of default. The model is estimated using a very large sample of nonfinancial firms that borrow from banks.

Figure 2: Ratio of new bad debts to outstanding loans(1)



Sources: Supervisory statistical reports and Central Credit Register. (1) Quarterly flow of adjusted bad debts in relation to the stock of loans at the end of the previous quarter; annual data up to the fourth quarter of 1995. Seasonally adjusted where necessary and annualized.

Prior evidence shows that leverage increases the probability of default during an economic downturn (Carling et al., 2007; Loffler and Maurer, 2011; Bonfim, 2009; Molina, 2005); leverage is also one of the key variables in the estimation of credit scores. Our analysis contributes to this literature by showing not only the direct effect of leverage on default but also how leverage interacts with economic stress. In particular, we study if leverage implied a differential impact of the adverse shock to firm sales on the probability of firm insolvency and quantify these effects using a very large sample of nonfinancial firms, mostly medium and small by international standard.

A second contribution is that we use a definition of insolvency based on credit data from the Italian Credit register. We link information on firms' balance sheets from the Firm Register with information on the status of a borrower in terms of repayment of outstanding loans. In essence, in the CR a firm is considered defaulted if it is unable to repay its bank debts. The default status is based on a combination of different conditions, including default on one or more loans

and materiality of the defaulted exposure with respect to the entire exposure of the borrower to the banking system. Thanks to this definition we can include a large number of small firms that do not issue bonds, for which data on defaults are not available from market sources.

Our analysis shows that the drop in sales is the variable that better explains default during the recession. Nevertheless, the financial conditions of the firms at the onset of the first recession, particularly their leverage, had a substantial impact on the default probability. The effect of leverage is twofold. Not only more levered firms have higher default rates on average, but also the sensitivity of the probability of default to a given shock is greater. The effect is sizable as a drop in sales of 10 percentage points raised the default probability by about 6 percentage points for firms that in 2008 were in the top quartile of leverage; the same shock raised the default probability by about 1.7 percentage points for firms in the lowest quartile of leverage.

2. Data

The first source of our data is the universe of Italian limited liability companies reported in the database Cerved. The sample of nonfinancial firms with information on financial debts for 2007 or 2008 are matched with the records of borrowers in the Central credit register (CR) in 2008. The CR reports, for each Italian credit institution (banks and specialized financial companies), all loans and guarantees to resident borrowers above a given threshold (75,000 euros before 2009 and 30,000 thereafter). Outstanding loans can be performing, past-due, restructured, substandard or bad. There is no threshold for reporting bad loans. A loan becomes bad if the lender deems the borrower irreversibly unable to repay its debt after having assessed his/her overall financial conditions. A late payment is not sufficient to be considered defaulted.

The CR also constructs several indicators of the status of borrowers, defined with reference to all the loans they receive from the entire system of reporting intermediaries. A client can be performing, nonperforming or defaulted ("in sofferenza" in Italian). In our analysis clients default if they enter the CR status of defaulted as a result of having bad loans above a given share of total outstanding credit (see the Data Appendix for the details).

An important caveat of our analysis is that we are focusing on default on bank loans and we are not considering the performance of firms that default on market debt. Nonetheless, financial accounts data show that in Italy bank debt is almost two thirds of firms' financial debt and only very large firms resort to bond issuances (Bank of Italy, 2014). Therefore, our analysis is relevant for assessing the determinants of default for a substantial share of the economy. Furthermore, our notion of default is more general than bankruptcy because the opening of a formal

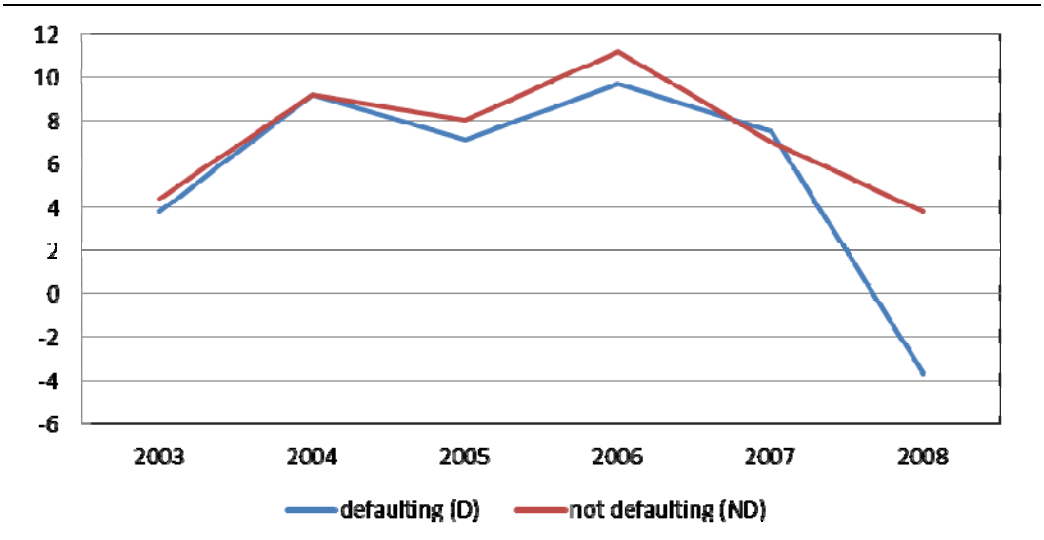
bankruptcy procedure is a sufficient but not necessary condition for entering the CR default status.

We dropped from the initial cross-section all firms that are considered defaulted already in 2008. The matched sample consists of around 200,000 firms that are followed over time until the end of 2012. Following the sample over time, we observe that the flow of firms that are newly recorded as defaulting steadily increased, from 2.8 percent in 2009 to 4.9 in 2012 (Table 1), consistent with the aggregate series plotted in Figure 2. The incidence of default is higher in the construction sector.

We divided the firms into two subsamples: those that did (D) and those that did not default (ND). Those that became nonperforming (substandard, restructured or past-due) but did not become insolvent by 2012 are keep among the ND since they can still revert to performing status, although it is unlikely. As discussed below, aggregating them with the D firms did not change the results of the analysis.

Figure 3 shows the yearly growth rate of aggregate sales of the two types of companies between 2003 and 2008. Until 2007 their sales behaved in a very similar way. In 2008, when the Italian economy entered the recession, sales growth started to diverge reflecting the differentiated impact of the exogenous macroeconomic shock across firms.

Figure 3: Yearly growth rate of sales by default status 2009-12



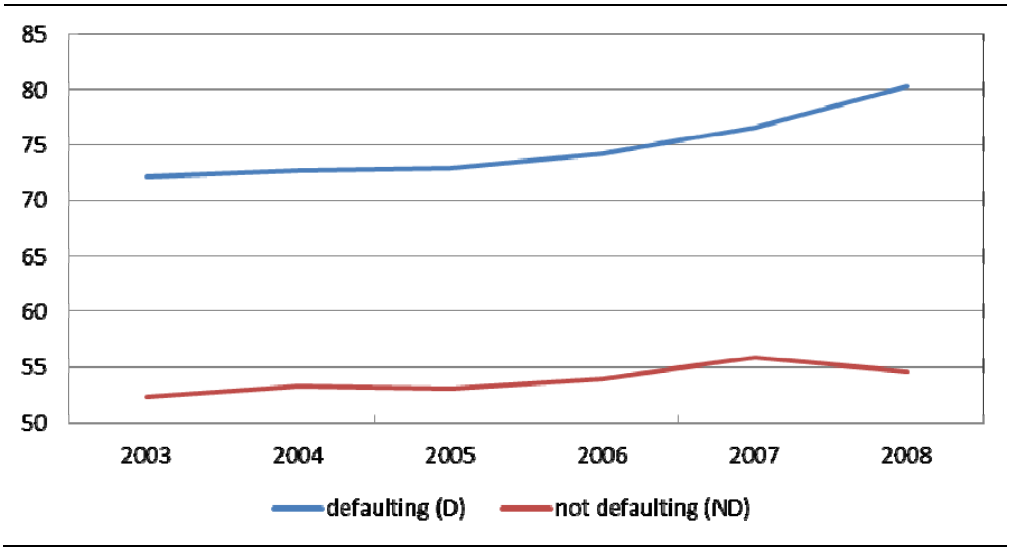
Note: Data are from Cerved Group and Central credit register (CR). The sample includes nonfinancial companies for which data on financial debts are available in each year and have loans in the CR. For the definitions see the Data Appendix.

