Journal of Banking and Finance 166 (2024) 107219

Contents lists available at ScienceDirect

Journal of Banking and Finance

journal homepage: www.elsevier.com/locate/jbf

Corporate bankruptcy and banking deregulation: The effect of financial leverage ☆

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ARTICLE INFO

JEL classification:
G21
G32
G33

Keywords:
Banking deregulation
Banking competition
Bankruptcy risk
Debt maturity
Financial constraints
Financial leverage

ABSTRACT

We investigate the impact of deregulation-induced banking competition on corporate credit risk. Although banking competition does not, on average, affect corporate bankruptcy rates, we find that it causes corporate bankruptcies to increase significantly for high-leverage firms. We show that higher borrowing costs for high-leverage firms post-deregulation and the resulting credit rationing may be key factors behind our findings. The effect of deregulation lasts for up to seven years after the introduction of deregulation and originates mainly from firms that have high short-term debt and are financially constrained. Our results suggest that banking competition, which is expected to expand lending and reduce its cost, may, in fact, create more challenging credit conditions, particularly for firms that are more heavily dependent on external funding.

1. Introduction

What is the effect of banking competition on the bankruptcy risk of highly leveraged firms? On one hand, banking competition could lead to a decrease in lending rates, which would lower the default risk of marginal borrowers (Boyd and De Nicolo, 2005). On the other hand, banking competition may reduce banks' incentives to extend credit to marginal borrowers (Petersen and Rajan, 1995). This would cause such borrowers to face a higher default risk in competitive credit markets.

In this paper, we focus on this important question. We investigate empirically the impact of the introduction of the Riegle–Neal Interstate Banking and Branching Efficiency Act (IBBEA) in 1994 on corporate bankruptcy. We adopt a difference-in-differences approach and treat the staggered implementation of the IBBEA, which removed limitations on interstate bank branching as an exogenous shock to banking competition.[1]

We find that banking competition does not, on average, influence firm bankruptcy rates. However, averaging conceals wide heterogeneity. In particular, according to our difference-in-differences analysis, after banking deregulation and the concomitant increase in bank competition, high-leverage firms experience a substantial 1.6% rise in bankruptcy rates, relative to the pre-reform period. To the best of our knowledge, no other study has analysed the impact of banking deregulation on bankruptcies among high-leverage firms.

Our results are consistent with the borrowing cost mechanism of Petersen and Rajan (1995). Specifically, in highly competitive markets, borrowers' ability to easily switch between lenders acts as a deterrent for banks to offer better loan terms to assist struggling high-leverage firms. Contrary to the case of a monopolistic lender that can charge lower rates in the distress phase and higher rates when the borrower has recovered, thus compensating for the lower interest income

☆ We thank an anonymous Referee for their suggestions, Giovanni Calice, Hans Degryse (discussant), Luca Del Viva, Marco Giometti, Marc Goergen, Jens Hagendorff, Nagore Iriberri, Hans Koster, Dong Lou, Miriam Marra, David Martinez-Miera, Danny McGowan, Salvatore Nunnari, José-Luis Peydró, Stefano Sacchetto, Julien Sauvagnat, Michel Serafinelli, Ana Sina, participants at the Emerging Scholars in Banking and Finance Conference (virtual), the Royal Economic Society Conference (virtual), Paris School of Economics – Centre for Economic Policy Research Policy Forum (Paris), and seminar participants at the ICMA Centre – Henley Business School for the useful comments and suggestions. Ludovico Rossi acknowledges the financial support of the Foundation Ramón Areces from the 20th National Competition for Economic Research Grants (2021), the Spanish Ministry of Science and Innovation Grant PID2021-128994NA-I00 (2022), and the Spanish Ministry of Science and Innovation Grant TED2021-132896A-I00 (2022).

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[1] Following the implementation of the IBBEA, the number of out-of-state branches grew (Johnson and Rice, 2008), which resulted in higher competition in the lending market (Dick, 2006) and more credit being extended to small firms (Rice and Strahan, 2010).

https://doi.org/10.1016/j.jbankfin.2024.107219
Received 24 November 2022; Accepted 19 May 2024
Available online 25 May 2024

when the borrower is in distress, under intense competition this intertemporal revenue transfer would not be possible. This is because the borrower could easily switch to another lender when interest charges rise. Consequently, companies with high leverage or perceived riskiness face higher borrowing costs and/or additional loan covenants as competition in the banking sectors increases, which amplify their credit risk. In line with this theory, we find that, after deregulation, both the credit spreads and number of covenants increase for high-leverage firms in the syndicated loan market.

Next, we explore the role of rollover risk and financial constraints. We show that high-leverage firms that rely on short-term debt to a larger degree exhibit higher bankruptcy rates in a more competitive environment. We also find that the effect of banking competition on corporate default is more pronounced for high-leverage firms that are financially constrained. Our results align with Zarutskie (2006), who shows that with increased banking competition, young firms, which are perceived as riskier in the credit market, are less likely to receive bank financing. Consequently, they are more likely to downsize or fail. In contrast, we assess a firm's riskiness based on financial leverage rather than the firm's age.

Our study is related to the works of Kerr and Nanda (2009) and Cornaggia et al. (2021) who investigated the manner in which the earlier wave of US intrastate banking deregulation from the 1970s, 1980s and the early 1990s impacted corporate defaults and bankruptcies. Kerr and Nanda (2009) showed that firm entry and exit increase after banking deregulation. By contrast, Cornaggia et al. (2021) showed that banking deregulation leads to lower bankruptcy rates for private firms but does not affect the bankruptcy rates of public firms. The latter result is in line with our findings for the whole sample when we do not control for the level of a firm's leverage.

Nonetheless, it is important to emphasize that our work differs from that of Kerr and Nanda (2009) and Cornaggia et al. (2021) in three fundamental ways. Firstly, while they analyse firm closures at the aggregate level, we investigate bankruptcies at the firm level. This enables us to control for firm-specific factors that are critical for explaining bankruptcy rates. Secondly, we document the non-homogeneity of the effect of deregulation across firms and identify financial leverage as a key differentiating factor. Finally, we focus on the process of IBBEA interstate deregulation that began in 1994 rather than on the earlier banking deregulation laws of the 1970s.[2] Therefore, we can analyse responses to a homogeneous set of deregulatory provisions and the causal relationship between interstate banking competition and corporate credit risk.

Interestingly, Gormley et al. (2018) investigated how banking competition increased corporate bankruptcies in India, where state-owned banks historically held a monopolistic share of the market.[3] The authors found that banking deregulation led to an increase in bankruptcies among private firms. This finding can be attributed to the fact that in a competitive environment, creditors are more incentivized to pursue delinquent firms and expedite the resolution of bankruptcies. The contrasting results of Gormley et al. (2018) and Cornaggia et al. (2021) highlight the need for further empirical research. We address this gap by providing evidence of the heterogeneous effect of banking deregulation on corporate bankruptcies. We find no effect of banking competition on the probability of bankruptcy for the average firm, but only for high-leverage firms.

Our work is also related to that of Sapienza (2002) and Jiang et al. (2020). Sapienza (2002) studied the effects of Italian bank mergers on the cost of borrowing and credit availability, following the introduction of branching deregulation in Italy.[4] The study showed that merger activity can either decrease or increase the cost of borrowing, depending on the type of merger. Specifically, mergers where efficiency gains are weaker (or stronger) than the market power gains of the merged entity can result in higher (or lower) lending rates for the customers of the merged entity, compared to customers of other banks not subject to consolidation. Jiang et al. (2020) analysed how the IBBEA impacted indirect measures of corporate risk, such as the volatility of returns on assets and the idiosyncratic volatility of stock returns, with a particular focus on external finance dependency. They documented a decrease of ROA and stock return volatilities due to banking deregulation. Our results can help clarify the findings of Jiang et al. (2020). Indeed, firm risk may decrease because credit market competition leads to an increase in the failure rate of the riskiest, highly-leveraged firms. This leaves a lower average level of risk among the surviving firms.

Various strands of the literature investigate the real effects of banking competition and its impact on different aspects of corporate activity. The empirical evidence shows that the market power of banks affects access to credit and profitability (Delis et al., 2017), financial constraints (Carbo-Valverde et al., 2009; Chong et al., 2013), and Ryan et al. (2014), financial leverage and investments in research and development (Braggion and Ongena, 2017), and competition in non-financial industries (Cetorelli, 2004). In addition, banking competition impacts the allocation of credit between private and state-owned enterprises, and their cost of credit (Ornelas et al., 2022) and Gao et al. (2023).

The rest of the paper is organized as follows: In Section 2 we describe the data and the variables that are used in this study. In Section 3 we outline the empirical methodology and discuss our results. In Section 4 we present some robustness tests. Section 5 concludes.

2. Data and variables

We collect annual financial reports for firms headquartered in the US from Compustat. We also collect daily market data from the Center for Research in Security Prices (CRSP), focusing only on firms that are located in one of the 50 US states or the District of Columbia. We exclude firms that operate in the transportation, communication, electric, gas and sanitary services sectors (SIC codes: 4000–4999), in the finance, insurance and real estate industries (SIC codes: 6000–6799), in public administration (SIC codes: 9100–9729) and firms that are non-classifiable (SIC codes: 9900–9999). We consider the period between 1984 and 2007. We drop firms without a CIK code. Our main analysis is conducted on yearly observations for each firm, and our sample consists of 92,678 firm-year observations.

We investigate how deregulation impacts loan spreads and covenants for highly leveraged firms. To do so, we collect syndicated loan data from the Loan Pricing Corporation (LPC) Dealscan database and match it with Compustat and CRSP using the (Chava and Roberts, 2008) link table. Consistent with Berg et al. (2016) and Giometti (2022), we retain credit lines, term loans, bridge loans, and letters of credit. We drop facilities that do not report the all-in spread drawn, loan amount, or loan maturity. The analysis on loan spreads is performed on 28,630 observations at the lead arranger-facility level. Covenants are reported at the loan package level. Therefore, we collapse loan facilities at the package level, weighting each facility with their respective loan amounts. The analysis on loan covenants is performed on 17,658 observations at the lead arranger-package level.

[2] Kroszner and Strahan (1999) showed how private interest groups drove the implementation of deregulation. Other papers address the impact of deregulation on economic growth (Jayaratne and Strahan, 1996; Morgan et al., 2004; Huang, 2008), and Berger et al. (2021), on firm growth (Berger et al., 2020), on firm innovation (Amore et al., 2013) and Chava et al. (2013), on bank stability (Goetz, 2018), on bank opacity (Jiang et al., 2016), etc.

[3] India has a bankruptcy process that is costlier and creditor rights that are weaker than in the US (Gormley et al., 2018).

[4] The lack of a publicly available credit registry with loan level information in the US limits our ability to directly investigate the impact of bank mergers on lending rates and credit availability for high-leverage firms.

In the robustness test, we associate each borrower in the matched Dealscan-Compustat CRSP database with all active lenders in the syndicated loan market for that year. A lender is defined as "active" if it participates in at least one syndicated loan facility during the year. We retain borrowers and lenders active in the credit lines, term loans, bridge loans, and letters of credit markets. This results in 14,492,774 possible borrower–lender yearly connections in the period of analysis.

2.1. Interstate banking and branching efficiency act

Historically, the US banking sector was highly segmented. Banks faced restrictions that prevented them from expanding their activities within state borders (intrastate barriers) or to other states (interstate barriers). These restrictions mainly precluded banks from acquiring and establishing new branches and were enacted by both local and federal legislators. The barriers were progressively lifted during the 20th century. In the 1970s and 1980s, most intrastate barriers were dismantled, and banks were allowed to establish and acquire new branches within their states. However, interstate branching was still largely prohibited. This changed in 1994, when the IBBEA was passed. It allowed bank holding companies (BHCs) to establish branches in different states without having to seek permissions from local authorities.

Before the passage of the IBBEA in 1994, the volume of interstate branch banking was negligible, and a very limited number of BHCs had out-of-state branches. After the IBBEA was passed, the number of BHCs that were operating across states surged (Johnson and Rice, 2008). This process substantially increased the level of competition in the credit supply market (Rice and Strahan, 2010). It also allowed banks to diversify their activities further (Goetz et al., 2016), leading to higher stability (Goetz, 2018).

The IBBEA removed any remaining federal restrictions on interstate bank expansion. At the same time, it allowed states to determine how the Act would be implemented. During the implementation period, which ran between 1994 and the 1st of June 1997, state legislators had the opportunity to adopt opt-out provisions and to limit the ability of out-of-state banks to establish or acquire branches in their states. We follow the literature (Johnson and Rice, 2008) and consider four important provisions that states used to limit competition from out-of-state banks. BHCs had alternative means of engaging in interstate branching. For instance, they could acquire small banks and transform them into branches. The first of the provisions that we consider imposes a minimum age requirement on the target institutions. BHCs could also open new branches. The second provision thus prohibits the establishment of *de novo* branches. Furthermore, instead of acquiring an entire local bank, a BHC could acquire only one, or a few, of its branches. The third provision prohibits the acquisition of individual branches. Finally, the fourth provision imposes a limit on the percentage of deposits that out-of-state BHCs can hold. The strict application or removal of these restrictions can lead to the level of competition from out-of-state banks varying across states and over time. Moreover, some states might elect to lift restrictions only if the state of the entrant bank applies similar conditions, that is, they may impose a reciprocity requirement. The empirical evidence confirms that the growth of out-of-state branching is significantly lower in states with more barriers to entry for out-of-state banks (Johnson and Rice, 2008).

To study the effect of banking competition on default probabilities, we introduce a state-specific DEREGULATION INDEX. For each state, we set this DEREGULATION INDEX equal to 0 for all firm-year observations prior to the first implementation of the IBBEA by that state. After the implementation of the IBBEA, the DEREGULATION INDEX increases by one unit if the state imposes a relatively low minimum-age restriction of up to 3 years, which is less than the standard 5-year requirement, on the target institution. It increases by one unit if *de novo* branching is permitted and by a further unit if individual branch acquisition is authorized. Finally, it increases by one unit if the deposit cap is equal to or higher than 30%. Thus, the DEREGULATION INDEX varies between 0 and 4, where 4 indicates the highest level of deregulation. The DEREGULATION INDEX changes over time at the state level as provisions are modified. Effectively, our DEREGULATION INDEX is equal to 4 minus the RSIndex of Rice and Strahan (2010).

Given that annual reports are completed at different times of the year, we construct firm-specific deregulation indicators by checking whether the annual report was filed before or after state-level changes in regulation. We build two additional variables to capture IBBEA deregulation, and we use them as robustness checks. Firstly, we introduce a state-specific DEREGULATION DUMMY. For every state, the DEREGULATION DUMMY takes a value of zero for the period prior to the IBBEA implementation and a value of 1 from the date of the IBBEA adoption. Secondly, we construct a DEREGULATION RECIPROCITY INDEX. This index takes a value of 0 for dates prior to the implementation of the IBBEA. After implementation, the index takes the same value as the DEREGULATION INDEX plus 1 if a state does not adopt a reciprocity requirement.

The various IBBEA provisions were adopted by states from 1994 to 2005. The timing of these adoptions is taken from Rice and Strahan (2010). Our sample period begins in 1984, that is, our analysis is sensitive to developments in the run-up to the deregulation and ends in 2007, just about one year after the last provision was adopted. In one of our robustness tests, we restrict the analysis to the period between 1993 and 2001.

2.2. Variable definitions

The main dependent variable (BANKRUPTCY) is a dummy that takes a value of 1 if a firm has filed for bankruptcy in a specific year and 0 otherwise. Once a firm becomes bankrupt, it exits the sample. We include both Chapter 7 and Chapter 11 bankruptcies. We employ bankruptcy data provided by BankrutpcyData and we complement the database with bankruptcies reported in Chava and Jarrow (2004), Chava et al. (2011), and Chava (2014).[5] Firms often delist prior to filing for bankruptcy. For these cases, we use the last available date in Compustat as the bankruptcy date, in line with Chava and Jarrow (2004).[6] For firms that delisted without filing for bankruptcy, firms that merged and firms that were acquired, the value of BANKRUPTCY is 0 until the last year in the database. In a robustness test, we employ a dummy (DOWNGRADE) that takes a value of 1 if the S&P Domestic Long Term Issuer Credit Rating of the firm experiences a downgrade from the previous year and 0 otherwise.

