JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS Vol. 54, No. 3, June 2019, pp. 1231–1262
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doi:10.1017/S0022109018001084

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

Relationship Bank Behavior during Borrower Distress

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Abstract

This article provides a comprehensive examination of the time-series behavior of relationship banks around and during borrower distress. Relationship and outside loans have similar interest rates during distress and even 2 years prior to distress. Relative to outside loans in distress, relationship loans in distress have lower maturity. The fraction of bank lending given by relationship banks reduces during borrower distress. Overall, borrowers in distress do not derive benefits from relationship banks. These findings are inconsistent with models that suggest banks have an implicit commitment to help their borrowers in distress due to reputation concerns.

I. Introduction

Financial distress has been a topic of extensive research in finance due to its importance in determining a variety of corporate financial policies. The estimated costs of financial distress on firm value are also large (Andrade and Kaplan (1998), Almeida and Philippon (2007)). Given the large impact of financial distress, borrowing firms should seek mechanisms to avoid the potential costs of distress.

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Is maintaining a banking relationship a potential solution for firms to mitigate the effect of distress?

There are strong arguments that maintaining a banking relationship should minimize the effects of distress. First, repeated transactions with the same bank should generate inside knowledge of the firm's prospects, mitigating informational frictions in the bank's decision to continue financing a firm in distress (Sharpe (1990), Diamond (1991)). Second, Berlin and Mester (1999) and Bolton, Freixas, Gambacorta, and Mistrulli (2016) suggest that banks have incentives to smooth out the interest charged on loans in the presence of an aggregate economy-wide shock. Third, implicit contracting incentives should induce banks to continue giving preferential treatment to a relationship borrower, even if it falls into distress (Boot, Greenbaum, and Thakor (1993), Dinc (2000)). All of these arguments suggest that borrowers should continue to derive benefits from relationship banks during distress. In fact, borrowers may even derive greater benefits from relationship lending in distress relative to a normal period because they can hold up their banks by threatening to strategically file for bankruptcy (Anderson and Sundaresan (1996), Davydenko and Strebulaev (2007)).

A second possibility is that potential relationship termination, due to the increased likelihood of bankruptcy, may lead to a reduction of the benefits of relationship lending as the relationship bank sees little benefit in continuing the relationship in the future due to a lower likelihood of business from the same borrower (Bharath, Dahiya, Saunders, and Srinivasan (2007)). This suggests that loan terms in distress may become similar for relationship and outside loans, and borrowing firms may not derive any benefits or pay any costs from relationship lending in distress. Additionally, banks may have incentives to develop a reputation for optimal liquidation and continuation decisions for firms in distress (Chemmanur and Fulghieri (1994)) and not give any concessional terms for loans in distress.

A third possibility is that the banks may hold up borrowers. Outside banks may be reluctant to finance a firm due to an informational disadvantage relative to relationship banks (Rajan (1992)). This may enable relationship banks to hold up borrowers by charging higher interest rates in distress, thus exacerbating the impact of financial distress (Gorton and Kahn (2000)). These arguments imply that the contract terms in distress may be even worse for relationship loans relative to outside loans.

Despite ample theoretical literature on this topic, there is little empirical work testing the behavior of relationship banks during borrower distress. Do relationship banks mitigate the effect of borrower distress, exacerbate it, or become irrelevant after distress? This is the question that we study in detail by comparing the time-series behavior of contract terms of loans by relationship banks and outside banks as a firm falls into distress and comes out of it. We test the three sets of arguments (insurance, irrelevance, and hold-up) by measuring the net effect of relationships on loan rates and the likelihood of collateral. Lower values of these will be interpreted as benefits for borrowers. We also examine the volume of relationship lending and the maturity of loans in distress. A greater maturity or lending volume will be a significant benefit to borrowers because refinancing during distress is likely to be difficult.

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

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As a firm falls into distress, we find that the special nature of relationship loans diminishes. Even 2 years prior to distress, the interest rates charged on relationship and outside loans become similar. This continues for 2 years after distress. Our results on collateral requirements are rather mixed; the only reliable conclusion that can be drawn is that collateral requirements for inside and outside bank loans are also similar during distress. This suggests that relationship banks do reduce the benefits from the borrowers' perspective.