Figure 4 shows the aggregate value of leverage for the two types of firms. Type D firms had a much higher leverage ratio (financial debt divided by the sum of financial debt and equity) than ND ones, well before 2008. Until 2007 leverage was increasing for both categories, at a

similar pace. For D firms it went from 72 to 77 per cent between 2003 and 2007; for ND firms it increased from 52 to almost 56 percent. In 2008 leverage kept increasing for D firms while it declined for the others.

In Table 2 we explored the incidence of defaults breaking the sample into the quartiles of 2008 leverage and average sales growth during 2009-2012. The distribution of firms by sales growth is based on the mean of the last two available years for each firm.

Figure 4: Firm Leverage by default status in 2009-12



Note: Data are from Cerved Group and Central credit Register. The sample includes nonfinancial companies for which data on financial debts are available in each year and have loans in CR. Leverage is financial debt divided by the sum of financial debt and equity. For the definition of default see the Data Appendix.

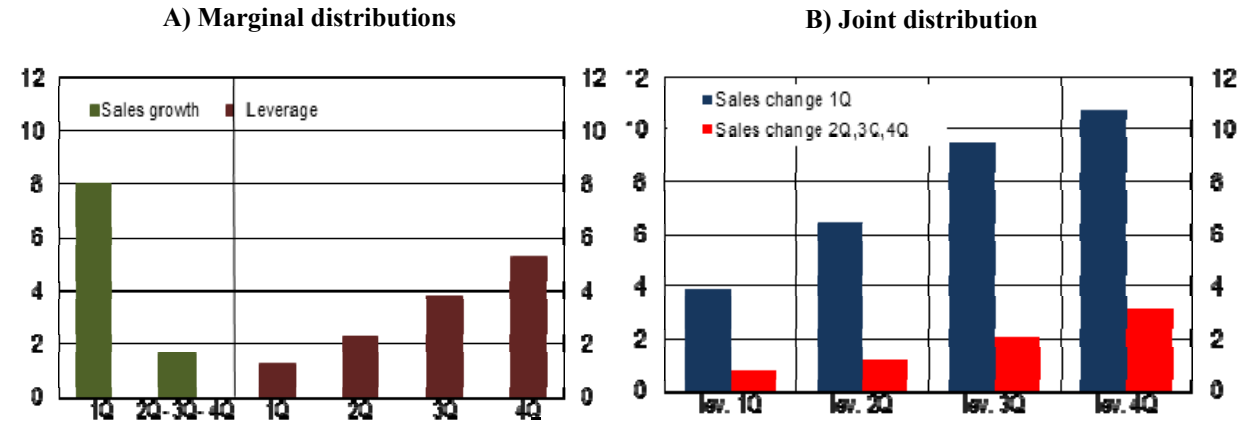
More than half of the firms had negative sales growth as the median of the distribution is -1.4 per cent. The worst performing quartile of firms had a contraction in sales of at least 13.9 per cent on an annual basis. The best quartile had positive growth greater or equal to 9,7 per cent. As shown in Figure 5, Panel A, the default rate is more than quadruple for firms in the bottom quartile of sales growth (8 per cent) with respect to the other companies (1.7 per cent). It also increases monotonically with initial leverage. The joint distribution of leverage and change in sales is shown in Panel B. Among firms with the highest drop in sales, those in the bottom quartile of leverage (less than 47 per cent) have an average default rate of 3.8 per cent, about a third of the 10.8 percent rate of firms in the top quartile (leverage greater than 90 percent; see also Table 2).

Table 3 reports descriptive statistics for a number of economic and financial variables for the D and ND firms (weighted averages). We recall that balance sheet data are usually unavailable for firms once they default so as firms become insolvent they tend to exit the sample. Overall, the firms in our sample are small by international standards. Median total assets are similar in

the two subsamples while mean total assets of the D firms are almost half (5.2 million euros) than those of the ND firms (10.3 million). The reason of this discrepancy is that the size distribution of the D firms is skewed, with a small number of very large corporations that have very low default rates.

In the years 2003-2007 the D firms are less profitable both based on Gross Operating Profits/Total Assets and EBIT/Total Assets. At the aggregate level, their ROE is negative, whereas it is positive for the ND firms.

Figure 5: Share of newly defaulting firms, by leverage (2008) and change in sales (2009-2012)



Note: The default rates are averages of the yearly default rates over the period 2009-2012. Data from Cerved Group and Central Credit Register, with data in the Register for 2008. For the definition of default see the Data Appendix. The sample includes nonfinancial companies for which data on financial debts are available in each year. Leverage is financial debt divided by the sum of financial debt and equity and is computed in 2008 or 2007 based on availability of data. The distribution of sales growth is based on the mean of the last two yearly changes in sales between 2008 and 2012.

The negative aggregate figure for the D firms is the result of a small number of large firms having substantial losses and a large number of firms with positive but weak profitability. The percentage of firms that have positive net income is lower (between 60 and 70 percent) among the D firms; it is somewhat higher for the ND firms (above 70 percent). In both groups this share drops in 2008, the first year of recession, but the extent of the change is larger for the D firms than the ND ones.

The data on the financial structure of the two types of companies reveal substantial differences in addition to the wide differential in leverage shown in Figure 4. While the ratio of financial debt to sales is very similar, the D firms resort to a larger extent to bank debt than the ND firms; they also have a greater share of short term debt and are less liquid.

This evidence partly reflects the industry composition since the D firms have a higher share of companies in the construction sector but the key differences remain even when repeating the analysis by sector (manufacturing, services, construction, other).

3. Variables and Statistical Model

We estimated a series of logistic statistical models of the probability that a firm defaults as a function of demographic and balance sheet variables. Given the limited number of years, we study occurrences of default by 2012, i.e. we consider the probability that a firm defaults at any point in time between 2009 and 2012. The dependent variable is equal to 1 if the firm switches to default status (DEFAULT), 0 otherwise.

The key variable under investigation is leverage, defined as the ratio of financial debt and the sum of financial debt plus equity (LEVERAGE). We include measures of liquidity and profitability as they are shown to affect default in the literature (e.g. Altman 1968; Carling et al. 2007). These variables are measured as of 2008 so they pre-date the shock that hit firms as a result of the recession: i) OPPROFIT/TA (Gross Operating Profit/Total Assets), LIQUIDITY (Current Assets/Current Liabilities), BANKDEBT (Bank Debt/Financial Debt). This list is parsimonious because it is the result of a selection among a larger set of indicators.

We preferred a measure of operating profits because it is not influenced by interest payments. Liquidity is included because firms with more cash and liquid assets are better equipped to repay their debts when they face an adverse profitability shock. Finally, bank debt is included because for a large number of firms financial debts include some loans from owners. There are tax incentives for the owners to lend to the limited liability company because the interests that the firm pays are tax deductible. We do not expect these loans to play a role in triggering default.

We also include log of total assets (LOGASSETS) and its square to control for size, a set of dummy variables for industries, 4 dummies for the region in which the firm has its headquarters (North-West, North East, Center, South), and a control for the age of the firm in 2008. The variable enters the regression either as a set of dummy variables for age groups (1-5, 6-15, 16-25, >25 years) or as the log of years since the firm was first recorded in the Firm Register.

We computed a measure of the average yearly change in sales before the crisis (SALESDROP 2006-08) to account for the fact that firms might have entered the recession already in bad shape. The variable proxies for differences in how their performance was evolving before the macroeconomic shock.