We are interested in understanding whether deregulation has a different impact on the bankruptcy probabilities of firms that have a high level of financial leverage. Therefore, we interact the DEREGULATION INDEX with an indicator of high financial leverage in all models.

We define LEVERAGE as the ratio of total debt to firm value. We calculate firm value as the sum of total debt and the market value of equity. Highly leveraged observations are identified by HIGH LEVERAGE, which takes a value of 1 if the observation is in the top tercile of LEVERAGE for a specific year and 0 otherwise. To capture firms' maturity structure, we use PROPORTION SHORT DEBT, which is the ratio of short-term debt to total debt.

In all regressions, we control for an array of variables that are commonly identified in the literature as predictors of firm bankruptcy. NET INCOME is the ratio of net income to total assets. SALES GROWTH is the growth of sales. SIZE is the natural logarithm of a firm's total assets in millions of dollars, adjusted for the GDP deflator and with 2004 as the base year. CAPEX is the ratio of capital expenditure to total assets. MB is the ratio of the market value of equity to total assets. TANGIBILITY is the ratio of property, plant and equipment to total

[5] We thank Sudheer Chava for making his dataset available to us.

[6] We adopt this approach for firms that have delisted and filed for bankruptcy within the following five years.

assets. DIVIDEND is the ratio of dividends to total assets. CASH FLOW is the ratio of cash flow to total assets. AGE is the natural logarithm of one plus the number of years since the firm was first added to Compustat. EXRET is the yearly excess return on the firm's equity by reference to the S&P 500. SIGMA is the standard deviation of the residuals of the regression of the daily equity return of the firm on the S&P 500 return for the preceding year.

We extend our analysis of the impact of deregulation to the cost of borrowing. We do so by studying the spreads of syndicated loans, specifically at the level of the syndicated loan facility. In line with previous studies (Bharath et al., 2011; Prilmeier, 2017; Schwert, 2018), and (Giometti, 2022) we focus only on lead arrangers. For this part of the analysis we use the following variables: LN AISD, LN AISU, LN AMOUNT, LN MATURITY, SECURED, SOLE LENDER, SYNDICATE SIZE, and LEAD SIZE. LN AISU is the natural logarithm of the all-in spread undrawn. LN AMOUNT is the natural logarithm of the syndicated loan amount in millions of dollars, adjusted for the GDP deflator, with 2004 used as the base year. LN MATURITY is the natural logarithm of the maturity of the syndicated loan facility in months. SECURED is a dummy variable that takes a value of 1 if the syndicated loan facility is secured and 0 otherwise. SOLE LENDER is a dummy variable that takes a value of 1 if the syndicated loan facility is provided by a single lender and 0 otherwise. SYNDICATE SIZE is the number of lenders in the syndicated loan facility. LEAD SIZE is the number of lead lenders in the syndicated loan facility.

Further, we investigate whether deregulation has a greater influence on the number and strictness of loan covenants for high leverage firms. This analysis is done at the level of the syndicated loan package while considering only lead arrangers. We classify different covenant types as in Ivashina (2005) and consider the following variables: N COVENANT, N FINANCIAL COVENANT, N GENERAL COVENANT and PVIOL. N COVENANT is the number of covenants included in a syndicated loan package. N FINANCIAL COVENANT is the number of financial covenants included in a syndicated loan package. N GENERAL COVENANT is the number of general covenants included in a syndicated loan package. PVIOL is the probability of financial covenant violation in Demerjian and Owens (2016).[7]

Next, we investigate lending relationships in the syndicated market and focus on syndicated loan borrowers and lead arrangers. We employ the following variables: LOAN PARTICIPANT, LEAD ARRANGER, PREVIOUS PARTICIPANT, and PREVIOUS LEAD. LOAN PARTICIPANT is a dummy variable that takes the value of 1 if, in a given year, a lender participates in at least one syndicated loan facility issued to a firm in any form and 0 otherwise. LEAD ARRANGER is a dummy variable that takes the value of 1 if, in a given year, a lender participates in at least one syndicated loan facility issued to a firm as a lead arranger and 0 otherwise. PREVIOUS PARTICIPANT is a dummy variable that takes the value of 1 if, in the previous five years, a lender participated in at least one syndicated loan facility issued to a firm in any form and 0 otherwise. PREVIOUS LEAD is a dummy variable that takes the value of 1 if, in the previous five years, a lender participated in at least one syndicated loan facility issued to a firm as a lead arranger and 0 otherwise.

We also create a set of variables to identify firms that are financially constrained. NODIV is a dummy that takes a value of 1 if the firm does not distribute dividend in a specific year and 0 otherwise. KZ INDEX is an index that is based on the variables that were proposed by Kaplan and Zingales (1997) and which uses the coefficients that were estimated by Lamont et al. (2001). WW INDEX is an index that is based on Whited and Wu (2006) and Hennessy and Whited (2007). HP INDEX is based on Hadlock and Pierce (2010). The definitions of all variables are displayed in Table 1.

[7] We thank Peter R. Demerjian and Edward L. Owens for making PVIOL available via their websites.

2.3. Summary statistics

We winsorise all variables (except for the bankruptcy indicator) at the 1st and the 99th percentiles. Table 2 reports the summary statistics for all of the variables. In general, bankruptcy is an infrequent event. Out of the 10,685 firms in our sample, 1381 became bankrupt. Financial leverage exhibits high variability. The average value of LEVERAGE is 21.8%, but firms at the 25th percentile have almost no debt (1.5%), whereas those at the 75th percentile have high debt (35.2%). Moreover, most of LEVERAGE comprises long-term debt. The average of PROPORTION SHORT DEBT is 32.6%.

Table 3 reports the average of BANKRUPTCY for the sample. We compute the average for various sub-samples in different time windows. We fix the pre-deregulation window to the three years before the implementation of the IBBEA. In the first year after deregulation, the increase in BANKRUPTCY is not statistically significant at the 99% confidence level for either low- or high-leverage firms, reflecting the fact that only a small proportion of debts matures within the year.[8]

Turning to the three-year time window, the average of BANKRUPTCY increases from the pre-IBBEA implementation period (0.895%) to the post-IBBEA implementation period (1.772%). Computing the same average for low- and high-leverage firms indicates that the increase is much sharper for the latter. The average of BANKRUPTCY for these firms increases by 1.92% (in absolute terms); it increases by 0.37% (in absolute terms) for firms with low leverage. This preliminary evidence seems to indicate that the deregulation process affects the credit risk of firms with a higher proportion of external debt to a greater extent.

The more we expand the post-deregulation time window, the larger the difference between the pre- and post-IBBEA average of BANKRUPTCY for high-leverage firms. This is because a higher proportion of debt expires as time passes. In the fourth and fifth year after deregulation, there is also a positive trend for low-leverage firms. For this reason, we employ a more formal difference-in-differences model that controls for heterogeneous time trends at the industry and state levels.

Fig. 1 shows the average value of DEREGULATION INDEX across states in each year. It also displays the bankruptcy rates of firms in the two bottom leverage terciles (HIGH LEVERAGE = 0) and of firms in the upper leverage tercile (HIGH LEVERAGE = 1) in each year. Most of the increase in DEREGULATION INDEX occurs between 1995 and 2000. Bankruptcy rates increase during the same period. However, the increase is not of the same magnitude for low- and high-leverage firms — it is much sharper for the latter.

3. Results

In order to determine whether and how banking deregulation affects the relationship between firm leverage and firm bankruptcy probability, we estimate the following difference-in-differences linear probability model with annual data:

$$
\begin{aligned}
BANKRUPTCY_{i,t} = {} & \beta_1 HIGH\ LEVERAGE_{i,t-1} \\
& + \beta_2 DEREGULATION\ INDEX_{i,t-1} \\
& + \beta_3 DEREGULATION\ INDEX_{i,t-1} \\
& \times HIGH\ LEVERAGE_{i,t-1} \\
& + \boldsymbol{X}_{i,t-1}\delta + \alpha_s + \alpha_{j,t} + \epsilon_{i,t}\,,
\end{aligned} \tag{1}
$$

where α_s are state fixed effects, and $\alpha_{j,t}$ are industry-by-year fixed effects defined at the three-digit SIC level to control for heterogeneous time trends across industries. $\boldsymbol{X}_{i,t}$ is a vector of firm-level controls that vary across firms (i) and years (t). We cluster standard errors at the

[8] The change for the entire sample is statistically significant with 99% confidence, which is probably due to the larger number of observations.

Table 1
Variable definitions.
In this table, we provide the definitions of the variables that we use in the paper.

Variable	Definition
	Panel A: Credit Risk Indicator
BANKRUPTCY	A dummy that takes a value of 1 if a firm has filed for bankruptcy in a specific year and 0 otherwise.
DOWNGRADE	A dummy that takes a value of 1 if the S&P Domestic Long Term Issuer Credit Rating experiences a downgrade from the previous year and 0 otherwise.
	Panel B: Deregulation Indexes
DEREGULATION INDEX	An indicator that takes a value of 0 before the implementation of the IBBEA and increases by 1 if there is no minimum age requirement, if *de novo* branching is permitted, if the acquisition of individual branches is allowed and if the deposit cap is above 30% after the implementation of the IBBEA.
DEREGULATION DUMMY	A dummy that takes a value of 0 before a state implements the IBBEA for the first time and a value of 1 starting from the first year in which the IBBEA is adopted by a state.
DEREGULATION INDEX RECIPROCITY	An indicator that is equal to DEREGULATION INDEX plus 1 if legislators impose reciprocity requirements after the implementation of the IBBEA.
	Panel C: Financial Leverage
LEVERAGE	The ratio of total debt to firm value, calculated as the sum of total debt and the market value of equity.
HIGH LEVERAGE	A dummy that takes a value of 1 if the firm is in the top tercile for LEVERAGE in a specific year and 0 otherwise.
PROPORTION SHORT DEBT	The ratio of short-term debt, that is, debt with maturity that is equal to or lower than one year, to total debt.
HIGH LEVERAGE BEFORE DEREGULATION	A dummy that takes a value of HIGH LEVERAGE in the last year available before deregulation takes place.
	Panel D: Control Variables
NET INCOME	The ratio between net income and total assets.
SALES GROWTH	The growth of sales.
SIZE	The natural logarithm of the total assets of a firm in millions of dollars, adjusted for the GDP deflator and with 2004 used as base year.
CAPEX	The ratio of capital expenditure to total assets.
MB	The ratio of market value to the book value of equity.
TANGIBILITY	The ratio of property, plant and equipment to total assets.
DIVIDEND	The ratio of dividends to total assets.
CASH FLOW	The ratio of cash flow to total assets.
AGE	The natural logarithm of one plus the number of years since the firm was first added to Compustat.
EXRET	The yearly excess return on the equity of the firm by reference to the S&P 500.
SIGMA	The standard deviation of the residuals of the regression of the daily equity return of the firm from the S&P 500 return for the preceding year.
	Panel E: Syndicated Loan Variables
LN AISD	The natural logarithm of the all-in spread drawn.
LN AISU	The natural logarithm of the all-in spread undrawn.
LN AMOUNT	The natural logarithm of the syndicated loan amount in millions of dollars, adjusted for the GDP deflator and with 2004 used as base year.
LN MATURITY	The natural logarithm of the maturity of the syndicated loan facility in months.
SECURED	A dummy that takes a value of 1 if the syndicated loan facility is secured and 0 otherwise.
SOLE LENDER	A dummy that takes a value of 1 if the syndicated loan facility is provided by a single lender and 0 otherwise.
SYNDICATE SIZE	The number of lenders in the syndicated loan facility.
LEAD SIZE	The number of lead lenders in the syndicated loan facility.
N COVENANT	The number of covenants included in a syndicated loan package.
N FINANCIAL COVENANT	The number of financial covenants included in a syndicated loan package. Ivashina (2005) includes among financial covenants: Coverage covenants based on interest coverage, fixed charge coverage, debt service coverage or cash interest coverage; leverage covenants based on debt to EBITDA, debt to tangible net worth, leverage ratio, senior debt to EBITDA, debt to equity, loan to value or senior leverage; Liquidity covenants based on the current ratio or quick ratio; Tangibility covenants based on tangible net worth, net worth or EBITDA; Investments covenants based on CAPEX.
N GENERAL COVENANT	The number of general covenants included in a syndicated loan package. Ivashina (2005) includes among general covenants: Prepayment covenants based on asset sales sweep, equity issuance sweep, debt issuance sweep, excess cash flow sweep or insurance proceeds sweep; Dividend covenants based on dividend restrictions, percentage of net income or percentage of excess cash flow; Voting rights covenants based on required lenders, term changes or collateral release.
PVIOL	The probability of financial covenant violation provided by Demerjian and Owens (2016).
LOAN PARTICIPANT	A dummy that take the value of 1 if in a given year a lender participates in at least one syndicated loan facility issued to a firm in any form and 0 otherwise.
LEAD ARRANGER	A dummy that take the value of 1 if in a given year a lender participates in at least one syndicated loan facility issued to a firm as lead arranger and 0 otherwise.
PREVIOUS PARTICIPANT	A dummy that take the value of 1 if in the previous five years a lender participated in at least one syndicated loan facility issued to a firm in any form and 0 otherwise.
PREVIOUS LEAD	A dummy that take the value of 1 if in the previous five years a lender participated in at least one syndicated loan facility issued to a firm as lead arranger and 0 otherwise.
	Panel F: Financial Constraint Variables
NODIV	A dummy that takes a value of 1 if the firm does not distribute dividend in a specific year and 0 otherwise.
KZ INDEX	An index that is based on the variables that were proposed by Kaplan and Zingales (1997) and which uses the coefficients that were estimated by Lamont et al. (2001). It is computed by using Compustat items as follows: $-1.001909 * (ib + dp)/ppent_{t-1} + 0.2826389 * (at + prcc\_f * csho - ceq - txdb)/at + 3.139193 * (dltt + dlc)/(dltt + dlc + seq) - 39.3678 * dv/ppent_{t-1} - 1.314759 * che/ppent_{t-1}$.
HIGH KZ INDEX	A dummy that takes a value of 1 if the firm is in the top tercile for KZ INDEX in a specific year and 0 otherwise.
WW INDEX	An index that is based on Whited and Wu (2006) and Hennessy and Whited (2007), which is computed as follows: $-0.091 * (ib + dp)/at - 0.062 * (1 - NODIV) + 0.021 * dltt/at - -0.044 * ln[(at * 100)/GDPDeflator_{2004}] - 0.035 * (sale - sale_{t-1})/sale_{t-1} + 0.102 * [sale(industry) - sale(industry)_{t-1}]/sale(industry)_{t-1}$.
HIGH WW INDEX	A dummy that takes a value of 1 if the firm is in the top tercile for WW INDEX in a specific year and 0 otherwise.
HP INDEX	An index that is based on the work of Hadlock and Pierce (2010). It is computed by using Compustat items as follows: $-0.737 * min[ln[(at * 100)/GDPDeflator_{2004}]; ln(4,500)] + 0.043 * min[ln[(at * 100)/GDPDeflator_{2004}]; ln(4,500)]^2 - 0.040 * min(age; 37)$.
HIGH HP INDEX	A dummy that takes a value of 1 if the firm is in the top tercile for HP INDEX in a specific year and 0 otherwise.

Table 2
Summary statistics.
In this table, we report summary statistics for the variables used in the analysis. Variables definitions are reported in Table 1. The sample period ranges from 1984 to 2007.