Finally, our measure of the firm specific shock during the recession period is the change in sales between 2009 and 2012. We computed the average of annual changes over the years for which the information is available (SALESDROP 2009-12). To facilitate the interpretation of coefficients we use the transformation (-1)*(change in sales) in the regressions. The effect on the default probability should therefore be positive.

Some studies found that macroeconomic conditions improve significantly the predictive power of statistical default models (e.g. Carling et al., 2007) but they cannot be included in cross-section models. Including the change in sales in our regression is an indirect way to incorporate the macroeconomic shock. The intuition is that the main channel through which the recession affected firms was a drop in demand, both domestic and foreign, and that firms were affected differently depending on the composition of their clients, an unobserved factor. We preferred the change in sales to the change in profits because sales are less influenced by financing conditions of firms and the levels of interest rates charged by banks.

Data on the change in sales during the crisis are available only for a smaller sample of firms, about 105,000. Descriptive statistics for this sample are reported in Table 4. The mean growth rate of sales was 7 in 2006-08 per cent and -5 per cent during 2009-12. The average leverage is 60 per cent; 83 per cent of financial debt is bank debt.

We compared means for the larger dataset (Full sample) and the estimation sample to assess possible differences due to selection (Table a5). The geographic and industry distribution is similar but the firms in the estimation sample are larger, have a lower leverage (60 versus 65 per cent) and are more profitable. Nevertheless, they are not stronger along all dimensions since they are less liquid and have a higher share of bank debt. Overall, the firms in the subsample have a lower default frequency, 6.1 per cent versus 10.6 per cent in the larger dataset, suggesting that most of the selection depends on missing balance sheet data due to insolvency. Some robustness tests will be discussed in Section 5 below.

4. Results

Table 5 reports the results of the first set of regressions. We show marginal effects computed as averages of predicted marginal effects from the model. We study the contribution of each financial variable by estimating separate regressions with the set of demographic controls (size, region, age and industry dummies) and one balance sheet variable at a time. In the last specification of the table we include them all.

The results show that leverage has a positive, monotonically increasing effect on the probability of default (column B) as expected; the coefficient of the dummy of the top quartile of lev-

erage (greater than 84.3 per cent) indicates that the estimated default probability is about 10 percentage points higher than the one of firms in the bottom quartile (less than 38.8 per cent), the excluded category.

The coefficient of pre-crisis sales drop is statistically significant and has the expected positive sign, but the economic effect is not very large. Firms in the bottom quartile of sales (yearly sales drop greater than 4 per cent) have a 3.5 percent higher probability of default with respect to those in the top quartile (yearly sales growth above 14 per cent). The effect is not monotonic.

The other financial covariates are statistically significant at the standard levels and have the expected signs. The probability of default declines as operating profitability and liquidity go up. It is higher when firms have a substantial share of bank debt, as expected, but there is not much difference in the coefficients as the share of bank debt increases above the median (in the tables we collapsed the 3rd and 4th quartiles for the sake of brevity). We also find that firm age is significant and has a negative coefficient indicating that younger firms tend to be riskier, consistent with the evidence in the literature.

So far we related the probability of default to variables that were pre-determined with respect to the shock that hit the firms during the recession. Although firm size, industry and region account for some of the heterogeneity in the impact that the recessions had on firms, the yearly change in sales 2009-2012 should improve the fit of the model because it is a firm-specific shock. The implicit assumption is that the change in sales was not the result of an anticipated increase in the probability of default by clients.

Not surprisingly, the estimated coefficient of the full model specification (column G) shows that the drop in sales during the recession is much more relevant in terms of both explanatory power and economic significance than the change of sales in the three years before the recession. The Pseudo R square almost doubles when we include this variable.

The improvement in the explanatory power of the model due to the addition of SALES-DROP 2009-12 is shown also by the changes in the following accuracy indicators, reported in the last rows of the table: the share of *correctly predicted* (the share of firms that are classified correctly, defaulted or not defaulted[1]); the *sensitivity rate* (the share of defaulting firms that are correctly classified); the *false positive rate* (the share of ND firms that erroneously predicted as D by the model). In particular, the percent of correctly predicted cases jumps from 69 per to 80

[1] The sensitivity rate, the false positive rate and the share of correctly predicted depend on the value of the threshold that is used to get the predicted values. We opted for a conservative choice of the threshold, approximated by the sample frequency of positives (see Hoetker, 2004). The use of alternative thresholds does not change the ranking of the models in terms of accuracy.

per cent;, the sensitivity increases from 72 to 76 per cent, and the false positive declines from 31 to 20.

Adding SALESDROP 2009-12 does not change the economic and statistical significance of leverage in explaining default. The difference in the default probability between firms in the top quartile of leverage and those in the bottom one is about 7 percentage points, almost the same as the one estimated without controlling for the contemporaneous change in sales. The two variables have independent effects on the probability of insolvency.

We then estimated the model using continuous variables rather than quartiles of leverage and sales (Table 6). All the results hold. The coefficient of leverage indicates that increasing leverage by 10 percentage points (around one third of the standard deviation) the probability of default increases by 0.7 percentage points, a sizable effect since the frequency of default in the sample is about 6 per cent. The coefficient of the drop in sales before the crisis is significant and positive but the economic effect is small: a 10 percentage point drop in sales before the crisis (the average change of sales in 2006-2008 is almost 7 per cent for our sample) raises only modestly the probability of default in subsequent years (0.1 percentage points). As in the previous model, adding the drop of sales during the crisis among the set of covariate improves the explanatory power of the model (column G, Table 6).

Interaction between sales drop and leverage

In this paragraph we explore the role of initial leverage in the transmission of the shock to sales adding interaction terms between SALESDROP 2009-12 and LEVERAGE. To facilitate the interpretation of coefficients we use a specification with dummy variables for each quartile of leverage and we estimated a linear probability model (LPM) instead of the logit model.

The results are reported in Table 7. The first column shows the linear model with the full set of controls without the interaction terms. The marginal effects are very similar to those obtained with the logit model, reported in the last column. In columns (B)-(E) the model is estimated on subsamples of firms in the quartiles of leverage. In column (F) we interact leverage quartiles and the drop in sales during the crisis. The coefficients of all the interaction terms are statistically significant and monotonically increasing. An additional drop by 10 percentage points in yearly sales 2009-12 increases the probability of default by about 6 percentage points for the firms whose leverage falls in the top quartile; the same shock to sales, on the other hand, yields an estimated increase in the default probability by less than 2 percentage points for the firms whose leverage falls in the bottom quartile.

5. Robustness

Even if we control for pre-crisis sales growth and the ratio of operating profits over total assets in 2008, we conducted further tests to ensure that we are not overstating the effect of leverage due to insufficient controls for firm performance before the crisis. High leverage could be the result of debt accumulation due to deteriorating performance before the first recession. To rule out this hypothesis we analyzed the characteristics of firms in the leverage quartiles before 2008.

Table 8 shows the 2005-07 change in operating profits, sales and leverage by leverage quartile. The mean growth rate of operating profits is very similar across the four groups but firms that ended with higher leverage in 2008 experienced faster sales growth before the crisis, which suggests that they were expanding rather than underperforming. The increase in leverage also reflects structural differences since firms in the bottom quartile (low leverage) experienced the lowest growth of debt, while those in the top quartile were characterized by the highest growth. Since the aggregate statistics could be reflecting the behavior of specific industries, we ran a simple regression of the change in leverage between 2005 and 2007 on firm size, age, industry and the pre-crisis sales growth and find that the change in sales does not predict the increase in leverage (estimates not reported).

Other robustness checks were based on changing the sample to limit the selection of firms due to the lack of data on sales between 2003 and 2007. Removing SALESDROP 2006-08 and other financial and economic covariates increases the sample size to around 150,000 firms. The results on our main identification variables – leverage and drop in sales during 2009-12 – reported in Table 9 (columns (A)-(C)), are unchanged. In a further robustness check we calculated the change in sales over the period 2005-07 instead of 2006-08. The estimates (Table 9, columns (D)-(F)) show that there are no substantial changes in the coefficients of interest. In an additional robustness test we estimated our model on the level of leverage in 2007 rather than that of 2008; the estimates (not reported) confirm our findings.

Finally, we estimated the LPM model employing a wider definition of nonperforming that includes not only default but also situations in which the firm has past-due, restructured or substandard loans. Indeed, given the truncation of the data in 2012, we could be underestimating defaults because almost 17,000 firms exhibit repayment difficulties by 2012 but are not recorded as defaulted yet. The estimates, reported in Table 10, confirm our previous findings both in terms of significance and magnitude of the coefficients.

6. Conclusions

Using a statistical model we estimated the effect of leverage on the probability that a firm defaults on its bank loans in a very large sample of Italian firms, mostly privately held. Our results show that the variable that better explains firm default during a period of economic contraction is the drop in sales. Controlling for the drop in sales, initial leverage has a substantial influence on the probability of default. The effect of leverage is twofold. It raises the default probability for any given drop in sales, but it also increases the sensitivity of the default probability to the shock to sales. Our findings support the conjecture that the degree of indebtedness of firms plays a role in financial stability because it amplifies the adverse impact of a real shock on firm solvency and, through this channel, on banks' health. We cannot provide evidence on the mechanism through which leverage and deteriorating performance interact with each other because this would require a structural model of firm insolvency, which is outside of the scope of this paper.

References

Altman E.I., 1968. Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. The Journal of Finance, 23: pp. 589-609.

Altman E.I., Marco G., and Varetto F., 1994. Corporate distress diagnosis: comparisons using linear discriminant analysis and neural networks (the Italian experience). Journal of Banking and Finance, 18: pp. 505-552.

Bank of Italy, 2014. Annual Report on 2013, available on www.bancaditalia.it.

Bonfim, D., 2009. Credit risk drivers: Evaluating the contribution of firm level information and of macroeconomic dynamics, Journal of Banking and Finance 33: pp.281-299.

Carling, K., Jacobson T., Lindé J., and K. Roszbach, 2007. Corporate credit risk modeling and the macroeconomy, Journal of Banking and Finance 31: pp.845-868.

Hoetker, G., 2004. Confounded Coefficients: Extending Recent Advances in the Accurate Comparison of Logit and Probit Coefficients Across Groups. University of Illinois at Urbana Champaign Working Paper, October 22, 2004.

Jacobson, T., Kindell R., Lindé, J., and K. Roszbach, 2009. Firm Default and aggregate fluctuations, mimeo Sveriges Riksbank.

Löffler, G. and Maurer, A., 2011. Incorporating the dynamics of leverage into default prediction, Journal of Banking and Finance 35: pp. 3351-3361.

Molina, C.A, 2005. Are Firms Underleveraged? An Examination of the Effect of Leverage on Default Probabilities, The Journal of Finance 60 (3), pp. 1427-1459.

Shumway, T., 2001. Forecasting bankruptcy more accurately: A simple hazard model, Journal of Business 74: 101-124.

Tables

Table 1

Sample description: Firms defaulting between 2009 and 2012, by year and industry

Data are from Cerved Group and Central Credit Register. Limited Liability companies and corporations that report information on financial debt. The data reported are weighted averages for the firms that have data in each year. (1) Firms that default in the period 2009-12 based on the records in the Credit Register (a client is defaulted if net bad loans are greater than 10 per cent of total outstanding loans provided by all banks and reporting financial companies). – (2) Firms that are never recorded as defaulted in the period 2009-12 by the Credit Register and have balance sheet information in the given year; firms can have past-due, restructured or substandard loans –. (3) Firms that are always performing in years 2009-12 and have balance sheet information in the given year. (4) Total includes also agriculture, extraction and energy.

	2009	2010	2011	2012
		Total (4)		
Number of newly defaulted firms in the year (a) (1)	5,730	7,005	6,910	7,987
Number of firms not defaulted (b) (2)	196,395	186,281	174,763	154,415
Of which: Performing firms (3)	162,158	159,935	155,793	143,841
Default rate (b)/(a+b)	2.8	3.6	3.8	4.9
		Manufacturing		
Number of newly defaulted firms in the year (a) (1)	1,949	2,141	1,813	2,123
Number of firms not defaulted (b) (2)	57,414	55,007	52,260	47,819
Of which: Performing firms (3)	48,490	48,177	47,282	45,010
Default rate (b)/(a+b)	3.3	3.7	3.4	4.3
		Services		
Number of newly defaulted firms in the year (a) (1)	2,533	3,210	3,238	3,687
Number of firms not defaulted (b) (2)	97,297	92,500	86,888	76,552
Of which: Performing firms (3)	81,577	80,496	78,349	71,796
Default rate (b)/(a+b)	2.5	3.4	3.6	4.6
		Construction		
Number of newly defaulted firms in the year (a) (1)	1,145	1,499	1,700	2,016
Number of firms not defaulted (b) (2)	35,069	32,402	29,540	24,576
Of which: Performing firms (3)	26,535	25,764	24,767	22,006
Default rate (b)/(a+b)	3.2	4.4	5.4	7.6

Table 2

Frequency of default by year, leverage and change in sales

Data are from Cerved Group and Central Credit Register. Limited Liability companies and corporations that report information on financial debt and are reported in the Credit register with outstanding loans, used or unused. Values are percentages. (1) Financial debt/(financial debt+equity), 2007 or 2008. – (2) Mean of the most recent two yearly changes in sales available in the period 2009-2012.

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Variables	2009	2010	2011	2012	Mean
		By 2008 leverage (1)			
Firms with leverage in quartile 1 (≤46.7%)	0.7	1.2	1.3	2.1	1.3
Firms with leverage in quartile 2 (>46.7% and ≤73.8%)	1.2	2.1	2.5	3.5	2.3
Firms with leverage in quartile 3 (>73.8% and ≤89.7%)	2.1	3.5	4.1	5.7	3.8
Firms with leverage in quartile 4 (> 89.7%)	3.1	4.8	5.5	7.6	5.3
		By change in sales 2009-2012 (2)			
Sales change quartile 1 (yearly mean≤ -13.9%)	4.6	7.0	8.5	11.7	8.0
Sales change quartile 2,3,4 (yearly mean> -13.9%)	0.8	1.6	1.8	2.7	1.7
		By leverage and change in sales			
Sales change quartile 1 (yearly mean≤ -13.9%)					
leverage in quartile 1 (≤46.7%)	2.1	3.3	4.0	6.0	3.8
leverage in quartile 2 (>46.7% and ≤73.8%)	3.1	5.6	7.1	10.1	6.5
leverage in quartile 3 (>73.8% and ≤89.7%)	5.1	8.1	10.4	14.2	9.5
leverage in quartile 4 (>89.7%)	6.8	9.7	11.2	15.5	10.8
Sales change quartile 2,3,4 (media anno> -13.9%)					
leverage in quartile 1 (≤46.7%)	0.3	0.7	0.8	1.3	0.8
leverage in quartile 2 (>46.7% and ≤73.8%)	0.6	1.2	1.4	1.9	1.2
leverage in quartile 3 (>73.8% and ≤89.7%)	1.0	2.0	2.2	3.3	2.1
leverage in quartile 4 (>89.7%)	1.5	2.9	3.4	5.0	3.2

Table 3

Financial and economic conditions of firms by subsequent default status

Data are from Cerved Group and Central Credit Register. Limited Liability companies and corporations that report information on financial debt. The data reported are weighted averages for the firms that have data in each year. (1) Firms that default in the period 2009-12 based on the records in the Credit Register (a client is defaulted if net bad loans are greater than 10 per cent of total outstanding loans provided by all banks and reporting financial companies). – (2) Firms that are never recorded as defaulted in the period 2009-12 by the Credit Register; firms can have past-due, restructured or substandard loans – (3) EBIT/total assets. – (4) Net income/equity. – (5) Financial debts/(financial debt + equity). – (6) Current assets/current liabilities. – (7) (Current assets – unsold stock)/current liabilities. – (8) (Trade credit + inventories - trade debt)/sales. Assets are in thousand euros. Other variables are in percentage points.