	Obs.	Mean	St. Dev.	Min	25th percentile	Median	75th percentile	Max	Skewness	Kurtosis
Panel A: Credit Risk Indicator										
BANKRUPTCY	92,678	0.016	0.124	0.000	0.000	0.000	0.000	1.000	7.840	62.465
DOWNGRADE	16,977	0.115	0.319	0.000	0.000	0.000	0.000	1.000	2.408	6.798
Panel B: Deregulation Indexes										
DEREGULATION INDEX	92,678	1.002	1.368	0.000	0.000	0.000	1.000	4.000	1.121	2.793
DEREGULATION DUMMY	92,678	0.512	0.500	0.000	0.000	1.000	1.000	1.000	−0.046	1.002
DEREGULATION INDEX RECIPROCITY	92,678	1.322	1.536	0.000	0.000	0.000	2.000	5.000	0.690	2.143
Panel C: Financial Leverage										
LEVERAGE	92,678	0.218	0.235	0.000	0.015	0.138	0.352	0.898	1.093	3.292
HIGH LEVERAGE	92,678	0.333	0.471	0.000	0.000	0.000	1.000	1.000	0.708	1.501
PROPORTION SHORT DEBT	79,663	0.326	0.330	0.000	0.049	0.199	0.532	1.000	0.885	2.435
HIGH LEVERAGE BEFORE DEREGULATION	77,059	0.374	0.484	0.000	0.000	0.000	1.000	1.000	0.522	1.273
Panel D: Control Variables										
NET INCOME	92,505	−0.067	0.306	−1.752	−0.072	0.028	0.074	0.269	−3.235	15.351
SALES GROWTH	80,232	0.214	0.642	−0.779	−0.025	0.092	0.259	4.499	4.210	26.060
SIZE	92,678	4.803	2.007	0.721	3.364	4.679	6.131	9.881	0.270	2.635
CAPEX	91,400	0.065	0.070	0.000	0.021	0.043	0.081	0.399	2.440	10.064
MB	92,671	3.081	4.473	−7.697	1.109	1.931	3.479	30.110	3.370	19.254
TANGIBILITY	92,521	0.270	0.219	0.005	0.097	0.210	0.382	0.900	1.068	3.429
DIVIDEND	92,482	0.009	0.024	0.000	0.000	0.000	0.009	0.172	4.547	27.295
CASH FLOW	92,256	−0.014	0.283	−1.535	−0.019	0.069	0.119	0.310	−3.117	14.454
AGE	92,678	1.680	0.905	0.000	1.099	1.792	2.398	3.135	−0.393	2.178
EXRET	90,987	−0.136	0.586	−2.049	−0.425	−0.081	0.201	1.384	−0.507	4.224
SIGMA	89,026	0.040	0.024	0.010	0.023	0.034	0.051	0.134	1.469	5.444
Panel E: Syndicated Loan Variables										
LN AISD	28,630	4.993	0.866	2.773	4.472	5.165	5.617	6.485	−0.721	2.725
LN AISU	17,379	3.167	0.736	1.386	2.526	3.219	3.912	4.605	−0.499	2.426
LN AMOUNT	28,630	4.450	1.758	0.029	3.255	4.643	5.730	7.957	−0.337	2.610
LN MATURITY	28,630	3.595	0.736	1.386	3.178	3.871	4.094	4.595	−0.953	2.985
SECURED	28,630	0.567	0.496	0.000	0.000	1.000	1.000	1.000	−0.268	1.072
SOLE LENDER	28,630	0.278	0.448	0.000	0.000	0.000	1.000	1.000	0.990	1.980
SYNDICATE SIZE	28,630	7.439	8.693	1.000	1.000	4.000	10.000	118.000	2.687	15.655
LEAD SIZE	28,630	1.279	0.529	1.000	1.000	1.000	2.000	13.000	5.922	112.910
N COVENANT	17,658	3.357	3.664	0.000	0.000	2.000	6.000	15.000	0.758	2.443
N FINANCIAL COVENANT	17,658	1.221	1.424	0.000	0.000	0.000	2.000	7.000	0.732	2.301
N GENERAL COVENANT	17,658	2.136	2.642	0.000	0.000	1.000	4.000	9.000	1.093	3.116
PVIOL	7424	0.396	0.414	0.000	0.024	0.161	0.919	1.000	0.486	1.431
LOAN PARTICIPANT	16,060,204	0.007	0.085	0.000	0.000	0.000	0.000	1.000	11.601	135.586
LEAD ARRANGER	16,060,204	0.001	0.035	0.000	0.000	0.000	0.000	1.000	28.348	804.601
PREVIOUS PARTICIPANT	16,060,204	0.008	0.090	0.000	0.000	0.000	0.000	1.000	10.879	119.353
PREVIOUS LEAD	16,060,204	0.001	0.035	0.000	0.000	0.000	0.000	1.000	28.825	831.908
Panel F: Financial Constraints Variables										
NONPAYER	92,464	0.634	0.482	0.000	0.000	1.000	1.000	1.000	−0.558	1.312
KZ INDEX	78,027	−5.265	18.733	−137.698	−4.210	−0.478	1.192	14.717	−5.109	32.855
HIGH KZ INDEX	78,027	0.333	0.471	0.000	0.000	0.000	1.000	1.000	0.708	1.501
WW INDEX	80,092	−0.224	0.119	−0.495	−0.305	−0.222	−0.147	0.125	0.167	3.119
HIGH WW INDEX	80,092	0.333	0.471	0.000	0.000	0.000	1.000	1.000	0.708	1.501
HP INDEX	92,678	−2.410	0.641	−3.197	−2.935	−2.542	−2.028	−0.548	0.854	3.064
HIGH HP INDEX	92,678	0.333	0.471	0.000	0.000	0.000	1.000	1.000	0.708	1.501

state level because DEREGULATION INDEX is correlated within states. In the robustness tests, we cluster standard errors at the firm level and double-cluster at the state and the firm level.

We use a linear probability model in order to arrive at a direct and intuitive interpretation of the impact of our explanatory variables on the bankruptcy rate. Non-linear alternatives of difference-in-differences specifications produce coefficient estimates of the interaction terms whose signs, magnitudes and significances can be misinterpreted easily (Ai and Norton, 2003).

Table 4 displays the baseline results from the main regression (Eq. (1)). We expect β_1 to be positive, in line with the vast literature that identifies leverage as one of the key drivers of corporate default (Altman, 1968; Merton, 1974), and Traczynski (2017). The focus of this paper is on β_2, β_3 and the sum of the two. β_2 captures the increase in bankruptcy risk for low-leverage firms after deregulation. β_3 reflects the effect of the interaction between DEREGULATION INDEX and HIGH LEVERAGE, which, in turn, reflects the differential impact of high leverage on bankruptcy risk after deregulation. We expect β_2 not to be statistically significant, in line with results of Cornaggia et al. (2021), who showed that, on average, banking deregulation does not impact the bankruptcy rates of public firms. We expect β_2+β_3 to be positive, in line with Petersen and Rajan's (1995) findings, which suggest that increased banking competition may reduce the availability of credit to firms perceived as risky.

Table 3
Bankruptcy before and after deregulation.
In this table, we report the average of BANKRUPTCY for the period before the implementation of the IBBEA and for the period after the implementation of the IBBEA. We restrict the pre-implementation period to the three years before deregulation, and we expand the time windows from one to five years after deregulation. We compute averages for observations in the bottom two terciles of LEVERAGE (HIGH LEVERAGE = 0) and in the top tercile of LEVERAGE (HIGH LEVERAGE = 1) in a specific year. We compute t-tests for the differences between the average of BANKRUPTCY before and after IBBEA implementation. *** p < 0.01; ** p < 0.05; * p < 0.1.

	Pre	Post				
	[−3; −1]	[1; 1]	[1; 2]	[1; 3]	[1; 4]	[1; 5]
Overall Sample	0.895%	1.398%	1.570%	1.772%	1.960%	2.093%
Δ(Post − Pre)		*0.503%****	*0.675%****	*0.877%****	*1.065%****	*1.198%****
HIGH LEVERAGE = 0	0.417%	0.760%	0.789%	0.787%	0.800%	0.822%
Δ(Post − Pre)		*0.343%***	*0.372%****	*0.370%****	*0.383%****	*0.406%****
HIGH LEVERAGE = 1	1.838%	2.633%	3.134%	3.758%	4.284%	4.646%
Δ(Post − Pre)		*0.796%**	*1.296%****	*1.920%****	*2.447%****	*2.809%****

Table 4
Bankruptcy, financial leverage and banking competition.
This table reports the estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variable is BANKRUPTCY. $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. The definitions of the variables are given in Table 1. All independent variables are lagged one year. The sample period ranges from 1984 to 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
HIGH LEVERAGE	0.027***	0.024***	0.023***	0.024***	0.025***	0.023***	0.023***	0.024***	0.023***	0.023***	0.024***	0.016***	0.020***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DEREGULATION INDEX	0.001**	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000	0.000	−0.000	−0.001	−0.001
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)
DEREGULATION INDEX × HIGH LEVERAGE		0.003***	0.004***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.004***	0.003***	0.004***	0.004***	0.004***
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NET INCOME			−0.056***											−0.024***
			(0.003)											(0.008)
SALES GROWTH				−0.001										0.001
				(0.001)										(0.001)
SIZE					−0.003***									0.004***
					(0.000)									(0.000)
CAPEX						0.018*								0.031**
						(0.010)								(0.012)
MB							−0.000*							−0.000**
							(0.000)							(0.000)
TANGIBILITY								−0.005						−0.004
								(0.004)						(0.004)
DIVIDEND									0.021					0.052*
									(0.031)					(0.028)
CASH FLOW										−0.059***				−0.015
										(0.003)				(0.009)
AGE											−0.003***			0.002**
											(0.001)			(0.001)
EXRET												−0.028***		−0.019***
												(0.002)		(0.002)
SIGMA													0.639***	0.546***
													(0.042)	(0.059)
$\beta_2 + \beta_3$		0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.003***	0.004***	0.004***
Observations	92,678	92,678	92,505	80,232	92,678	91,400	92,671	92,521	92,482	92,256	92,678	90,987	89,026	78,000
R^2	0.018	0.019	0.037	0.020	0.021	0.019	0.019	0.019	0.019	0.036	0.019	0.036	0.033	0.053
State FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

We find the signs of the control variables to be consistent with the empirical literature on credit risk (Shumway, 2001; Chava and Jarrow, 2004), and Traczynski (2017). Looking at Table 4 one variable at a time, more profitable firms (NET INCOME), larger firms (SIZE), firms with higher cash flow (CASH FLOW), older firms (AGE), and firms which have higher market returns (EXRET) have lower probabilities of bankruptcy. Conversely, firms with more volatile stock returns (SIGMA) have higher probabilities of bankruptcy. More importantly, HIGH LEVERAGE increases the probability of bankruptcy in all specifications.

In Model 1 in Table 4, DEREGULATION INDEX is positive and statistically significant at the 95% confidence interval. However, when the interaction term is introduced, DEREGULATION INDEX is not statistically significant. This indicates that deregulation does not impact the bankruptcy rates of low-leverage firms. By contrast, the coefficient of the interaction between DEREGULATION INDEX and HIGH LEVERAGE is positive and highly significant, which indicates strongly that, after deregulation, highly leveraged firms have a higher likelihood of entering bankruptcy proceedings than other firms. Furthermore, the sum of β_2 and β_3 is positive and statistically significant, which confirms that the bankruptcy probability of high-leverage firms increases upon the implementation of the IBBEA. Full deregulation results in a 1.6% rise in the probability of bankruptcy for high-leverage firms. This has been computed as $(\beta_2 + \beta_3) \times 4 = 0.004 \times 4 = 1.6\%$, where the values of β_2 and β_3 are taken from Model 14 in Table 4 and where 4 is the deregulation index value that denotes the highest level of deregulation. This result is consistent with Jiang et al. (2019), who showed that, after deregulation, banks limit liquidity creation by reducing the availability of credit for riskier activities.

In order to validate our identification strategy, in Table 5, we show that the effect of banking deregulation on the bankruptcy rates of high-leverage firms is not driven by pre-existing bankruptcy trends. To that end, we augment Eq. (1) with temporal dummies that are interacted with HIGH LEVERAGE. Specifically, we create a dummy that takes a value of 1 in the year before a state implements the IBBEA for the first time and a value of 0 otherwise (BEFORE [−1; −1]), a dummy that

Table 5
Pre-Trends.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is BANKRUPTCY, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. BEFORE is a dummy variable that takes a value of 1 in the year before, in the three years before and in the five years before the introduction of the IBBEA in a state; otherwise, it takes a value of 0. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
HIGH LEVERAGE	0.024***	0.014***	0.026***	0.015***	0.026***	0.016***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
DEREGULATION INDEX	−0.000	−0.001	−0.000	−0.001	0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
DEREGULATION INDEX × HIGH LEVERAGE	0.003***	0.004***	0.002***	0.004***	0.002**	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
BEFORE [−1; −1] × HIGH LEVERAGE	−0.006	−0.003				
	(0.004)	(0.005)				
BEFORE [−1; −3] × HIGH LEVERAGE			−0.009***	−0.007***		
			(0.002)	(0.002)		
BEFORE [−1; −5] × HIGH LEVERAGE					−0.008***	−0.007***
					(0.002)	(0.002)
NET INCOME		−0.024***		−0.024***		−0.024***
		(0.008)		(0.008)		(0.008)
SALES GROWTH		0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)
SIZE		0.004***		0.004***		0.004***
		(0.000)		(0.000)		(0.000)
CAPEX		0.031**		0.031**		0.031**
		(0.012)		(0.012)		(0.012)
MB		−0.000**		−0.000**		−0.000**
		(0.000)		(0.000)		(0.000)
TANGIBILITY		−0.004		−0.004		−0.004
		(0.004)		(0.004)		(0.004)
DIVIDEND		0.053*		0.052*		0.052*
		(0.028)		(0.028)		(0.028)
CASH FLOW		−0.015		−0.015		−0.015
		(0.009)		(0.009)		(0.009)
AGE		0.002**		0.002**		0.002**
		(0.001)		(0.001)		(0.001)
EXRET		−0.019***		−0.019***		−0.019***
		(0.002)		(0.002)		(0.002)
SIGMA		0.546***		0.546***		0.548***
		(0.059)		(0.059)		(0.059)
$\beta_2 + \beta_3$	0.003***	0.004***	0.002***	0.003***	0.002***	0.003***
Observations	92,678	78,000	92,678	78,000	92,678	78,000
R^2	0.019	0.053	0.019	0.053	0.019	0.053
State FE	YES	YES	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES	YES	YES

takes a value of 1 in the three years before a state implements the IBBEA for the first time and 0 otherwise (BEFORE [−1; −3]), and a dummy that takes a value of 1 in the five years before a state implements the IBBEA for the first time and 0 otherwise (BEFORE [−1; −5]).

The term for the interaction between BEFORE and HIGH LEVERAGE is negative and statistically significant, which means that, in the pre-IBBEA implementation period that is identified by BEFORE, the bankruptcy rate of high-leverage firms is lower than in the earlier period, which denotes a downward rather than an upward trend. This suggests that the implementation of the IBBEA precipitated a trend reversal. In fact, $\beta_2+\beta_3$ is positive and statistically significant, which indicates that the implementation of the IBBEA reversed the pre-existing trend. This finding is confirmed by Fig. 2. In the pre-IBBEA implementation period, highly leveraged firms exhibit decreasing bankruptcy rates over time. After the implementation of IBBEA, bankruptcy rates for low-leverage firms remain stable, whereas those of highly leveraged firms increase sharply.

We also analyse the dynamic impact of the IBBEA on the probability of bankruptcy. Specifically, in Eq. (1), we include a set of triple interactions between DEREGULATION INDEX, HIGH LEVERAGE and AFTER, which is a time dummy that identifies a post-IBBEA period of two or more years. The results are reported in Table 6. It emerges that $\beta_2 + \beta_3$ is positive and statistically significant, starting from two years after the implementation of the IBBEA. This is explained by the fact that only a small portion of debt matures within a year. Thus, the effect of deregulation on bankruptcy rates is not immediate. It begins to fade away eight years after the implementation of IBBEA, which can be explained by the tendency for new relationships between firms and banks to be established over time.