Variables	2003	2004	2005	2006	2007	2008	2003	2004	2005	2006	2007	2008
	Firms defaulted 2009-2012 (1)						Performing (2) or Nonperforming Firms excluding defaults					
Change of sales	3.8	9.2	7.1	9.7	7.5	-3.7	4.4	9.2	8.0	11.2	7.0	3.8
Unsold Stock/Assets	23.4	23.6	23.6	23.8	24.3	22.9	12.2	12.3	12.5	13.0	13.5	13.6
Gross Operating Margin/Value Added	28.7	28.1	27.0	25.6	24.5	1.9	39.2	40.4	39.7	41.1	41.5	38.7
Gross Operating Margin/Assets	5.7	5.3	4.8	4.1	3.8	0.2	7.3	7.6	7.2	7.5	7.6	6.7
ROA (3)	3.4	3.2	3.0	2.6	2.2	-2.3	4.6	4.8	5.0	5.6	5.7	4.8
ROE (4)	-1.6	-0.6	-0.9	-3.0	-8.4	-66.6	3.8	7.8	6.2	7.2	7.9	4.8
Interest/EBIT	43.8	44.4	53.4	60.2	75.4	1.457	22.8	19.4	20.7	23.1	24.5	31,0
Leverage (5)	72.2	72.7	72.9	74.2	76.6	80.3	52.3	53.3	53.1	53.9	55.9	54,6
Financial Debt/Sales	37.5	38.4	40.7	43.1	46.7	52.7	38.4	38.0	37.9	37.2	39.4	41,0
Medium-LT Financial Debt/Financial Debt	31.8	33.8	35.1	35.8	35.1	33.9	40.5	46.2	47.2	46.7	46.0	47,1
Bank Debt/Financial Debt	83.3	84.1	84.4	85.1	86.0	85.8	53.4	51.9	54.2	55.7	56.5	59,0
Liquidity	104.7	105.4	105.9	106.8	105.3	95.9	110.2	113.3	112.7	110.5	110.2	110,1
Immediate Liquidity (7)	69.6	69.6	69.8	70.4	68.8	62.3	84.6	86.7	85.6	83.1	82.1	80,9
Payment flow index (8)	20.8	21.2	22.7	24.2	26.5	26.5	12.5	12.6	14.3	14.9	15.8	17,1
Share of firms net interest payments/Gross Op. Margin> 50%	34.6	35.1	36.3	39.4	47.0	60.3	22.4	22.1	22.8	23.4	26.8	33,6
Share of firms net interest payments/ Gross Op. Margin> 100%	20.8	20.5	21.1	22.9	27.6	42.2	15.1	14.9	15.4	15.2	16.4	21,1
Share of firms net income>0	68.1	70.2	70.5	68.4	65.0	49.2	71.3	73.3	73.8	73.4	73.8	67,7
Assets (average)	4197	4205	4351	4556	4886	4948	9425	9369	9491	9615	9927	9843
Assets (median)	1263	1242	1291	1334	1439	1460	1205	1203	1237	1284	1337	1387
Number of firms	12855	15059	17051	19642	22860	23031	121878	135547	151281	166450	176040	195834

Table 4

Descriptive Statistics – Estimation Sample

Variable	Definition	MEAN	STD.DEV	P25	P50	P75
DEFAULT	Equal to 1 if the firm enters default status between 2009 and 2012, as defined in the Credit Register and Data Appendix.	0.06	0.23	0.00	0.00	0.00
SALESDROP 2006-08	(-1)*Growth rate of sales in 2006-08, yearly mean over available data.	-0.07	0.23	-0.14	-0.04	0.04
SALESDROP 2009-12	(-1)*Growth rate of sales in 2009-12, yearly mean over available data.	0.05	0.17	-0.03	0.03	0.11
LEVERAGE	Financial debt divided by the sum of financial debt and equity. Percentage points, 2008.	60.53	31.00	38.79	65.19	84.26
OPPROF/TA	Gross operating profit divided by total assets, 2008.Percentage points.	8.57	10.63	3.72	7.77	13.03
BANKDEBT	Bank debt divided by financial debt, 2008. Percentage points.	83.22	27.43	76.91	99.46	100.00
LIQUIDITY	Current assets divided by current liabilities, 2008. Percentage points.	136.63	102.83	94.55	114.73	148.58
TOTAL ASSETS	Log of total assets in 2008.	7.77	1.45	6.73	7.61	8.67
AGE	Log of number of years since incorporation.	2.67	0.73	2.08	2.77	3.22
N. of observations	104,809					

Table 5

Logit model of the probability of default 2009-2012 – Variables in quartiles

Variable	(A)	(B)	(C)	(D)	(E)	(F)	(G)
LOGASSETS	0.068***	0.059***	0.049***	0.061***	0.062***	0.051***	0.043***
	(0.004)	(0.0049)	(0.004)	(0.005)	(0.004)	(0.004)	(0.004)
LOGASSETS_SQ	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***	-0.002***
	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0002)
NORTHEAST	-0.004**	-0.005***	-0.006***	-0.005***	-0.005***	-0.007***	-0.006***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
CENTRE	0.006***	0.006***	0.005**	0.007***	0.006***	0.004**	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
SOUTH	0.011***	0.020***	0.008***	0.014***	0.011***	0.0172***	0.009***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
AGE (6-15)	-0.029***	-0.013***	-0.026***	-0.026***	-0.020***	-0.014***	-0.014***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
AGE (16-25)	-0.050***	-0.024***	-0.047***	-0.047***	-0.037***	-0.026***	-0.027***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
AGE (>25)	-0.055***	-0.021***	-0.052***	-0.050***	-0.038***	-0.026***	-0.026***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
INDUSTRY FE	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
SALESDROP.Q2	-0.013***					-0.011***	-0.003*
2006-08	(0.002)					(0.002)	(0.002)
SALESDROP.Q3	-0.001					-0.001	0.004*
2006-08	(0.002)					(0.00194)	(0.002)
SALESDROP.Q4	0.036***					0.024***	0.016***
2006-08	(0.002)					(0.002)	(0.002)
LEVERAGE.Q2		0.020***				0.018***	0.018***
2008		(0.001)				(0.001)	(0.002)
LEVERAGE.Q3		0.054***				0.047***	0.044***
2008		(0.002)				(0.002)	(0.002)
LEVERAGE.Q4		0.103***				0.080***	0.067***
2008		(0.002)				(0.002)	(0.002)
OPPROFIT/TA.Q2			-0.030***			-0.022***	-0.012***
2008			(0.002)			(0.002)	(0.002)
OPPROFIT/TA.Q3			-0.049***			-0.037***	-0.022***
2008			(0.002)			(0.002)	(0.002)
OPPROFIT/TA.Q4			-0.073***			-0.052***	-0.037***
2008			(0.002)			(0.002)	(0.002)
BANKDEBT. Q2				0.034***		0.027***	0.024***
2008				(0.002)		(0.002)	(0.002)
BANKDEBT.Q3 & Q4				0.016***		0.025***	0.023***
2008				(0.002)		(0.002)	(0.002)
LIQUIDITY.Q2					-0.024***	-0.018***	-0.015***
2008					(0.003)	(0.002)	(0.002)
LIQUIDITY.Q3					-0.049***	-0.027***	-0.023***
2008					(0.002)	(0.002)	(0.002)
LIQUIDITY.Q4					-0.068***	-0.041***	-0.039***
2008					(0.002)	(0.002)	(0.002)
SALESDROP.Q2							-0.007***
2009-12							(0.001)
SALESDROP.Q3							0.006***
2009-12							(0.001)
SALESDROP.Q4							0.127***
2009-12							(0.002)
Observations	104809	104809	104809	104809	104809	104809	104809
Pseudo R-squared	0.043	0.088	0.059	0.037	0.057	0.13	0.248
% corr. predicted	64.65	65.20	62.65	62.97	63.78	68.90	79.84
Sensitivity	59.25	71.14	66.28	60.15	63.88	72.19	76.32
False + rate	35.02	35.16	37.57	36.85	36.23	31.30	19.94

The table reports marginal effects computed as averages of the predicted marginal effects for the sample. Standard errors in brackets below coefficients. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 6

Logit model of the probability of default 2009-2012 – Continuous Variables

Variable	(A)	(B)	(C)	(D)	(E)	(F)	(G)
LOGASSETS	0.066***	0.071***	0.062***	0.060***	0.063***	0.065***	0.046***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
LOGASSETS_SQ	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***
	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)
NORTHEAST	-0.005***	-0.005***	-0.005***	-0.005***	-0.005***	-0.007***	-0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
CENTRE	0.006***	0.006***	0.005**	0.007***	0.006***	0.005***	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
SOUTH	0.012***	0.019***	0.008***	0.014***	0.010***	0.018***	0.008***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LOGAGE	-0.024***	-0.012***	-0.022***	-0.023***	-0.019***	-0.015***	-0.012***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
INDUSTRY FE	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*	*YES*
SALESDROP 2006-08	0.032***					0.017***	0.013***
	(0.004)					(0.003)	(0.003)
LEVERAGE 2008		0.001***				0.001***	0.001***
		(2.85e-05)				(3.02e-05)	(2.52e-05)
OPPROFIT/TA 2008			-0.003***			-0.002***	-0.001***
			(6.38e-05)			(7.65e-05)	(6.69e-05)
BANKDEBT 2008				0.001***		0.001***	0.0005***
				(3.08e-05)		(3.39e-05)	(3.18e-05)
LIQUIDITY 2008					-0.0004***	-0.0002***	-0.0002***
					(2.42e-05)	(1.81e-05)	(1.50e-05)
SALESDROP 2009-12							0.235***
							(0.00351)
Observations	104809	104809	104809	104809	104809	104809	104809
Pseudo R-squared	0.033	0.092	0.067	0.037	0.051	0.123	0.266
% corr. predicted	62.42	65.88	65.56	61.86	61.69	68.18	81.14
Sensitivity	59.12	71.07	64.01	60.77	65.90	72.82	76.17
False + rate	37.38	34.44	34.34	38.08	38.56	32.11	18.55

The table reports marginal effects computed as averages of the predicted marginal effects for the sample. Standard errors in brackets below coefficients. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1

Estimation with interactions between Leverage and Sales Drop - Linear Probability Model

Variable		*SAMPLE SPLITS BY LEVERAGE*					*LOGIT*
		QLEV=1	QLEV=2	QLEV=3	QLEV=4		
	(A)	(B)	(C)	(D)	(E)	(F)	*(G)*
LOGASSETS	0.035***	-0.0001	0.0185***	0.0455***	0.0358***	0.0340***	*0.0352****
	(0.003)	(0.0034)	(0.005)	(0.0065)	(0.0107)	(0.0028)	*(0.0038)*
LOGASSETS_SQ	-0.002***	-1.71e-05	-0.0008***	-0.0019***	-0.0008	-0.0015***	*-0.0016****
	(0.0002)	(0.0002)	(0.0003)	(0.0004)	(0.0007)	(0.0002)	*(0.0002)*
NORTHEAST	-0.004***	-0.0008	-0.0024	-0.0057	-0.0106**	-0.0045***	*-0.005****
	(0.002)	(0.0015)	(0.003)	(0.0035)	(0.004)	(0.0016)	*(0.0016)*
CENTRE	0.002	0.0036*	0.0040	0.0066	-0.006	0.0018	*0.0003*
	(0.002)	(0.002)	(0.003)	(0.004)	(0.0049)	(0.0019)	*(0.0018)*
SOUTH	0.008***	0.008***	0.0241***	0.0175***	-0.0109*	0.0090***	*0.008****
	(0.002)	(0.003)	(0.004)	(0.005)	(0.006)	(0.002)	*(0.0021)*
AGE (6-15)	-0.020***	-0.015***	-0.0165***	-0.0319***	-0.0176***	-0.019***	*-0.0135****
	(0.003)	(0.004)	(0.005)	(0.005)	(0.005)	(0.0026)	*(0.0025)*
AGE (16-25)	-0.035***	-0.027***	-0.0255***	-0.0484***	-0.0387***	-0.0340***	*-0.0237****
	(0.003)	(0.005)	(0.005)	(0.0057)	(0.0058)	(0.0028)	*(0.0026)*
AGE (>25)	-0.037***	-0.028***	-0.0257***	-0.0465***	-0.033***	-0.0351***	*-0.0219****
	(0.003)	(0.005)	(0.0048)	(0.0061)	(0.0067)	(0.0029)	*(0.0027)*
INDUSTRY FE	YES	YES	YES	YES	YES	YES	*YES*
LEVERAGE.Q2 2008	0.011***					0.0050***	*0.0178****
	(0.001)					(0.001)	*(0.0016)*
LEVERAGE.Q3 2008	0.038***					0.025***	*0.0429****
	(0.002)					(0.0016)	*(0.0018)*
LEVERAGE.Q4 2008	0.064***					0.043***	*0.0595****
	(0.002)					(0.002)	*(0.002)*
SALESDROP 2006-08	0.023***	0.0142***	0.0133**	0.0177**	0.0362***	0.0219***	*0.014****
	(0.004)	(0.0052)	(0.0066)	(0.0081)	(0.0075)	(0.004)	*(0.0029)*
SALESDROP 2009-12	0.441***	0.1740***	0.3440***	0.4930***	0.574***	0.171***	*0.238****
	(0.007)	(0.0130)	(0.0151)	(0.0150)	(0.0133)	(0.013)	*(0.0035)*
*SALESDROP*LEV.Q2 2009-12*						0.174***	
						(0.0196)	
*SALESDROP*LEV.Q3 2009-12*						0.324***	
						(0.0195)	
*SALESDROP*LEV.Q4 2009-12*						0.414***	
						(0.018)	
OPPROFIT/TA.Q2 2008	-0.019***	-0.016***	-0.022***	-0.017***	-0.019***	-0.018***	*-0.008****
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.002)	*(0.0018)*
OPPROFIT/TA.Q3 2008	-0.031***	-0.022***	-0.033***	-0.029***	-0.038***	-0.031***	*-0.019****
	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.002)	*(0.0019)*
OPPROFIT/TA.Q4 2008	-0.037***	-0.024***	-0.036***	-0.043***	-0.056***	-0.037***	*-0.034****
	(0.002)	(0.002)	(0.003)	(0.005)	(0.005)	(0.002)	*(0.002)*
BANKDEBT.Q2 2008	0.026***	0.008***	0.013***	0.029***	0.043***	0.025***	*0.023****
	(0.002)	(0.003)	(0.003)	(0.004)	(0.005)	(0.002)	*(0.0017)*
BANKDEBT.Q3 & Q4 2008	0.022***	0.003*	0.015***	0.025***	0.0396***	0.0216***	*0.0214****
	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.002)	*(0.0015)*
LIQUIDITY.Q2 2008	-0.016***	-0.014***	-0.012***	-0.011***	-0.028***	-0.016***	*-0.0109****
	(0.002)	(0.004)	(0.004)	(0.004)	(0.005)	(0.002)	*(0.0018)*
LIQUIDITY.Q3 2008	-0.026***	-0.021***	-0.023***	-0.019***	-0.035***	-0.026***	*-0.018****
	(0.002)	(0.003)	(0.004)	(0.004)	(0.005)	(0.002)	*(0.002)*
LIQUIDITY.Q4 2008	-0.034***	-0.026***	-0.024***	-0.027***	-0.0732***	-0.035***	*-0.034****
	(0.002)	(0.003)	(0.004)	(0.005)	(0.006)	(0.002)	*(0.002)*
Constant	-0.129***	0.064***	-0.0398*	-0.138***	-0.113***	-0.112***	
	(0.013)	(0.017)	(0.021)	(0.029)	(0.042)	(0.0130)	
Observations	104809	26204	26202	26201	26202	104809	*104809*
R-squared	0.146	0.063	0.101	0.130	0.181	0.158	*0.269*