3.1. Mechanism

We investigate one of the possible mechanisms through which lower banking competition may increase the bankruptcy risk of highly leveraged firms. Petersen and Rajan (1995) posit that competitive credit markets may be an obstacle to the establishment of long-term relationships between banks and risky firms. In such markets, the ease with which borrowers can switch between lenders deters banks from setting lower interest rates to help struggling high-leverage firms. This is because higher compensatory rates in the longer term may not be secured due to competition. As a result, firms that are highly leveraged or perceived as risky face more stringent lending conditions, which

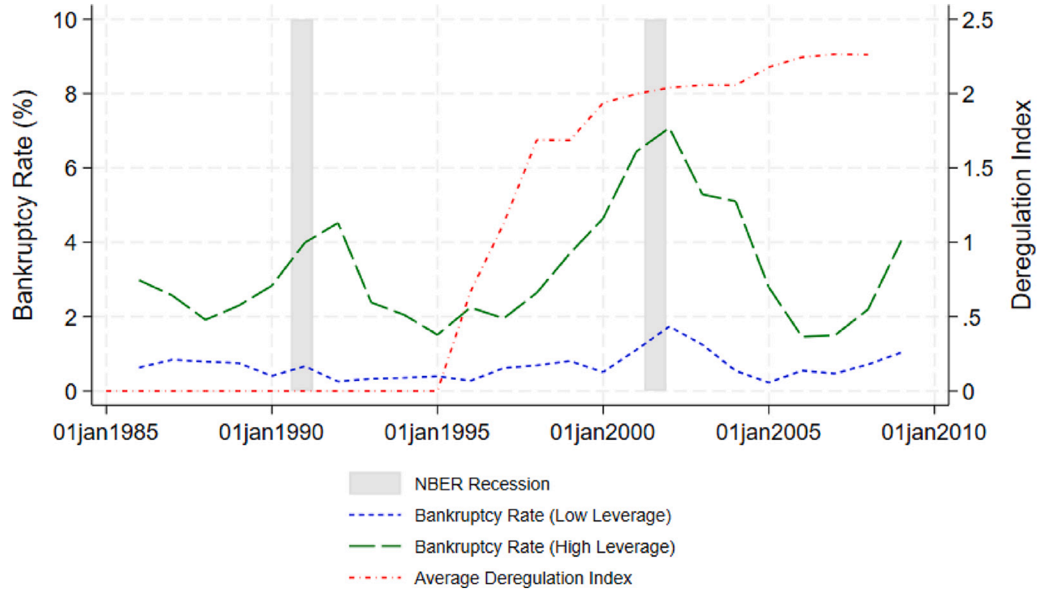

Fig. 1. Deregulation index and bankruptcy rates.
This figure presents the average value of DEREGULATION INDEX and the yearly bankruptcy rates of firms in the bottom two LEVERAGE terciles (HIGH LEVERAGE = 0) and of firms in the top LEVERAGE tercile (HIGH LEVERAGE = 1) in a specific year. Grey areas indicate recession periods as identified by the National Bureau of Economic Research.

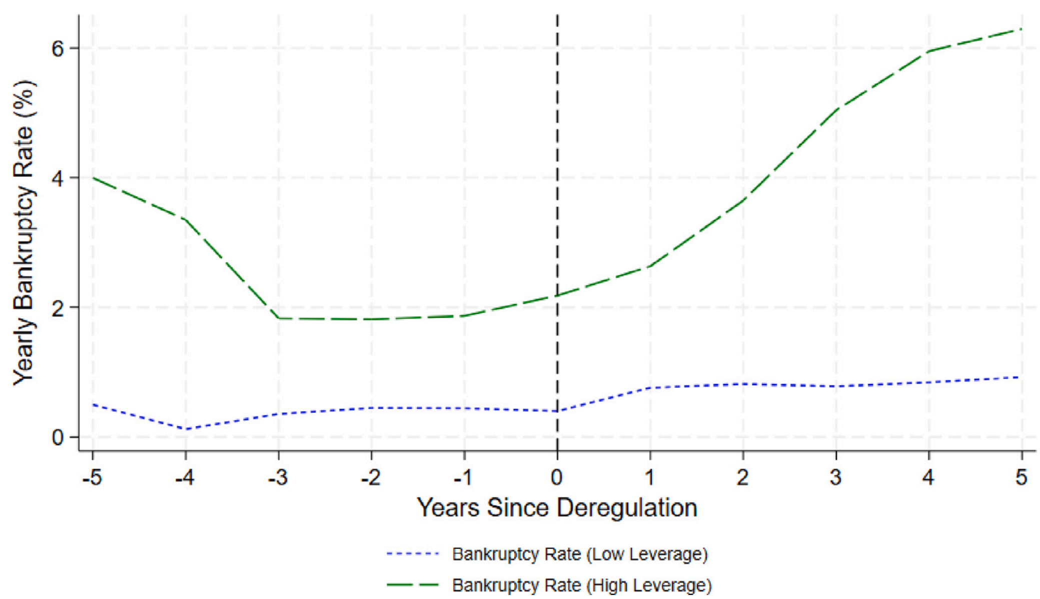

Fig. 2. Bankruptcy rates before/after deregulation.
This figure presents the yearly bankruptcy rates of firms in the bottom two LEVERAGE terciles (HIGH LEVERAGE = 0) and of firms in the top LEVERAGE tercile (HIGH LEVERAGE = 1) in a specific year over the five-year periods before and after the implementation of the IBBEA.

may heighten their credit risk. This scenario underscores a paradox in which competitive lending environments, while seemingly beneficial, can lead to more restrictive financial conditions for firms that most require financial support. We investigate this mechanism by analysing syndicated loans' spreads and covenants.

3.1.1. Borrowing cost

One of the implications of Petersen and Rajan (1995) is that lenders charge higher interest rates to riskier firms when banking competition is higher. For this reason, we test how the passage of the IBBEA regulation affected the spreads of syndicated loan facilities for highly leveraged firms by estimating the following difference-in-differences model:

$$\begin{aligned} LN\ SPREAD_{f,b,i,t} = & \beta_1 HIGH\ LEVERAGE_{i,t-1} \\ & + \beta_2 DEREGULATION\ INDEX_{i,t-1} \\ & + \beta_3 DEREGULATION\ INDEX_{i,t-1} \\ & \times HIGH\ LEVERAGE_{i,t-1} \\ & + \boldsymbol{X}_{i,t-1}\delta + \boldsymbol{Y}_f\lambda + \alpha_s + \alpha_{j,t} + \alpha_b + \alpha_{lt} + \alpha_{lp} + \epsilon_{f,b,i,t}\ , \end{aligned} \tag{2}$$

in which LN SPREAD is the dependent variable that can be either the natural logarithm of the all-in spread drawn (LN AISD) or the natural logarithm of the all-in spread undrawn (LN AISU). α_b are bank fixed effects, α_{lt} are loan type fixed effects, and α_{lp} are loan purpose fixed effects. $\boldsymbol{Y}_f$ is a vector of syndicated loan facility-level controls.

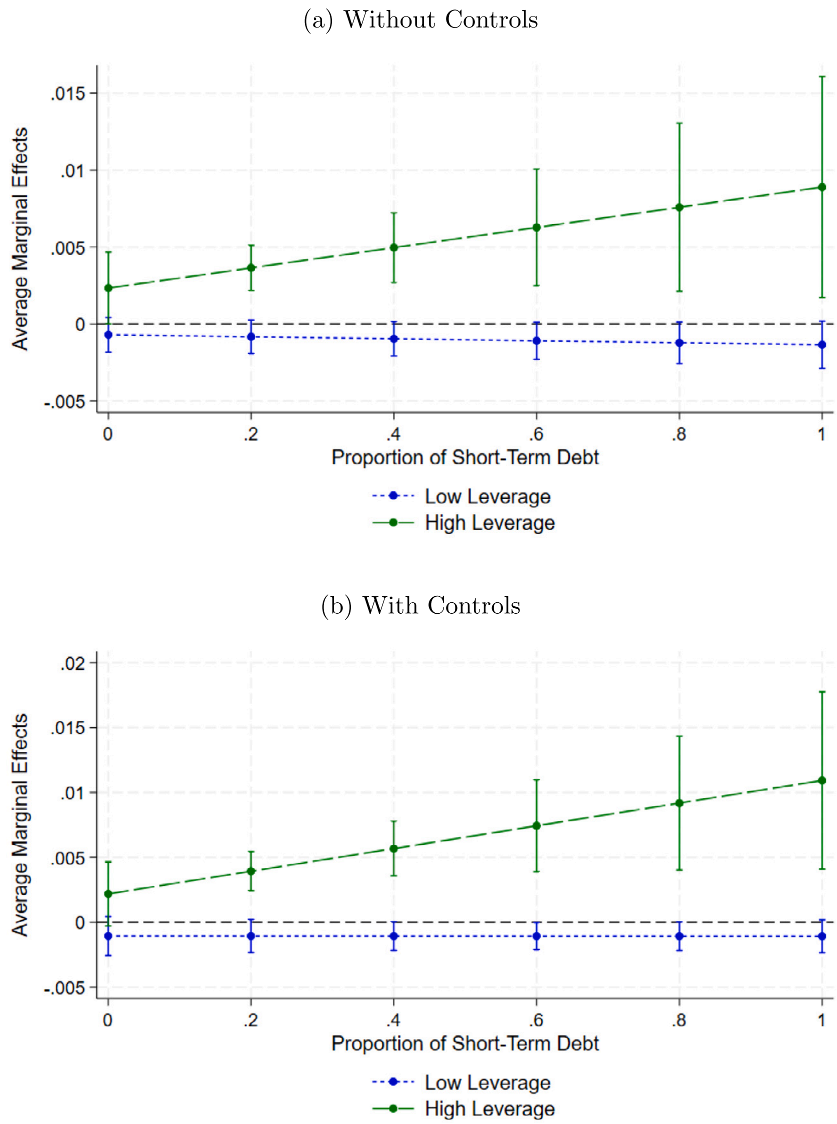

Fig. 3. Effects of short-term debt.
This figure presents the average marginal effects of DEREGULATION INDEX on BANKRUPTCY at different levels of PROPORTION SHORT DEBT for firms in the bottom two LEVERAGE terciles (HIGH LEVERAGE = 0) and for firms in the top LEVERAGE tercile (HIGH LEVERAGE = 1) in a specific year. Average marginal effects are estimated on the basis of the coefficients that are reported in Table 9. Confidence intervals are plotted and calculated at the 95% level.

Table 7 reports the estimation results. β_2 is negative, in line with Lian (2018), but not statistically significant, except in column 4. The interaction term between DEREGULATION INDEX and HIGH LEVERAGE is always positive and statistically significant, both for the all-in spread drawn and the all-in spread undrawn. This confirms that, post deregulation, riskier firms suffer an increase in their cost of borrowing with respect to low-leverage firms.

The economic significance of full deregulation for high-leverage firms with respect to low-leverage firms is 15.32 basis points for the all-in spread drawn and 3.3 basis points for the all-in spread undrawn.[9,10] These effects are a non-negligible cost as they are equivalent to 9.51% and 14.59% of the total all-in spread drawn and all-in spread undrawn, respectively.[11]

3.1.2. Covenants

We test how the passage of the IBBEA regulation affected the covenants of syndicated loan packages of highly leveraged borrowers

[9] The impact of full deregulation on LN AISD for low-leverage firms is $\beta_2 \times 4 = -0.003 \times 4 = -0.012$, and it is $(\beta_2 + \beta_3) \times 4 = (-0.003 + 0.025) \times 4 = 0.088$ for high-leverage firms. The values of β_2 and β_3 are taken from Model 2 in Table 7. The deregulation index value of 4 denotes the highest level of deregulation. Applying these changes to the sample average of LN AISD in Table 2 (4.993), we obtain a value of the all-in spread drawn equal to $e^{4.993-0.012} = 145.62$ for low-leverage firms, and equal to $e^{4.993+0.012} = 160.94$ for high-leverage firms.

[10] The impact of full deregulation on LN AISU for low-leverage firms is $\beta_2 \times 4 = -0.014 \times 4 = -0.048$, and it is $(\beta_2 + \beta_3) \times 4 = (-0.014 + 0.036) \times 4 = 0.088$ for high-leverage firms. The values of β_2 and β_3 are taken from Model 2 in Table 7. The deregulation index value of 4 denotes the highest level of deregulation. Applying these changes to the sample average of LN AISU in Table 2 (3.167), we obtain a value of the all-in spread undrawn equal to $e^{3.167-0.048} = 22.62$ for low-leverage firms, and equal to $e^{3.167+0.088} = 25.92$ for high-leverage firms.

[11] $\frac{15.32}{160.94} = 9.51\%$ for the all-in spread drawn and $\frac{3.3}{22.62} = 14.59\%$ for the all-in spread undrawn.

Table 6
Dynamic effects.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is BANKRUPTCY, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for AFTER × DEREGULATION INDEX and AFTER × DEREGULATION INDEX × HIGH LEVERAGE. AFTER is a dummy variable that takes a value of 1 in the years after the introduction of the IBBEA in a state and a value of 0 otherwise (the relevant years are indicated within brackets). The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)
HIGH LEVERAGE	0.023***	0.014***
	(0.002)	(0.002)
AFTER [0; 1] × DEREGULATION INDEX	0.001**	0.001
	(0.001)	(0.001)
AFTER [0; 1] × DEREGULATION INDEX × HIGH LEVERAGE	−0.002	−0.001
	(0.001)	(0.001)
AFTER [2; 3] × DEREGULATION INDEX	−0.002*	−0.002**
	(0.001)	(0.001)
AFTER [2; 3] × DEREGULATION INDEX×HIGH LEVERAGE	0.007***	0.009***
	(0.002)	(0.002)
AFTER [4; 5] × DEREGULATION INDEX	−0.003***	−0.003***
	(0.001)	(0.001)
AFTER [4; 5] × DEREGULATION INDEX × HIGH LEVERAGE	0.011***	0.011***
	(0.002)	(0.002)
AFTER [6; 7] × DEREGULATION INDEX	0.000	−0.001
	(0.001)	(0.001)
AFTER [6; 7] × DEREGULATION INDEX × HIGH LEVERAGE	0.006***	0.007***
	(0.001)	(0.001)
AFTER [8; +∞) × DEREGULATION INDEX	0.002**	0.001
	(0.001)	(0.001)
AFTER [8; +∞) × DEREGULATION INDEX × HIGH LEVERAGE	−0.002*	−0.001
	(0.001)	(0.001)
NET INCOME		−0.024***
		(0.008)
SALES GROWTH		0.001
		(0.001)
SIZE		0.004***
		(0.000)
CAPEX		0.032***
		(0.012)
MB		−0.000**
		(0.000)
TANGIBILITY		−0.005
		(0.004)
DIVIDEND		0.052*
		(0.028)
CASH FLOW		−0.015*
		(0.009)
AGE		0.002**
		(0.001)
EXRET		−0.018***
		(0.002)
SIGMA		0.547***
		(0.058)
$\beta_2 + \beta_3$ [0; 1]	−0.001	−0.000
$\beta_2 + \beta_3$ [2; 3]	0.005***	0.007***
$\beta_2 + \beta_3$ [4; 5]	0.008***	0.008***
$\beta_2 + \beta_3$ [6; 7]	0.006***	0.007***
$\beta_2 + \beta_3$ [8; +∞)	−0.000	0.000
Observations	92,678	78,000
R^2	0.020	0.054
State FE	YES	YES
Industry × Year FE	YES	YES

by estimating the following difference-in-differences model:

$$\begin{aligned} COVENANT_{p,b,i,t} = {} & \beta_1 HIGH\ LEVERAGE_{i,t-1} \\ & + \beta_2 DEREGULATION\ INDEX_{i,t-1} \\ & + \beta_3 DEREGULATION\ INDEX_{i,t-1} \\ & \times HIGH\ LEVERAGE_{i,t-1} \\ & + \boldsymbol{X}_{i,t-1}\delta + \boldsymbol{Y}_p\lambda + \alpha_s + \alpha_{j,t} + \alpha_b + \alpha_{lp} + \epsilon_{p,b,i,t}\ , \end{aligned} \tag{3}$$

in which COVENANT is the dependent variable. We employ four alternative dependent variables: the number of covenants included in a syndicated loan package (N COVENANT), the number of financial covenants included in a syndicated loan package (N FINANCIAL COVENANT), the number of general covenants included in a syndicated loan package (N GENERAL COVENANT), or the probability of financial covenant violation (PVIOL) as defined in Demerjian and Owens (2016).