Robust standard errors in brackets below coefficients. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 8

Robustness: Firms performance in the period 2005-07, by quartile of leverage in 2008

	SALES *growth rate 2005-07* (1)	OPPROF/TA *growth rate 2005-07* (2)	LEVERAGE *growth rate 2005-07* (3)
LEVERAGE.Q1 (2008)	0.11	0.13	0.03
Observations	*22811*	*20901*	*19913*
LEVERAGE.Q2 (2008)	0.12	0.13	0.09
Observations	*22638*	*20424*	*22036*
LEVERAGE.Q3 (2008)	0.14	0.12	0.06
Observations	*21986*	*19674*	*21648*
LEVERAGE.Q4 (2008)	0.17	0.13	0.06
Observations	*20741*	*17743*	*20489*

Note: (1) Growth rate of sales in 2005-07, yearly mean. – (2) Growth rate of gross operating profit divided by total assets in 2005-07, yearly mean. – (3) Growth rate of leverage (Financial debt divided by the sum of financial debt and equity) in 2005-07, yearly mean.

Table 9

Robustness: Large sample and lagged sales dynamics - Linear Probability Model

Variable	(A)	(B)	(C)	(D)	(E)	(F)
SALESDROP 2005-07				0.0079**	0.0077**	0.0080**
				(0.0038)	(0.0038)	(0.0038)
LEVERAGE.Q2		0.0356***	0.0297***		0.0347***	0.0251***
2008		(0.0012)	(0.0011)		(0.0014)	(0.0012)
LEVERAGE.Q3		0.0690***	0.0609***		0.0694***	0.0528***
2008		(0.0015)	(0.0014)		(0.0020)	(0.0018)
LEVERAGE.Q4		0.137***	0.101***		0.145***	0.0817***
2008		(0.0050)	(0.0048)		(0.0076)	(0.0078)
LEVERAGE	0.0010***			0.0010***		
2008	(2.05e-05)			(2.53e-05)		
SALESDROP	0.375***	0.373***	0.205***	0.456***	0.454***	0.218***
2009-12	(0.0056)	(0.0056)	(0.0092)	(0.0082)	(0.0082)	(0.0121)
*SALESDROP*LEV.Q2*			0.180***			0.253***
2009-12			(0.0135)			(0.0183)
*SALESDROP*LEV.Q3*			0.212***			0.351***
2009-12			(0.0131)			(0.0196)
*SALESDROP*LEV.Q4*			0.487***			0.628***
2009-12			(0.0252)			(0.0380)
LOGASSETS	0.0198***	0.0211***	0.0194***	0.0446***	0.0458***	0.0432***
	(0.0025)	(0.0025)	(0.0025)	(0.0030)	(0.0029)	(0.0029)
LOGASSETS_SQ	-0.0008***	-0.0008***	-0.0008***	-0.0020***	-0.00198***	-0.0019***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
NORTHEAST	-0.0020	-0.0019	-0.0021	-0.0006	-0.0005	-0.0010
	(0.0014)	(0.0014)	(0.0014)	(0.0017)	(0.0017)	(0.0016)
CENTRE	0.0039**	0.0041**	0.0041**	0.0056***	0.0058***	0.0058***
	(0.0017)	(0.0017)	(0.0017)	(0.0020)	(0.0020)	(0.0020)
SOUTH	0.0138***	0.0150***	0.0159***	0.0090***	0.0104***	0.0118***
	(0.0019)	(0.0019)	(0.0019)	(0.0024)	(0.0024)	(0.0024)
INDUSTRY FE	YES	YES	YES	YES	YES	YES
AGE (6-15)	-0.0200***	-0.0195***	-0.0191***	-0.0131***	-0.0124***	-0.0121***
	(0.0023)	(0.0023)	(0.0022)	(0.0033)	(0.0033)	(0.0033)
AGE (16-25)	-0.0337***	-0.0332***	-0.0322***	-0.0258***	-0.0251***	-0.0244***
	(0.0024)	(0.0024)	(0.0023)	(0.0034)	(0.0034)	(0.0034)
AGE (>25)	-0.0164***	-0.0165***	-0.0152***	-0.0279***	-0.0275***	-0.0258***
	(0.0023)	(0.0023)	(0.0023)	(0.0035)	(0.0035)	(0.0035)
CONSTANT	-0.104***	-0.0849***	-0.0719***	-0.230***	-0.209***	-0.187***
	(0.0113)	(0.0113)	(0.0112)	(0.0138)	(0.0137)	(0.0135)
Observations	151369	151369	151369	91663	91663	91663
R-squared	0.111	0.112	0.120	0.141	0.142	0.157

Robust standard errors in brackets below coefficients. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 10

Robustness: Default and other nonperforming loans - Linear Probability Model

Variable	(1)	*SAMPLE SPLITS BY LEVERAGE*				(6)
		QLEV=1	QLEV=2	QLEV=3	QLEV=4	
		(2)	(3)	(4)	(5)	
LOGASSETS	0.0607***	-0.0025	0.0204***	0.0312***	0.0272*	0.0335***
	(0.0040)	(0.0050)	(0.0065)	(0.0090)	(0.0140)	(0.0038)
LOGASSETS_SQ	-0.0025***	0.0003	-0.0005	-0.0005	0.0005	-0.0010***
	(0.0002)	(0.0003)	(0.0004)	(0.0005)	(0.0009)	(0.0002)
NORTHEAST	-0.0022	0.0003	-0.0077**	-0.0048	0.0001	-0.0027
	(0.0021)	(0.0020)	(0.0032)	(0.0042)	(0.0050)	(0.0019)
CENTRE	0.0204***	0.0120***	0.0089**	0.0203***	0.0125**	0.0134***
	(0.0025)	(0.0030)	(0.0040)	(0.0050)	(0.0058)	(0.0023)
SOUTH	0.0422***	0.0317***	0.0445***	0.0425***	0.0234***	0.0349***
	(0.0030)	(0.0039)	(0.0050)	(0.0059)	(0.0072)	(0.0028)
AGE (6-15)	-0.0324***	-0.0138***	-0.0243***	-0.0361***	-0.0210***	-0.0227***
	(0.0034)	(0.0053)	(0.0058)	(0.0062)	(0.0059)	(0.0031)
AGE (16-25)	-0.0606***	-0.0313***	-0.0409***	-0.0538***	-0.0446***	-0.0422***
	(0.0035)	(0.0053)	(0.0061)	(0.0066)	(0.0069)	(0.0033)
AGE (>25)	-0.0729***	-0.0347***	-0.0447***	-0.0558***	-0.0539***	-0.0488***
	(0.0037)	(0.0054)	(0.0063)	(0.0071)	(0.0077)	(0.0034)
INDUSTRY FE	YES	YES	YES	YES	YES	YES
LEVERAGE.Q2 2008						0.0123***
						(0.0017)
LEVERAGE.Q3 2008						0.0419***
						(0.0021)
LEVERAGE.Q4 2008						0.0718***
						(0.0026)
SALESDROP 2006-08	0.0574***	0.0284***	0.0332***	0.0290***	0.0605***	0.0396***
	(0.0048)	(0.0071)	(0.0087)	(0.0097)	(0.0091)	(0.0046)
SALESDROP 2009-12		0.285***	0.515***	0.676***	0.714***	0.280***
		(0.0151)	(0.0165)	(0.0160)	(0.0137)	(0.0149)
*SALESDROP*LEV.Q2 2009-12*						0.233***
						(0.0221)
*SALESDROP*LEV.Q3 2009-12*						0.398***
						(0.0216)
*SALESDROP*LEV.Q4 2009-12*						0.449***
						(0.0200)
OPPROFIT/TA.Q2 2008		-0.0331***	-0.0329***	-0.0341***	-0.0281***	-0.0310***
		(0.0039)	(0.0049)	(0.0058)	(0.0059)	(0.0027)
OPPROFIT/TA.Q3 2008		-0.0437***	-0.0527***	-0.0531***	-0.0478***	-0.0496***
		(0.0034)	(0.0046)	(0.0056)	(0.0058)	(0.0025)
OPPROFIT/TA.Q4 2008		-0.0449***	-0.0619***	-0.0735***	-0.0750***	-0.0612***
		(0.0033)	(0.0044)	(0.0055)	(0.0061)	(0.0024)
BANKDEBT.Q2 2008		0.0164***	0.0247***	0.0478***	0.0549***	0.0378***
		(0.0040)	(0.0041)	(0.0049)	(0.0056)	(0.0024)
BANKDEBT.Q3 & Q4 2008		0.0035	0.0204***	0.0345***	0.0497***	0.0281***
		(0.0024)	(0.0034)	(0.0043)	(0.0052)	(0.0019)
LIQUIDITY.Q2 2008		-0.0257***	-0.0286***	-0.0171***	-0.0328***	-0.0241***
		(0.0054)	(0.0050)	(0.0049)	(0.0051)	(0.0026)
LIQUIDITY.Q3 2008		-0.0356***	-0.0404***	-0.0300***	-0.0265***	-0.0344***
		(0.0046)	(0.0045)	(0.0050)	(0.0063)	(0.0025)
LIQUIDITY.Q4 2008		-0.0412***	-0.0417***	-0.0363***	-0.0626***	-0.0426***
		(0.0043)	(0.0047)	(0.0062)	(0.0072)	(0.0026)
Constant	-0.201***	0.113***	-0.0109	-0.0725*	-0.0878	-0.106***
	(0.0178)	(0.0250)	(0.0294)	(0.0392)	(0.0551)	(0.0173)
Observations	104809	26410	26315	26219	25865	104809
R-squared	0.023	0.093	0.139	0.174	0.205	0.192