Table 7
Syndicated loan pricing.
This table reports the estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variables are LN AISD and LN AISU. $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. Variables definitions are reported in Table 1. The sample period ranges from 1987 to 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors clustered at the state level in parentheses.

	LN AISD		LN AISU	
	(1)	(2)	(3)	(4)
HIGH LEVERAGE	0.243***	0.216***	0.176***	0.157***
	(0.022)	(0.020)	(0.019)	(0.016)
DEREGULATION INDEX	−0.006	−0.003	−0.015	−0.014**
	(0.009)	(0.007)	(0.009)	(0.007)
DEREGULATION INDEX × HIGH LEVERAGE	0.027***	0.025***	0.035***	0.036***
	(0.009)	(0.007)	(0.010)	(0.009)
NET INCOME	−0.024	−0.024	−0.194*	−0.130
	(0.082)	(0.086)	(0.101)	(0.105)
SALES GROWTH	0.016	0.027**	0.006	0.010
	(0.012)	(0.013)	(0.014)	(0.013)
SIZE	−0.112***	−0.104***	−0.068***	−0.062***
	(0.009)	(0.008)	(0.010)	(0.006)
CAPEX	−0.246	−0.170	−0.017	0.029
	(0.152)	(0.146)	(0.130)	(0.126)
MB	−0.005**	−0.006***	−0.006**	−0.005**
	(0.002)	(0.002)	(0.003)	(0.002)
TANGIBILITY	−0.153**	−0.034	−0.103	−0.001
	(0.068)	(0.050)	(0.077)	(0.062)
DIVIDEND	−3.761***	−2.886***	−3.714***	−3.180***
	(0.510)	(0.480)	(0.547)	(0.504)
CASH FLOW	−0.290***	−0.303**	−0.169	−0.276**
	(0.105)	(0.118)	(0.127)	(0.129)
AGE	−0.062***	−0.049***	−0.045***	−0.040***
	(0.014)	(0.013)	(0.014)	(0.013)
EXRET	−0.026	−0.026*	0.004	0.016
	(0.019)	(0.015)	(0.014)	(0.013)
SIGMA	2.807***	2.598***	2.012***	1.886***
	(0.447)	(0.422)	(0.375)	(0.406)
LN AMOUNT	−0.106***	−0.103***	−0.098***	−0.090***
	(0.010)	(0.008)	(0.007)	(0.006)
LN MATURITY	0.041***	−0.029***	0.197***	0.024
	(0.011)	(0.010)	(0.010)	(0.017)
SECURED	0.572***	0.410***	0.436***	0.363***
	(0.023)	(0.016)	(0.018)	(0.015)
SOLE LENDER	−0.097***	−0.095***	−0.254***	−0.222***
	(0.019)	(0.015)	(0.026)	(0.020)
SYNDICATE SIZE	−0.006***	−0.003***	−0.003**	−0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
LEAD SIZE	0.005	−0.014	−0.013	−0.028
	(0.022)	(0.016)	(0.026)	(0.025)
$\beta_2 + \beta_3$	0.021***	0.022***	0.020	0.022**
Observations	24,725	24,360	14,426	14,164
R^2	0.740	0.807	0.736	0.788
State FE	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES
Lender FE	NO	YES	NO	YES
Loan Type FE	NO	YES	NO	YES
Loan Purpose FE	NO	YES	NO	YES

$\boldsymbol{Y}_f$ is a vector of syndicated loan package-level controls.

The results are reported in Table 8. The interaction term between DEREGULATION INDEX and HIGH LEVERAGE on the overall number of covenants is positive and statistically significant at the 1% level. Interestingly, this is driven by the number of general covenants, rather than financial ones. General covenants may force the borrower to use the proceeds from new equity or debt issues, or any excess cash flow, to prepay or repay the existing debt. They can also limit the distribution of dividends. The economic significance of full deregulation for high-leverage firms with respect to low-leverage firms is a 0.504 increase in N COVENANT and a 0.516 increase in N GENERAL COVENANT.[12,13] These effects are non-negligible as they are equivalent to 15.01% and 24.16% in the number of covenants and the

[12] The impact of full deregulation on N COVENANT for low-leverage firms is $\beta_2 \times 4 = 0.042 \times 4 = 0.168$, and it is $(\beta_2 + \beta_3) \times 4 = (0.042 + 0.126) \times 4 = 0.672$ for high-leverage firms. The values of β_2 and β_3 are taken from Model 2 in Table 8. The deregulation index value of 4 denotes the highest level of deregulation.

[13] The impact of full deregulation on N GENERAL COVENANT for low-leverage firms is $\beta_2 \times 4 = 0.001 \times 4 = 0.004$, and it is $(\beta_2 + \beta_3) \times 4 = (0.001 + 0.129) \times 4 = 0.52$ for high-leverage firms. The values of β_2 and β_3 are taken from Model 6 in Table 8. The deregulation index value of 4 denotes the highest level of deregulation.

Table 8
Syndicated loan covenants.
This table reports the estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variables are N COVENANT, N FINANCIAL COVENANT, N GENERAL COVENANT, and PVIOL. $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. Variables definitions are reported in Table 1. The sample period ranges from 1987 to 2007 in columns (1) to (6), and it ranges from 1995 to 2007 in columns (7) and (8). *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors clustered at the state level in parentheses.

	N COVENANT		N FINANCIAL COVENANT		N GENERAL COVENANT		PVIOL	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HIGH LEVERAGE	0.093	0.071	0.024	0.042	0.069	0.029	0.201***	0.179***
	(0.103)	(0.085)	(0.048)	(0.048)	(0.078)	(0.063)	(0.020)	(0.020)
DEREGULATION INDEX	0.013	0.042	0.032*	0.041**	−0.019	0.001	0.002	0.001
	(0.043)	(0.040)	(0.018)	(0.018)	(0.030)	(0.029)	(0.009)	(0.011)
DEREGULATION INDEX × HIGH LEVERAGE	0.138***	0.126***	−0.005	−0.003	0.143***	0.129***	0.000	0.008
	(0.048)	(0.044)	(0.020)	(0.022)	(0.032)	(0.027)	(0.007)	(0.008)
NET INCOME	−1.421***	−1.472***	−0.232	−0.333*	−1.189***	−1.139***	−0.143	−0.092
	(0.456)	(0.452)	(0.186)	(0.168)	(0.400)	(0.375)	(0.133)	(0.129)
SALES GROWTH	0.131**	0.094*	0.057**	0.058**	0.074*	0.036	0.019	0.010
	(0.053)	(0.054)	(0.024)	(0.029)	(0.038)	(0.039)	(0.013)	(0.012)
SIZE	−0.570***	−0.387***	−0.256***	−0.179***	−0.314***	−0.208***	−0.012	−0.016*
	(0.054)	(0.045)	(0.020)	(0.016)	(0.039)	(0.033)	(0.008)	(0.010)
CAPEX	−0.176	0.333	0.189	0.284	−0.366	0.049	0.379***	0.381**
	(0.732)	(0.507)	(0.305)	(0.251)	(0.506)	(0.359)	(0.129)	(0.145)
MB	−0.018*	−0.015*	−0.008**	−0.005	−0.010	−0.010	−0.001	−0.001
	(0.010)	(0.008)	(0.003)	(0.003)	(0.008)	(0.006)	(0.002)	(0.001)
TANGIBILITY	0.418	0.455	0.295*	0.282**	0.123	0.173	−0.198***	−0.214***
	(0.386)	(0.279)	(0.152)	(0.130)	(0.272)	(0.200)	(0.064)	(0.065)
DIVIDEND	−7.409***	−3.369**	−3.493***	−2.539***	−3.916***	−0.830	−0.559	−0.877*
	(1.530)	(1.594)	(0.785)	(0.579)	(1.162)	(1.494)	(0.427)	(0.483)
CASH FLOW	2.984***	2.332***	1.121***	0.956***	1.863***	1.376***	−0.291*	−0.352**
	(0.625)	(0.600)	(0.210)	(0.206)	(0.564)	(0.489)	(0.154)	(0.152)
AGE	−0.094**	−0.017	0.033	0.054***	−0.127***	−0.071**	0.025***	0.022**
	(0.042)	(0.043)	(0.023)	(0.020)	(0.038)	(0.034)	(0.009)	(0.009)
EXRET	0.109*	0.112**	0.064***	0.054**	0.045	0.057	−0.029**	−0.040***
	(0.064)	(0.054)	(0.024)	(0.021)	(0.049)	(0.043)	(0.012)	(0.011)
SIGMA	−9.355***	−6.041***	−5.810***	−3.843***	−3.545**	−2.198	0.877	0.754
	(1.744)	(1.745)	(0.776)	(0.718)	(1.439)	(1.602)	(0.616)	(0.644)
LN AMOUNT	0.452***	0.262***	0.066***	0.042**	0.385***	0.220***	−0.021*	−0.016
	(0.043)	(0.044)	(0.021)	(0.021)	(0.027)	(0.026)	(0.011)	(0.013)
LN MATURITY	0.528***	0.397***	0.169***	0.142***	0.359***	0.255***	0.014	0.006
	(0.058)	(0.035)	(0.019)	(0.016)	(0.043)	(0.022)	(0.010)	(0.014)
SECURED	2.326***	2.145***	0.437***	0.437***	1.889***	1.708***	0.108***	0.123***
	(0.090)	(0.064)	(0.050)	(0.035)	(0.059)	(0.050)	(0.017)	(0.013)
SOLE LENDER	−1.177***	−1.069***	−0.139***	−0.105***	−1.038***	−0.965***	−0.059**	−0.040
	(0.076)	(0.078)	(0.026)	(0.029)	(0.059)	(0.059)	(0.023)	(0.025)
SYNDICATE SIZE	0.048***	0.046***	0.024***	0.021***	0.024***	0.025***	−0.001	−0.001
	(0.005)	(0.005)	(0.002)	(0.002)	(0.004)	(0.004)	(0.001)	(0.001)
LEAD SIZE	−0.091	−0.080	−0.006	0.008	−0.084	−0.088	−0.034**	−0.017
	(0.106)	(0.109)	(0.036)	(0.040)	(0.077)	(0.077)	(0.016)	(0.019)
$\beta_2 + \beta_3$	0.151***	0.168***	0.027	0.038*	0.124***	0.130***	0.002	0.009
Observations	14,092	13,638	14,092	13,638	14,092	13,638	5680	5443
R^2	0.588	0.675	0.518	0.614	0.573	0.660	0.464	0.535
State FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Lender FE	NO	YES	NO	YES	NO	YES	NO	YES
Loan Purpose FE	NO	YES	NO	YES	NO	YES	NO	YES

number of general covenants, respectively.[14] Finally, the interaction term influences positively PVIOL, but it is not statistically significant. A possible explanation for this finding is that PVIOL can only be reliably computed from 1995 onwards,[15] which means that the test cannot rely on a pre-treatment period since this was the first year of the IBBEA implementation.

3.2. Heterogeneous effects

In this section, we explore the heterogeneous effects of short- and long-term debt on bankruptcy rates. We also explore the effects of banking deregulation on financially constrained firms.

3.2.1. Short- and long-term leverage

This subsection studies the characteristics of firm's debt that may explain the differential impact of banking deregulation on firms with high levels of financial leverage. The focus is on the maturity dimension of leverage. We provide evidence that roll-over risk is a channel through which banking competition increases the bankruptcy risk of

[14] Applying these changes to the sample average in Table 2 of N COVENANT (3.357) and N GENERAL COVENANT (2.136), we obtain an increase of $\frac{0.504}{3.357}$ = 15.01% for N COVENANT and $\frac{0.516}{2.136}$ = 24.16% for N GENERAL COVENANT.

[15] The authors of the study by Demerjian and Owens (2016) have provided PVIOL data on a dedicated website, but only for the period starting from 1995.

Table 9
Bankruptcy, short-term financial leverage and banking competition.
This table reports estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variable is BANKRUPTCY. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)
HIGH LEVERAGE	0.007***	−0.002
	(0.002)	(0.003)
DEREGULATION INDEX	−0.001	−0.001
	(0.001)	(0.001)
HIGH LEVERAGE × DEREGULATION INDEX	0.003***	0.003***
	(0.001)	(0.001)
PROPORTION SHORT DEBT	0.011***	−0.000
	(0.001)	(0.002)
HIGH LEVERAGE × PROPORTION SHORT DEBT	0.063***	0.051***
	(0.007)	(0.007)
DEREGULATION INDEX × PROPORTION SHORT DEBT	−0.001	−0.000
	(0.001)	(0.001)
DEREGULATION INDEX × HIGH LEVERAGE × PROPORTION SHORT DEBT	0.007	0.009**
	(0.004)	(0.004)
NET INCOME		−0.019**
		(0.008)
SALES GROWTH		0.002*
		(0.001)
SIZE		0.005***
		(0.000)
CAPEX		0.027**
		(0.012)
MB		−0.000**
		(0.000)
TANGIBILITY		0.004
		(0.004)
DIVIDEND		0.023
		(0.038)
CASH FLOW		−0.028***
		(0.009)
AGE		0.001
		(0.001)
EXRET		−0.020***
		(0.002)
SIGMA		0.528***
		(0.061)
Observations	79,663	67,280
R^2	0.032	0.064
State FE	YES	YES
Industry × Year FE	YES	YES

firms. To this end, we estimate the following difference-in-differences linear probability model:

$$\begin{aligned} BANKRUPTCY_{i,t} = {} & \beta_1 HIGH\ LEVERAGE_{i,t-1} + \beta_2 DEREGULATION\ INDEX_{i,t-1} \\ & + \beta_3 DEREGULATION\ INDEX_{i,t-1} \times HIGH\ LEVERAGE_{i,t-1} \\ & + \beta_4 PROPORTION\ SHORT\ DEBT_{i,t-1} \\ & + \beta_5 HIGH\ LEVERAGE_{i,t-1} \times PROPORTION\ SHORT\ DEBT_{i,t-1} \\ & + \beta_6 DEREGULATION\ INDEX_{i,t-1} \times PROPORTION\ SHORT\ DEBT_{i,t-1} \\ & + \beta_7 DEREGULATION\ INDEX_{i,t-1} \times HIGH\ LEVERAGE_{i,t-1} \\ & \times PROPORTION\ SHORT\ DEBT_{i,t-1} \\ & + \boldsymbol{X_{i,t-1}}\delta + \alpha_s + \alpha_{j,t} + \epsilon_{i,t}\ , \end{aligned} \tag{4}$$

in which PROPORTION SHORT DEBT is the ratio of short-term debt with maturity that is equal to or lower than one year to total debt.

Table 9 shows the results. It might be surprising that the coefficient of HIGH LEVERAGE as a standalone variable is negative. This means that bankruptcy risk is lower for high-leverage firms with low short-term debt before deregulation. The implication is that high leverage, if stripped from roll-over risk, may signal high creditworthiness. As expected, the largest positive effect on bankruptcy rates (0.051) is associated with high-leverage firms that have a high proportion of short-term debt (Model 2). An increase in the proportion of short-term debt further increases the bankruptcy risk of high-leverage firms after deregulation.

In Fig. 3, we plot the marginal effects of DEREGULATION INDEX on BANKRUPTCY for different levels of PROPORTION SHORT DEBT. Deregulation does not increase bankruptcy rates for low-leverage firm. The effect of deregulation on the bankruptcy rate of high-leverage firms is associated with an increase in the proportion of short-term debt. These results are in line with those of He and Xiong (2012), who documented the riskiness of short-term debt that is due to roll-over risk. We find that roll-over risk is amplified by banking competition in the subset of firms with high debt.

3.2.2. Financial constraints

We also explore the differential impact of banking deregulation on financially constrained firms. The model that we use for this analysis is the following extension of Eq. (1):

$$\begin{aligned} BANKRUPTCY_{i,t} = {} & \beta_1 HIGH\ LEVERAGE_{i,t-1} + \beta_2 DEREGULATION\ INDEX_{i,t-1} \\ & + \beta_3 DEREGULATION\ INDEX_{i,t-1} \times HIGH\ LEVERAGE_{i,t-1} \\ & + \beta_4 FIN\ CONSTRAINT\ INDEX_{i,t-1} \\ & + \beta_5 DEREGULATION\ INDEX_{i,t-1} \times HIGH\ LEVERAGE_{i,t-1} \\ & \times FIN\ CONSTRAINT\ INDEX_{i,t-1} \\ & + \boldsymbol{X_{i,t-1}}\delta + \alpha_s + \alpha_{j,t} + \epsilon_{i,t}\ , \end{aligned} \tag{5}$$

in which FIN CONSTRAINT INDEX is a firm- and time-specific dummy that takes a value of 1 if the firm is financially constrained. Specifically,

Table 10
Bankruptcy, financial leverage, banking competition and financial constraints.
This table reports estimated coefficients for fixed effect panel regressions. The sum of the regression coefficients for DEREGULATION INDEX, DEREGULATION INDEX × HIGH LEVERAGE and DEREGULATION INDEX × HIGH LEVERAGE × FIN CONSTRAINT INDEX is $\beta_2 + \beta_3 + \beta_5$. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HIGH LEVERAGE	0.023***	0.013***	0.016***	0.012***	0.025***	0.013***	0.024***	0.013***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
DEREGULATION INDEX	−0.000	−0.001	−0.000	−0.001	−0.000	−0.001	−0.000	−0.001
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
DEREGULATION INDEX × HIGH LEVERAGE	0.000	0.001	−0.001*	−0.002**	0.002**	0.003***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NODIV	0.004***	−0.003*						
	(0.001)	(0.002)						
DEREGULATION INDEX × HIGH LEVERAGE × NODIV	0.005***	0.006***						
	(0.001)	(0.001)						
HIGH KZ INDEX			0.020***	0.007***				
			(0.002)	(0.001)				
DEREGULATION INDEX × HIGH LEVERAGE × HIGH KZ INDEX			0.007***	0.010***				
			(0.001)	(0.001)				
HIGH WW INDEX					0.013***	−0.009***		
					(0.002)	(0.002)		
DEREGULATION INDEX × HIGH LEVERAGE × HIGH WW INDEX					0.005***	0.006***		
					(0.002)	(0.002)		
HIGH HP INDEX							0.007***	−0.014***
							(0.002)	(0.002)
DEREGULATION INDEX × HIGH LEVERAGE × HIGH HP INDEX							−0.000	−0.000
							(0.001)	(0.001)
NET INCOME		−0.024***		−0.021***		−0.026***		−0.024***
		(0.008)		(0.008)		(0.009)		(0.008)
SALES GROWTH		0.001		0.001		0.001		0.001
		(0.001)		(0.001)		(0.001)		(0.001)
SIZE		0.004***		0.004***		0.003***		0.002***
		(0.000)		(0.000)		(0.000)		(0.000)
CAPEX		0.031***		0.035***		0.028**		0.028**
		(0.011)		(0.012)		(0.012)		(0.011)
MB		−0.000**		−0.000**		−0.000**		−0.000**
		(0.000)		(0.000)		(0.000)		(0.000)
TANGIBILITY		−0.005		−0.015***		−0.004		−0.004
		(0.004)		(0.004)		(0.004)		(0.004)
DIVIDEND		0.039		0.107***		0.037		0.061**
		(0.027)		(0.028)		(0.029)		(0.027)
CASH FLOW		−0.015*		−0.014		−0.016		−0.016*
		(0.009)		(0.009)		(0.010)		(0.009)
AGE		0.002**		0.002**		0.002**		0.002***
		(0.001)		(0.001)		(0.001)		(0.001)
EXRET		−0.019***		−0.019***		−0.019***		−0.019***
		(0.002)		(0.002)		(0.002)		(0.002)
SIGMA		0.546***		0.524***		0.557***		0.568***
		(0.058)		(0.058)		(0.062)		(0.060)
$\beta_2 + \beta_3 + \beta_5$	0.005***	0.006***	0.006***	0.007***	0.007***	0.008***	0.003**	0.003***
Observations	92,464	77,986	78,027	75,100	80,092	77,771	92,678	78,000
R^2	0.019	0.054	0.027	0.055	0.023	0.054	0.019	0.054
State FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES	YES	YES	YES	YES

we consider a firm to be financially constrained in a specific year if (1) it does not distribute dividend (NODIV = 1), (2) it is in the top tercile of the (Kaplan and Zingales, 1997) index that is calculated by using the coefficients that were estimated by Lamont et al. (2001) (HIGH KZ INDEX = 1), (3) it is in the top tercile of the Whited and Wu (2006) and Hennessy and Whited (2007) index (HIGH WW INDEX = 1) or (4) it is in the top tercile of the (Hadlock and Pierce, 2010) index (HIGH HP INDEX = 1). We use different indicators because no single measure can ensure the precise identification of financially constrained firms (Farre-Mensa and Ljungqvist, 2015).

Table 10 reports the results. The triple interaction term for NODIV, HIGH KZ INDEX and HIGH WW INDEX is positive and statistically significant, while the triple interaction term with HIGH HP INDEX is not statistically significant. More importantly, the sum of β_2, β_3 and β_5 is always statistically significant in all specifications. Taken together, these results confirm that banking deregulation increases bankruptcy rates of firms that are more financially constrained. Our results show that when deregulation occurs, financially constrained firms are unable to grow. These results are in line with the evidence from Berger et al. (2020).

4. Robustness tests

We run a battery of tests to confirm the validity of our results. One problem is that deregulation might impact firms' financial leverage, which then impacts the bankruptcy rate. To address this problem, we follow an approach similar to Giroud and Mueller (2017). We create HIGH LEVERAGE BEFORE DEREGULATION that is equal to the last value of HIGH LEVERAGE before the implementation of IBBEA. Table A.1 reports the results which confirm our findings.

In all regressions the dependent variable is BANKRUPTCY. We validate our main results by employing a different variable capturing firms' credit risk. Specifically, we perform the baseline regression using DOWNGRADE as dependent variable. DOWNGRADE is a dummy that takes a value of 1 if the S&P Domestic Long Term Issuer Credit Rating experiences a downgrade from the previous year and 0 otherwise. Table A.2 reports the number of firm-year observations and frequency of S&P Domestic Long Term Issuer Credit Rating. Table A.3 shows the results that confirm that the credit rating deteriorates for highly leveraged firms after deregulation.

Most of the IBBEA changes occurred between 1993 and 2001 (Fig. 1). We run the main regressions only for this restricted period, and we do not observe any substantial change in the baseline results (see Table A.4). In order to rule out the conjecture that our results are driven by the bankruptcies of tech firms during the dot-com bubble, we run the baseline and the dynamic regressions after excluding firms with a three-digit SIC code of 737 (i.e. computer programming, data processing and other computer-related services). The results are displayed in Table A.5, and they confirm our baseline findings.

In the main specification, we employ state fixed effects and industry-by-year fixed effects. In Table A.6, we re-estimate the baseline model by using different fixed effects combinations. All combinations confirm the main results.

In the regression analysis that we have discussed so far, we cluster standard errors at the state level because the intensity of banking competition is strongly autocorrelated within states (Krishnan et al., 2014). However, since bankruptcy events may not be independent over time (Shumway, 2001), we also explore whether clustering the standard errors at the firm level may significantly change our inferences. We find that our main results and our conclusions hold. In addition, we also calculate robust standard errors that are double-clustered at the state and the firm level. Double-clustering does not change the statistical significance of our findings. The results are reported in Table A.7.

In order to ensure that our results are not driven by the deregulation process in a specific US state, we replicate the main results by excluding one state at the time. We plot the coefficients of the interaction term for DEREGULATION INDEX and HIGH LEVERAGE in Fig. A.1. We also exclude California and Texas (the largest states) and Delaware and South Dakota (see Table A.8). In all these cases, our results are robust to the changes.

We also use an alternative definition of the banking competition indicator. We run Eq. (1) with DEREGULATION DUMMY and DEREGULATION RECIPROCITY INDEX instead of DEREGULATION INDEX. Table A.9 shows that our main results are robust to these alternative definitions of deregulation.

We also test the robustness of our results to the threshold that is used to define high-leverage firms. In Table A.10, we employ LEVERAGE TERCILE and LEVERAGE QUINTILE, which identify the terciles and quintiles, respectively, of LEVERAGE. The results hold regardless of the threshold that is used, with the highest tercile and quintile exhibiting the strongest effects.

The IBBEA has been used in several academic papers to investigate the impact of banking deregulation on several economic dimensions. Heath et al. (2023) pointed out that when the same experiment is reused many times, the probability of producing false positives increases. To address this issue, we employ the (Romano and Wolf, 2005, 2016) procedure for joint hypothesis testing. We include all control variables and BANKRUPTCY as dependent variables in the test in order to ensure that our results are not driven by the effect of banking deregulation on the financial ratios of firms. In other words, we want to rule out the possibility that the impact of banking deregulation on the bankruptcies of high-leverage firms is due solely to the deterioration of their financial ratios. In Table A.11, we report p-values for DEREGULATION INDEX and DEREGULATION INDEX*HIGH LEVERAGE which are calculated in line with the (Romano and Wolf, 2005, 2016) procedure. The p-values of the interaction term are always below 0.05, which supports our main findings.

Our baseline regression is a standard difference-in-difference model. Recent papers have shown that difference-in-difference models might yield biased average treatment effects (Goodman-Bacon, 2021). For this reason, we estimate the average treatment effect by using the estimator of de Chaisemartin and D'Haultfœuille (2020). We report the results in Fig. A.2. They confirm that banking deregulation increases bankruptcy risk for highly leveraged firms. Moreover, the findings from this robustness test confirm the dynamic effects that are reported in Table 6.

We check whether the statistical significance of the interaction term of interest in Eq. (1), that is, DEREGULATION INDEX*HIGH LEVERAGE, is not due to pure luck. We design a placebo experiment in which we shuffle DEREGULATION INDEX at random and irrespectively of the date of observation. We repeat the experiment 1000 times, and plot the coefficient of the interaction term in Fig. A.3. The placebo experiment clearly shows that the results of Table 4 are not random.

Finally, we test whether our results can be explained by a change in relationship lending occurring with bank deregulation. Given that we are studying public firms, our initial step is to find evidence corroborating the importance of relationship lending for public firms. Indeed, there are several reasons why this may not be the case. First, public firms have, on average, lower credit risk than private firms. Second, they provide detailed financial reports to creditors for evaluating their credit risk, thus reducing informational asymmetries. Third, they have relationships with multiple lenders. Fourth, they have establishments across multiple states (García and Norli, 2012) and are less restricted to borrowing only from banks with branches located in the same state as the firm headquarter.[16]

To address these issues, we perform a regression in the spirit of Chodorow-Reich (2014). Specifically, for each sample year we consider all borrowers in the Dealscan database who have syndicated loan facilities at any time during the year. For consistency with our previous models (see Eq. (2)), we include only the following facilities: credit lines, term loans, bridge loans, and letters of credit. For each borrower and each sample year, we then consider all lenders who are active in the syndicated loan market during that year and identify those who have a relationship with the borrower. A lender is defined as "active" if it participates in at least one syndicated loan facility during the year. This results in 14,492,774 possible borrower–lender yearly connections in the period of analysis on which we perform the following regression:

$$\begin{aligned} RELATIONSHIP_{b,i,t} = {} & \beta_1 HIGH\ LEVERAGE_{i,t-1} + \beta_2 DEREGULATION\ INDEX_{i,t-1} \\ & + \beta_3 DEREGULATION\ INDEX_{i,t-1} \times HIGH\ LEVERAGE_{i,t-1} \\ & + \beta_4 PREVIOUS\ RELATIONSHIP_{b,i,t} \\ & + \beta_5 HIGH\ LEVERAGE_{i,t-1} \times PREVIOUS\ RELATIONSHIP_{b,i,t} \\ & + \beta_6 DEREGULATION\ INDEX_{i,t-1} \times PREVIOUS\ RELATIONSHIP_{b,i,t} \\ & + \beta_7 DEREGULATION\ INDEX_{i,t-1} \times HIGH\ LEVERAGE_{i,t-1} \\ & \times PREVIOUS\ RELATIONSHIP_{b,i,t} \\ & + \boldsymbol{X_{i,t-1}}\delta + \alpha_s + \alpha_{j,t} + \alpha_b + \epsilon_{b,i,t}, \end{aligned} \tag{6}$$

in which RELATIONSHIP is the dependent variable that can be either a dummy that takes the value of 1 if in a given year a lender b participates in at least one syndicated loan facility issued to firm i in any form and 0 otherwise (LOAN PARTICIPANT) or a dummy that takes the value of 1 if in a given year a lender b participates in at least one syndicated loan facility issued to firm i as lead arranger and 0 otherwise (LEAD ARRANGER). PREVIOUS RELATIONSHIP is the independent variable that can be either a dummy that takes the value of 1 if in the previous

[16] We thank an anonymous reviewer for these comments.

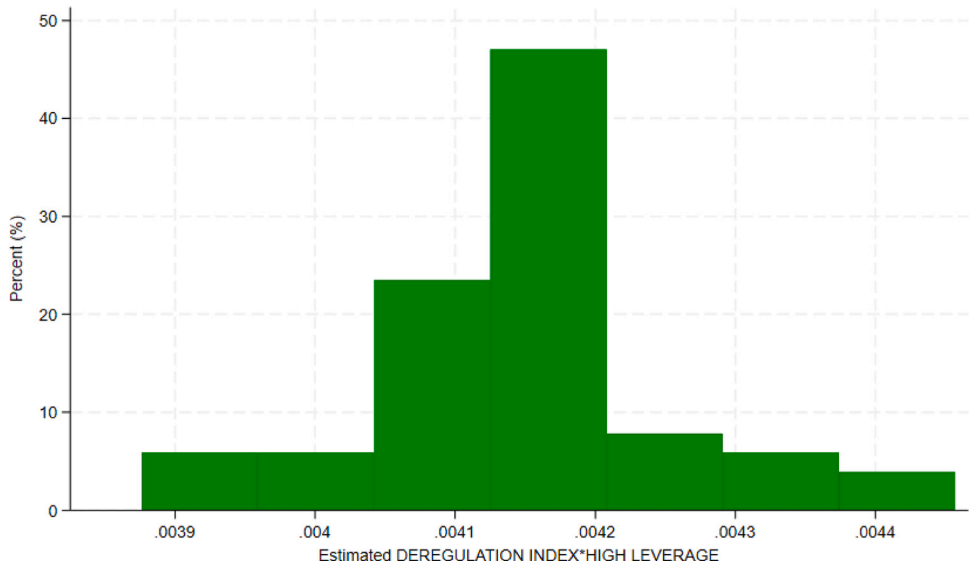

Fig. A.1. Sensitivity analysis for β_3 in Eq. (1). This figure presents the distribution of the estimates of β_3 in Eq. (1) with one state excluded at a time.

five years a lender b participated in at least one syndicated loan facility issued to firm i in any form and 0 otherwise (PREVIOUS PARTICIPANT) or a dummy that takes the value of 1 if in the previous five years a lender b participated in at least one syndicated loan facility issued to firm i as lead arranger and 0 otherwise (PREVIOUS LEAD).

Table A.12 shows that previous relationships positively influence the probability of establishing a future lending relationship. We find that the relationships between banks and firms in the syndicated loan market remain statistically significant for all firms, although slightly weaker after deregulation. This result is consistent with the literature on the importance of relationship lending in the syndicated loan market for public firms (Bharath et al., 2011; Dass and Massa, 2011; Chodorow-Reich, 2014, and Giometti, 2022). However, deregulation does not seem to affect differently the relationship lending of low- and high-leverage firms. Thus, the evidence rules out this alternative channel for explaining our results for the effects of deregulation on high-leverage firms.