The dependent variable is equal to 1 if the firm falls into a broader definition of nonperforming loans, that includes not only default but also situations in which the firm has past-due, restructured or substandard loans. Robust standard errors in brackets below coefficients. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Data Appendix

Balance sheet data are from the data base collected by Cerved Group on all limited liability companies and corporations. Default data are from the Central Credit Register. The sample was constructed from the set of firms that appear in the Cerved Group data in one or more years between 2003-2012. We kept firms for which non simplified balance sheets were publicly available, or those that provide information on financial debt. Very small firms are not required to compile a full balance sheet so for most of them we do not have information on financing.

Firms with balance sheet data on 2007 or 2008 were matched with data contained in the Italian Credit Register (CR) data for 2008. We kept firms that had outstanding loans, used or committed. A loan is considered "bad" (*in sofferenza* in Italian) if the borrower is deemed irreversibly unable to repay. Other less serious nonperforming categories are substandard, restructured and past-due. The CR produces four synthetic indicators of the status of the borrower aggregating the information on individual relationships between the borrower and all reporting intermediaries. The status is a combination of the quality of loans under each credit relationship and a criterion of materiality of the exposure. Our default definition is based on the most severe case of CR "adjusted default" status: a borrower is considered defaulted if total outstanding net bad loans are more than 10 percent of total net exposure in terms of disbursed credit. The CR utilizes similar definitions to categorize borrowers into three more classes if they have substandard, restructured or past-due exposures.

We dropped firms that were already in default in 2008 based on this definition. The resulting sample contains approximately 200,000 firms. Their status was then checked on a quarterly basis until the end of 2012 to detect switches to default.

The estimation sample used in the regressions is a subset for which there are balance sheet data to construct the variables employed in the regressions. The panel is unbalanced because of some missing data, most often for defaulting firms. When a company defaults in year *t* balance sheet information is usually available until *t-1*. We winsorized observations with values above the 1st and 99th percentiles. The sample contains almost 105,000 firms. As shown in Table a1 almost two thirds of the observations refer to companies headquartered in the Northern regions. Almost 50 per cent of firms belong to Services (Table a2).

Table a1

Firms distribution by region – estimation sample
(units and percentage values)

	BY QUARTILE OF LEVERAGE (2008)				Total	*not defaulting*	*defaulting*	*default rate*
	LEV=Q1	LEV=Q2	LEV=Q3	LEV=Q4				
North West	9,764	9,120	9,133	9,188	37,205	*35,214*	*1,991*	*5.7*
North East	7,534	7,504	7,632	7,943	30,613	*29,054*	*1,559*	*5.4*
Center	4,864	4,940	5,301	5,639	20,744	*19,454*	*1,290*	*6.6*
South and Islands	4,042	4,638	4,135	3,432	16,247	*15,082*	*1,165*	*7.7*
Total	26,204	26,202	26,201	26,202	104,809	*98,804*	*6,005*	*6.1*

Table a2

Firms distribution by sector – estimation sample
(units and percentage values)

	BY QUARTILE OF LEVERAGE (2008)				Total	*not defaulting*	*defaulting*	*default rate*
	LEV=Q1	LEV=Q2	LEV=Q3	LEV=Q4				
Manufacturing	10,835	10,192	8,967	7,101	37,095	*34,776*	*2,319*	*6.7*
Construction	2,364	2,853	3,651	4,570	13,438	*12,315*	*1,123*	*9.1*
Service	11,952	12,212	12,856	13,778	50,798	*48,345*	*2,453*	*5.1*
Other activities	1,053	945	727	753	3,478	*3,368*	*110*	*3.3*
Total	26,204	26,202	26,201	26,202	104,809	*98,804*	*6,005*	*6.1*

Table a3

Firms distribution by region – full dataset and estimation sample
(units and percentage values)

	Full sample	%	estimation sample	%
North West	64,040	*31.8*	37,205	*35.5*
North East	53,109	*26.4*	30,613	*29.2*
Centre	43,432	*21.6*	20,744	*19.8*
South and Islands	40,786	*20.3*	16,247	*15.5*
Total	**201,367**	***100.0***	**104,809**	***100.0***

Table a4

Firms distribution by sector – Full sample and estimation sample
(units and percentage values)

	full sample	%	estimation sample	%
North West	6,577	*3.3*	3,478	*3.3*
North East	59,089	*29.3*	37,095	*35.4*
Centre	36,201	*18.0*	13,438	*12.8*
South and Islands	99,500	*49.4*	50,798	*48.5*
Total	**201,367**	***100.0***	**104,809**	***100.0***

Table a5

Descriptive statistics: full sample and estimation sample

	Obs	**Mean**	**Std. Err**	**Std. Dev**	**[95% Conf. Interval]**	
			Leverage			
Full sample	201356	65.4	1.0	439.7	63.4	67.3
Est. sample	104809	60.5	0.1	31.0	60.3	60.7
	Means diff = 4.8		t = 4.9			
			Operating profit/TA			
Full sample	201367	7.4	0.04	19.1	7.3	7.5
Est. sample	104809	8.6	0.03	10.6	8.5	8.6
	Means diff = -1.18		t =-21.8			
			Share of Bank Debt			
Full sample	195487	81.22	0.06	28.69	81.09	81.34
Est. sample	104809	83.22	0.08	27.43	83.05	83.38
	Means diff = -2.00		t =-18.73			
			Liquidity			
Full sample	201219	187.5	4.7	2124.4	178.2	196.8
Est. sample	104809	136.6	0.3	102.8	136.0	137.2
	Means diff = 50.8		t =10.7			
			Total assets			
Full sample	201367	9772.0	732.3	328591.0	8336.8	11207.2
Est. sample	104809	14545.7	1392.2	450705.9	11817.0	17274.3
	Means diff = -4773.7		t =-3.0			