5. Conclusion

In this paper, we examine the impact of banking competition on corporate credit risk. In particular, we focus on the effects of the staggered implementation of the IBBEA on the probability of corporate bankruptcy. We find the effect of the introduction of IBBEA to be heterogeneous. Firms with high financial leverage experience an increase in their bankruptcy risk following deregulation. The magnitude of the increase is non-trivial: in our main estimation model, the implementation of the IBBEA increases the probability of high-leverage firms becoming bankrupt by 1.6%. The effect is durable, fading away only seven years after deregulation. We show that the increase in the probability of bankruptcy is more pronounced for high-leverage firms that rely more extensively on short-term debt and for financially constrained firms. This suggests that banking competition may exacerbate roll-over risk for those firms.

To better understand our results, we test a cost of borrowing mechanism related to Petersen and Rajan's (1995) theory, in which banking competition increases the cost of borrowing for risky borrowers. Accordingly, we note an increase in both the spreads and the number of general covenants of syndicated loans for high-leverage firms following deregulation.

Banking competition has been viewed as a positive driver of economic growth because it expands access to credit for firms. It has also been associated with higher corporate entry rates (Kerr and Nanda, 2009), higher corporate productivity (Krishnan et al., 2014) and superior lending conditions for small businesses (Rice and Strahan, 2010). We show that increased banking competition can have adverse effects on firms with high financial leverage. This has important implications for regulators and policymakers because competition between banks can have unintended consequences. Firms that are more dependent on the credit markets, particularly those which are expected to benefit the most from bank competition, could, in fact, be penalized.

CRediT authorship contribution statement

Lara Cathcart: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Alfonso Dufour:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ludovico Rossi:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Simone Varotto:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Data availability

Data will be made available on request.

Appendix

See Figs. A.1–A.3 and Tables A.1–A.12.

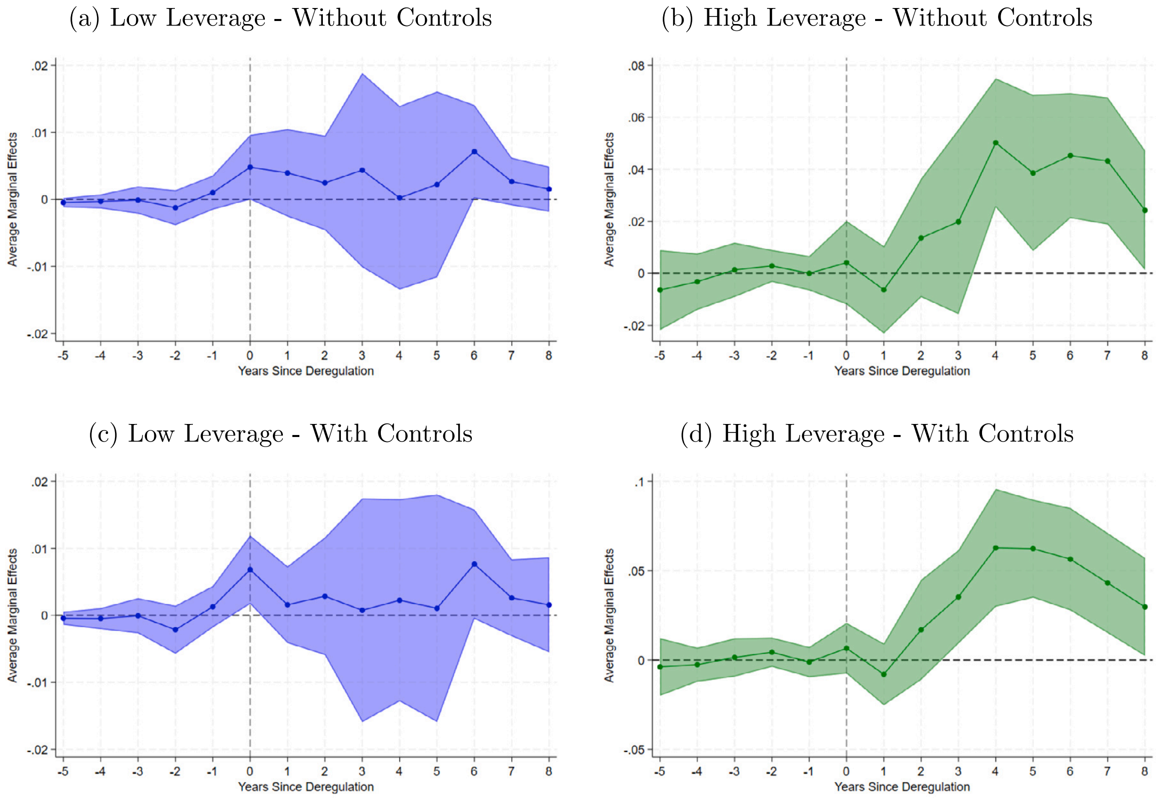

Fig. A.2. Average treatment effect of banking deregulation.
This figure reports the average treatment effects of banking deregulation, which is estimated in line with the de Chaisemartin and D'Haultfœuille (2020) procedure. In all specifications, following the variable definitions in de Chaisemartin and D'Haultfœuille (2020), the outcome variable is BANKRUPTCY, the group variable is the firm identifier, the time variable is years, and the treatment variable is DEREGULATION INDEX. The control variables are the same as in the baseline specification that is given in Table 4. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. The confidence intervals are plotted and calculated at the 95% level.

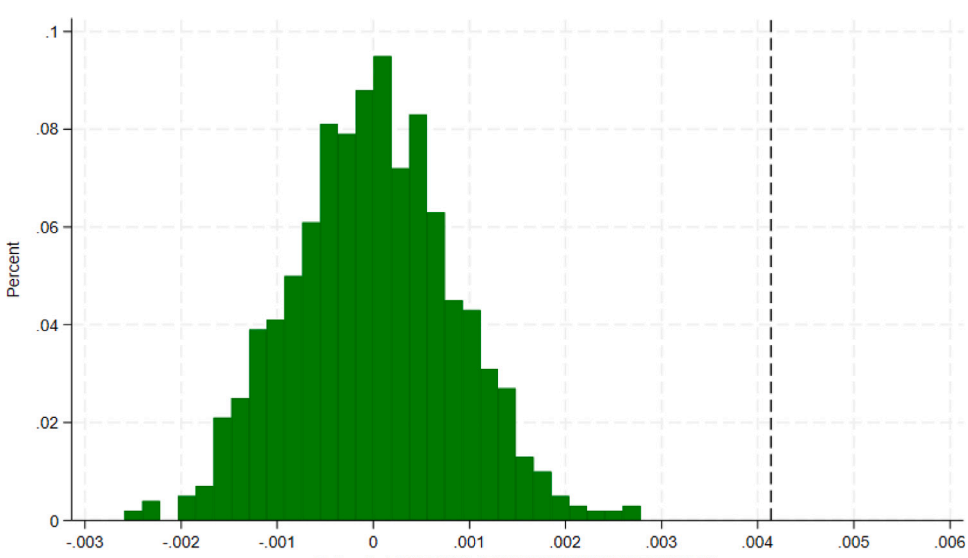

Fig. A.3. Placebo estimates.
This figure presents the placebo estimates of the beta (β_3) of the DEREGULATION INDEX × HIGH LEVERAGE variable in Eq. (1). DEREGULATION INDEX is randomly shuffled, irrespectively of the date of the observation. Eq. (1) is estimated with the new DEREGULATION INDEX. The process is repeated 1000 times. This figure displays the distribution of the estimates of β_3. The vertical line indicates the value of the coefficient of β_3 in column 14 of Table 4.

Table A.1
Bankruptcy, financial leverage and banking competition – Leverage before deregulation.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is BANKRUPTCY, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE BEFORE DEREGULATION. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. HIGH LEVERAGE BEFORE DEREGULATION is a defined as the value of HIGH LEVERAGE in the last year available before deregulation takes place. The sample period ranges from 1984 to 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)
HIGH LEVERAGE BEFORE DEREGULATION	0.011***	0.007***
	(0.001)	(0.002)
DEREGULATION INDEX	0.001*	0.000
	(0.001)	(0.000)
DEREGULATION INDEX × HIGH LEVERAGE BEFORE DEREGULATION	0.002*	0.003***
	(0.001)	(0.001)
NET INCOME		−0.025***
		(0.008)
SALES GROWTH		0.001
		(0.001)
SIZE		0.004***
		(0.000)
CAPEX		0.018
		(0.012)
MB		−0.001***
		(0.000)
TANGIBILITY		−0.000
		(0.004)
DIVIDEND		0.036
		(0.024)
CASH FLOW		−0.018**
		(0.009)
AGE		0.000
		(0.001)
EXRET		−0.020***
		(0.002)
SIGMA		0.551***
		(0.054)
$\beta_2 + \beta_3$	0.003***	0.004***
Observations	77,059	65,967
R^2	0.012	0.049
State FE	YES	YES
Industry × Year FE	YES	YES

Table A.2
S&P domestic long term issuer credit rating.
This table reports the number of firm-year observations and frequency of S&P domestic long term issuer credit rating.

Rating	Number of firm-year Obs.	Frequency (%)
AAA	197	1.04
AA+	86	0.45
AA	378	1.99
AA−	369	1.94
A+	751	3.95
A	1283	6.75
A−	927	4.88
BBB+	1093	5.75
BBB	1595	8.4
BBB−	1333	7.02
BB+	1114	5.86
BB	1777	9.35
BB−	2402	12.64
B+	2987	15.72
B	1219	6.42
B−	606	3.19
CCC+	246	1.29
CCC	116	0.61
CCC−	161	0.85
CC	70	0.37
C	9	0.05
SD and D	278	1.46

Table A.3
Downgrades, financial leverage and banking competition.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is DOWNGRADE, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. The definitions of the variables are given in Table 1. DOWNGRADE is a dummy that takes a value of 1 if the S&P Domestic Long Term Issuer Credit Rating experiences a downgrade from the previous year and 0 otherwise. The sample period ranges from 1984 to 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)
HIGH LEVERAGE	0.106***	0.064***
	(0.009)	(0.010)
DEREGULATION INDEX	−0.006	−0.006*
	(0.004)	(0.003)
DEREGULATION INDEX × HIGH LEVERAGE	0.007*	0.009***
	(0.004)	(0.003)
NET INCOME		−0.233***
		(0.075)
SALES GROWTH		−0.053***
		(0.008)
SIZE		0.038***
		(0.003)
CAPEX		−0.380***
		(0.103)
MB		−0.001**
		(0.000)
TANGIBILITY		0.062**
		(0.025)
DIVIDEND		0.591***
		(0.212)
CASH FLOW		−0.078
		(0.074)
AGE		0.014**
		(0.006)
EXRET		−0.051***
		(0.008)
SIGMA		2.308***
		(0.283)
$\beta_2 + \beta_3$	0.005**	0.005***
Observations	16,969	16,469
R^2	0.060	0.120
State FE	YES	YES
Industry × Year FE	YES	YES

Table A.4
Bankruptcy, financial leverage and banking competition – Restricted time period.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is BANKRUPTCY, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1993 and 2001. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)
HIGH LEVERAGE	0.024***	0.014***
	(0.002)	(0.002)
DEREGULATION INDEX	−0.000	−0.001
	(0.000)	(0.001)
DEREGULATION INDEX × HIGH LEVERAGE	0.003***	0.004***
	(0.001)	(0.001)
NET INCOME		−0.024***
		(0.008)
SALES GROWTH		0.001
		(0.001)
SIZE		0.004***
		(0.000)
CAPEX		0.031**
		(0.012)
MB		−0.000**
		(0.000)
TANGIBILITY		−0.004
		(0.004)
DIVIDEND		0.052*
		(0.028)

(continued on next page)

Table A.4 (*continued*).

	(1)	(2)
CASH FLOW		−0.015
		(0.009)
AGE		0.002**
		(0.001)
EXRET		−0.019***
		(0.002)
SIGMA		0.546***
		(0.059)
$\beta_2 + \beta_3$	0.003***	0.004***
Observations	92,678	78,000
R^2	0.019	0.053
State FE	YES	YES
Industry × Year FE	YES	YES

Table A.5
Bankruptcy, financial leverage and banking competition – Excluding tech firms.
This table reports the estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variable is BANKRUPTCY. $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. AFTER is a dummy variable that takes a value of 1 in the years reported in the parenthesis after the introduction of the IBBEA in a state and a value of 0 otherwise. Variable definitions are reported in Table 1. All independent variables are lagged one year. Firms are excluded if their 3-digit SIC code is 737. The sample period ranges from 1984 to 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)
HIGH LEVERAGE	0.024***	0.014***	0.023***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)
DEREGULATION INDEX	−0.000	−0.001		
	(0.000)	(0.001)		
DEREGULATION INDEX × HIGH LEVERAGE	0.003***	0.004***		
	(0.001)	(0.001)		
AFTER [0; 1] × DEREGULATION INDEX			0.001**	0.001
			(0.001)	(0.001)
AFTER [0; 1] × DEREGULATION INDEX × HIGH LEVERAGE			−0.002	−0.001
			(0.001)	(0.001)
AFTER [2; 3] × DEREGULATION INDEX			−0.002*	−0.002**
			(0.001)	(0.001)
AFTER [2; 3] × DEREGULATION INDEX × HIGH LEVERAGE			0.007***	0.009***
			(0.002)	(0.002)
AFTER [4; 5] × DEREGULATION INDEX			−0.003***	−0.003***
			(0.001)	(0.001)
AFTER [4; 5] × DEREGULATION INDEX × HIGH LEVERAGE			0.011***	0.011***
			(0.002)	(0.002)
AFTER [6; 7] × DEREGULATION INDEX			0.000	−0.001
			(0.001)	(0.001)
AFTER [6; 7] × DEREGULATION INDEX × HIGH LEVERAGE			0.006***	0.007***
			(0.001)	(0.001)
AFTER [8; +∞) × DEREGULATION INDEX			0.002**	0.001
			(0.001)	(0.001)
AFTER [8; +∞) × DEREGULATION INDEX × HIGH LEVERAGE			−0.002*	−0.001
			(0.001)	(0.001)
NET INCOME		−0.024***		−0.024***
		(0.008)		(0.008)
SALES GROWTH		0.001		0.001
		(0.001)		(0.001)
SIZE		0.004***		0.004***
		(0.000)		(0.000)
CAPEX		0.031**		0.032***
		(0.012)		(0.012)
MB		−0.000**		−0.000**
		(0.000)		(0.000)
TANGIBILITY		−0.004		−0.005
		(0.004)		(0.004)
DIVIDEND		0.052*		0.052*
		(0.028)		(0.028)
CASH FLOW		−0.015		−0.015*
		(0.009)		(0.009)
AGE		0.002**		0.002**
		(0.001)		(0.001)

(*continued on next page*)

Table A.5 (*continued*).

	(1)	(2)	(3)	(4)
EXRET		−0.019***		−0.018***
		(0.002)		(0.002)
SIGMA		0.546***		0.547***
		(0.059)		(0.058)
$\beta_2 + \beta_3$	0.003***	0.004***		
$\beta_2 + \beta_3$ [0; 1]			−0.001	−0.000
$\beta_2 + \beta_3$ [2; 3]			0.005***	0.007***
$\beta_2 + \beta_3$ [4; 5]			0.008***	0.008***
$\beta_2 + \beta_3$ [6; 7]			0.006***	0.007***
$\beta_2 + \beta_3$ [8; +∞)			−0.000	0.000
Observations	92,678	78,000	92,678	78,000
R^2	0.019	0.053	0.020	0.054
State FE	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES

Table A.6
Bankruptcy, financial leverage and banking competition – Fixed effects.
This table reports the estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variable is BANKRUPTCY. $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. Variable definitions are reported in Table 1. All independent variables are lagged one year. The sample period ranges from 1984 to 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HIGH LEVERAGE	0.014***	0.014***	0.005**	0.014***	0.014***	0.005**	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DEREGULATION INDEX	−0.001**	−0.001	−0.001*	0.000	0.000	0.002	−0.001*
	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
HIGH LEVERAGE × DEREGULATION INDEX	0.004***	0.004***	0.006***	0.004***	0.004***	0.006***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
NET INCOME	−0.021***	−0.023***	−0.017**	−0.024***	−0.024***	−0.018**	−0.017**
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
SALES GROWTH	0.001	0.001	−0.000	0.001	0.001	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
SIZE	0.004***	0.004***	−0.004***	0.004***	0.004***	−0.004***	−0.004***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
CAPEX	0.034***	0.030***	0.011	0.031**	0.030**	0.012	0.014
	(0.011)	(0.011)	(0.012)	(0.012)	(0.011)	(0.012)	(0.012)
MB	−0.000**	−0.000**	−0.000	−0.000**	−0.000**	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
TANGIBILITY	−0.003	−0.005	−0.002	−0.004	−0.005	−0.001	−0.004
	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)	(0.007)	(0.007)
DIVIDEND	0.046*	0.052*	0.059	0.052*	0.052*	0.058	0.062*
	(0.026)	(0.027)	(0.037)	(0.029)	(0.028)	(0.038)	(0.037)
CASH FLOW	−0.017**	−0.015*	−0.027***	−0.015	−0.015*	−0.026***	−0.028***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
AGE	0.001*	0.002**	0.041***	0.002**	0.002**	0.041***	0.041***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.003)
EXRET	−0.018***	−0.019***	−0.013***	−0.019***	−0.019***	−0.013***	−0.013***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
SIGMA	0.546***	0.544***	0.585***	0.545***	0.543***	0.584***	0.584***
	(0.055)	(0.059)	(0.067)	(0.059)	(0.059)	(0.067)	(0.067)
$\beta_2 + \beta_3$	0.004***	0.003***	0.005***	0.005**	0.004**	0.007***	0.005***
Observations	78,000	78,000	76,965	77,959	77,959	76,921	76,965
R^2	0.047	0.051	0.231	0.064	0.062	0.242	0.234
Firm FE	NO	NO	YES	NO	NO	YES	YES
Year FE	NO	YES	YES	NO	NO	NO	NO
State FE	NO	YES	NO	NO	NO	NO	NO
Industry FE	NO	YES	NO	NO	YES	NO	NO
State × Year FE	NO	NO	NO	YES	YES	YES	NO
Industry × Year FE	NO	NO	NO	YES	NO	NO	YES

Table A.7
Bankruptcy, financial leverage and banking competition – S.E. clustering.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is BANKRUPTCY, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the firm level in parentheses in column 1 and column 2 and robust standard errors that are double-clustered at the state and firm level in parentheses in column 3 and column 4.

	(1)	(2)	(3)	(4)
HIGH LEVERAGE	0.024***	0.014***	0.024***	0.014***
	(0.001)	(0.001)	(0.002)	(0.002)
DEREGULATION INDEX	−0.000	−0.001	−0.000	−0.001
	(0.001)	(0.001)	(0.000)	(0.001)
DEREGULATION INDEX × HIGH LEVERAGE	0.003***	0.004***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
NET INCOME		−0.024***		−0.024***
		(0.009)		(0.008)
SALES GROWTH		0.001		0.001
		(0.001)		(0.001)
SIZE		0.004***		0.004***
		(0.000)		(0.000)
CAPEX		0.031***		0.031**
		(0.011)		(0.012)
MB		−0.000***		−0.000**
		(0.000)		(0.000)
TANGIBILITY		−0.004		−0.004
		(0.004)		(0.004)
DIVIDEND		0.052**		0.052*
		(0.025)		(0.028)
CASH FLOW		−0.015		−0.015
		(0.009)		(0.009)
AGE		0.002**		0.002**
		(0.001)		(0.001)
EXRET		−0.019***		−0.019***
		(0.001)		(0.002)
SIGMA		0.546***		0.546***
		(0.037)		(0.059)
$\beta_2 + \beta_3$	0.003***	0.004***	0.003***	0.004***
Observations	92,678	78,000	92,678	78,000
R^2	0.019	0.053	0.019	0.053
State FE	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES

Table A.8
Bankruptcy, financial leverage and banking competition – Excluding states.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is BANKRUPTCY, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE. We exclude California and Texas in specifications (1) and (2) and Delaware and South Dakota in specifications (3) and (4). The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)
HIGH LEVERAGE	0.021***	0.011***	0.024***	0.014***
	(0.002)	(0.002)	(0.002)	(0.002)
DEREGULATION INDEX	−0.000	−0.001*	0.000	−0.001
	(0.000)	(0.000)	(0.000)	(0.001)
DEREGULATION INDEX × HIGH LEVERAGE	0.004***	0.005***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)
NET INCOME		−0.021**		−0.023***
		(0.010)		(0.008)
SALES GROWTH		0.000		0.001
		(0.001)		(0.001)
SIZE		0.004***		0.004***
		(0.000)		(0.000)
CAPEX		0.037**		0.029**
		(0.016)		(0.012)
MB		−0.001***		−0.000**
		(0.000)		(0.000)

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Table A.8 (*continued*).

	(1)	(2)	(3)	(4)
TANGIBILITY		−0.005		−0.004
		(0.005)		(0.004)
DIVIDEND		0.037		0.054*
		(0.024)		(0.028)
CASH FLOW		−0.016		−0.016*
		(0.012)		(0.009)
AGE		0.002**		0.002**
		(0.001)		(0.001)
EXRET		−0.019***		−0.019***
		(0.002)		(0.002)
SIGMA		0.562***		0.547***
		(0.077)		(0.059)
$\beta_2 + \beta_3$	0.004***	0.004***	0.003***	0.004***
Observations	68,049	57,584	92,256	77,635
R^2	0.019	0.052	0.019	0.053
State FE	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES

Table A.9
Bankruptcy, financial leverage and alternative indexes of banking competition.
This table reports estimated coefficients for fixed effect panel regressions. The dependent variable in all regressions is BANKRUPTCY, and $\beta_2 + \beta_3$ is the sum of the regression coefficients for DEREGULATION DUMMY and DEREGULATION DUMMY × HIGH LEVERAGE in specifications (1) and (2) and the sum of the coefficients for DEREGULATION INDEX RECIPROCITY and DEREGULATION INDEX RECIPROCITY × HIGH LEVERAGE in specifications (3) and (4). DEREGULATION INDEX RECIPROCITY is equal to DEREGULATION INDEX plus 1 if legislators impose reciprocity requirements after the implementation of the IBBEA. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)
HIGH LEVERAGE	0.020***	0.009***	0.022***	0.012***
	(0.002)	(0.002)	(0.002)	(0.002)
DEREGULATION DUMMY	−0.001	−0.003		
	(0.002)	(0.003)		
DEREGULATION DUMMY × HIGH LEVERAGE	0.014***	0.017***		
	(0.002)	(0.002)		
DEREGULATION INDEX RECIPROCITY			−0.000	−0.001*
			(0.000)	(0.000)
DEREGULATION INDEX RECIPROCITY × HIGH LEVERAGE			0.003***	0.005***
			(0.001)	(0.001)
NET INCOME		−0.024***		−0.024***
		(0.008)		(0.008)
SALES GROWTH		0.001		0.001
		(0.001)		(0.001)
SIZE		0.004***		0.004***
		(0.000)		(0.000)
CAPEX		0.031**		0.031**
		(0.011)		(0.012)
MB		−0.000**		−0.000**
		(0.000)		(0.000)
TANGIBILITY		−0.005		−0.004
		(0.004)		(0.004)
DIVIDEND		0.049*		0.052*
		(0.027)		(0.027)
CASH FLOW		−0.015		−0.015
		(0.009)		(0.009)
AGE		0.002**		0.002**
		(0.001)		(0.001)
EXRET		−0.019***		−0.019***
		(0.002)		(0.002)
SIGMA		0.551***		0.547***
		(0.059)		(0.059)
$\beta_2 + \beta_3$	0.012***	0.014***	0.003***	0.004***
Observations	92,678	78,000	92,678	78,000
R^2	0.019	0.053	0.019	0.053
State FE	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES

Table A.10
Bankruptcy, financial leverage and banking competition – Different thresholds.
This table reports estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variable is BANKRUPTCY. LEVERAGE TERCILE is a variable that identifies the terciles of LEVERAGE, and LEVERAGE QUINTILE is a variable that identifies the quintiles of LEVERAGE. The definitions of the variables are given in Table 1. All independent variables are lagged by a year. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors that are clustered at the state level in parentheses.

	(1)	(2)	(3)	(4)
LEVERAGE TERCILE = 2	0.003***	0.001		
	(0.001)	(0.001)		
LEVERAGE TERCILE = 3	0.025***	0.014***		
	(0.002)	(0.003)		
LEVERAGE QUINTILE = 2			0.003***	0.001
			(0.001)	(0.001)
LEVERAGE QUINTILE = 3			0.004***	0.001
			(0.001)	(0.001)
LEVERAGE QUINTILE = 4			0.009***	0.004***
			(0.001)	(0.001)
LEVERAGE QUINTILE = 5			0.038***	0.024***
			(0.003)	(0.003)
DEREGULATION INDEX	−0.000	−0.001**	0.000	−0.001*
	(0.001)	(0.001)	(0.001)	(0.001)
DEREGULATION INDEX × LEVERAGE TERCILE = 2	0.000	0.001**		
	(0.001)	(0.000)		
DEREGULATION INDEX × LEVERAGE TERCILE = 3	0.003***	0.005***		
	(0.001)	(0.001)		
DEREGULATION INDEX × LEVERAGE QUINTILE = 2			−0.001	0.000
			(0.001)	(0.001)
DEREGULATION INDEX × LEVERAGE QUINTILE = 3			−0.000	0.001**
			(0.000)	(0.001)
DEREGULATION INDEX × LEVERAGE QUINTILE = 4			−0.001*	0.001
			(0.001)	(0.001)
DEREGULATION INDEX × LEVERAGE QUINTILE = 5			0.005***	0.007***
			(0.001)	(0.001)
NET INCOME		−0.024***		−0.024***
		(0.008)		(0.008)
SALES GROWTH		0.001		0.001
		(0.001)		(0.001)
SIZE		0.004***		0.003***
		(0.000)		(0.000)
CAPEX		0.032***		0.040***
		(0.012)		(0.012)
MB		−0.000**		−0.000*
		(0.000)		(0.000)
TANGIBILITY		−0.005		−0.008**
		(0.004)		(0.004)
DIVIDEND		0.054*		0.066**
		(0.028)		(0.027)
CASH FLOW		−0.015*		−0.014
		(0.009)		(0.009)
AGE		0.002**		0.002**
		(0.001)		(0.001)
EXRET		−0.019***		−0.018***
		(0.002)		(0.002)
SIGMA		0.545***		0.498***
		(0.059)		(0.058)
Observations	92,678	78,000	92,678	78,000
R^2	0.019	0.053	0.025	0.058
State FE	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES

Table A.11
Romano–Wolf P-values.
This table reports the p-values of HIGH LEVERAGE, DEREGULATION INDEX and DEREGULATION INDEX × HIGH LEVERAGE when BANKRUPTCY is the dependent variable in the Romano and Wolf (2005, 2016) test procedure.. All of the other dependent variables that are included in the joint test are the control variables that feature in baseline specification (14) from Table 4. All independent variables are lagged by a year. The samples are bootstrapped at the state level. The sample period is between 1984 and 2007. *** p < 0.01; ** p < 0.05; * p < 0.1.

	(1)
HIGH LEVERAGE	0.010
DEREGULATION INDEX	0.990
DEREGULATION INDEX × HIGH LEVERAGE	0.010
Controls	NO
State FE	YES
Industry × Year FE	YES

Table A.12
Relationships in syndicated loans market.
This table reports the estimated coefficients for fixed effect panel regressions. In all regressions, the dependent variables are LOAN PARTICIPANT and LEAD ARRANGER. $\beta_4 + \beta_5$ is the sum of the regression coefficients for PREVIOUS RELATIONSHIP and HIGH LEVERAGE × PREVIOUS RELATIONSHIP. $\beta_4 + \beta_6$ is the sum of the regression coefficients for PREVIOUS RELATIONSHIP and DEREGULATION INDEX × PREVIOUS RELATIONSHIP. $\beta_4+\beta_5+\beta_6+\beta_7$ is the sum of the regression coefficients for PREVIOUS RELATIONSHIP, HIGH LEVERAGE × PREVIOUS RELATIONSHIP, DEREGULATION INDEX × PREVIOUS RELATIONSHIP, and DEREGULATION INDEX × HIGH LEVERAGE × PREVIOUS RELATIONSHIP. Variables definitions are reported in Table 1. The sample period ranges from 1984 to 2007. *** p < 0.01; ** p < 0.05; * p < 0.1. We report robust standard errors clustered at the state level in parentheses.

	LOAN PARTICIPANT		LEAD ARRANGER	
	(1)	(2)	(3)	(4)
HIGH LEVERAGE	0.001***	0.001***	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
DEREGULATION INDEX	0.000	0.000	0.000**	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
DEREGULATION INDEX × HIGH LEVERAGE	0.000*	0.000*	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
PREVIOUS PARTICIPANT	0.412***	0.377***		
	(0.010)	(0.010)		
HIGH LEVERAGE × PREVIOUS PARTICIPANT	−0.052***	−0.046***		
	(0.013)	(0.012)		
DEREGULATION INDEX × PREVIOUS PARTICIPANT	−0.025***	−0.026***		
	(0.004)	(0.004)		
DEREGULATION INDEX × HIGH LEVERAGE × PREVIOUS PARTICIPANT	0.005	0.005		
	(0.004)	(0.004)		
PREVIOUS LEAD			0.397***	0.377***
			(0.010)	(0.010)
HIGH LEVERAGE × PREVIOUS LEAD			−0.032**	−0.031**
			(0.015)	(0.015)
DEREGULATION INDEX × PREVIOUS LEAD			−0.017***	−0.019***
			(0.005)	(0.005)
DEREGULATION INDEX × HIGH LEVERAGE × PREVIOUS LEAD			−0.003	−0.003
			(0.006)	(0.006)
NET INCOME	0.002*	0.002*	0.000***	0.000***
	(0.001)	(0.001)	(0.000)	(0.000)
SALES GROWTH	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
SIZE	0.001***	0.002***	0.000	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
CAPEX	−0.002	−0.002	−0.000	−0.000
	(0.002)	(0.002)	(0.000)	(0.000)
MB	−0.000	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)	(0.000)
TANGIBILITY	0.000	0.000	−0.000***	−0.000***
	(0.001)	(0.001)	(0.000)	(0.000)
DIVIDEND	0.003	0.003	0.001***	0.001***
	(0.003)	(0.003)	(0.000)	(0.000)
CASH FLOW	−0.003**	−0.002**	−0.000***	−0.000***
	(0.001)	(0.001)	(0.000)	(0.000)
AGE	−0.000**	−0.000**	−0.000**	−0.000**
	(0.000)	(0.000)	(0.000)	(0.000)

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Table A.12 (*continued*).

	LOAN PARTICIPANT		LEAD ARRANGER	
	(1)	(2)	(3)	(4)
EXRET	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
SIGMA	−0.012***	−0.011***	0.001**	0.001***
	(0.004)	(0.003)	(0.000)	(0.000)
$\beta_4 + \beta_5$	0.387***	0.351***	0.380***	0.358***
$\beta_4 + \beta_6$	0.360***	0.332***	0.365***	0.346***
$\beta_4 + \beta_5 + \beta_6 + \beta_7$	0.340***	0.311***	0.345***	0.324***
Observations	14,492,774	14,492,774	14,492,774	14,492,774
R-squared	0.141	0.163	0.123	0.139
State FE	YES	YES	YES	YES
Industry × Year FE	YES	YES	YES	YES
Lender FE	NO	YES	NO	YES

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