Next, we turn our attention to nonprice benefits of relationship loans in distress. First, we examine the volume of lending because Petersen and Rajan (1994) suggest that relationship banking benefits may operate more in quantities rather than prices. We use the fraction of bank financing provided by relationship banks as a measure of the quantity benefit. We find that the fraction of financing from relationship banks reduces from approximately 62% in a normal period to approximately 42% in distress. Second, we examine differences in the number of covenants (Demiroglu and James (2010)) and covenant strictness (Murfin (2012)) and do not find any differences between relationship and nonrelationship loans. Third, we find that the reductions in the maturity of loans in distress are larger for relationship loans relative to outside loans. Thus, the nonprice results continue to support the hypothesis that the benefits of relationship lending diminish during distress.

Lastly, we examine the impact of relationship lending in distress and the future likelihood of bankruptcy. One potential benefit of such lending is that firms may be able to avoid bankruptcy due to mitigation of the financial constraints of raising new capital in distress. Further, the refinancing decision of relationship lenders may also certify the quality of the borrowers to other claimholders, such as trade creditors and outside banks, which may enable the firm to raise more external financing and thereby avoid bankruptcy. In contrast to the expected sign, there is no effect of relationship lending on the likelihood of bankruptcy for the full sample. Further, conditional on distress, firms that obtain loans from their relationship banks have a higher likelihood of filing for bankruptcy.[1]

We conduct a variety of tests to account for the possibility that unobservable borrower or lender characteristics cause the results. We use propensity-score matching (Drucker and Puri (2005)), an instrumental variable estimation using the distance between the borrower and the lender (Petersen and Rajan (2002)), lender heterogeneity (Ioannidou and Ongena (2010)), and firm-year fixed effects. We also use alternative measures of distress, which are based on cash flow and different time horizons to measure relationships, and find that our main results hold for these measures as well.

As a separate robustness test, we use a different measure of the loan interest rate, which is the total cost of borrowing defined by Berg, Saunders, and Steffen (2016), and find that the net effect of relationships in distress continues to be insignificant for this alternative measure of fees. We also investigate whether our results differ across loan type (term loan vs. line of credit) and find that the effects

[1]This evidence is consistent with Demiroglu and James (2015), who find that the likelihood of an out-of-court restructuring is lower for relationship loans in the United States. Their sample consists mainly of defaulted firms, which is different from our sample.

are larger for lines of credit. We ensure that the results are not due to technical defaults prior to distress (Roberts and Sufi (2009)). We also do not find differences between systemically important banks and other banks.

Overall, our results do not support the argument that relationship banking is a remedy for borrowing firm's distress.[2] Our results contrast sharply with the loan-level study of Elsas and Krahnen (1998) in Germany, who find the provision of liquidity insurance in distress. Using a more detailed data set from Armenia, Schäfer (2019) finds that relationship banks charge higher spreads in a normal period and provide liquidity insurance in distress. We find that relationship banks provide lower spreads in a normal period and provide no liquidity insurance in distress. Likewise, our results differ significantly from those for Japanese firms as reported by Hoshi, Kashyap, and Scharfstein (1990) and Peek and Rosengren (2005). We discuss possible reasons for the differences in our results from those in the articles just mentioned in Section V. Our main conjecture for the difference is that the provision of intertemporal insurance from banks (Allen and Gale (1997)) is less feasible in the United States due to competition from markets, and it is more feasible in bank-dominated economies such as Germany, Armenia, and Japan. Further research using cross-country data on individual borrowers would be needed to validate such differences.

We make contributions to four streams of literature. First, our evidence is inconsistent with the importance of implicit commitments for helping a distressed borrower due to reputation concerns (Boot et al. (1993), Dinc (2000)). This suggests that a reputation for helping borrowers in distress may not be the metric for borrowing firms to engage in relationship banking; other factors are probably more important.

Second, empirical work on bank hold-up (Santos and Winton (2008), Ioannidou and Ongena (2010)) demonstrates the strategic actions of banks in holding up bank-dependent borrowers. Despite the lower availability of external financing during distress, we find little evidence for bank hold-up, suggesting that this is relevant only for borrowers without access to alternate funding sources. Similarly, strategic capital structure models (Anderson and Sundaresan (1996), Hackbarth, Hennessy, and Leland (2007)) suggest greater hold-up of banks by borrowers in distress, due to greater potential losses arising from a protracted bankruptcy process. We find that relationship banks lower their share of lending volume to borrowers in distress and charge interest rates that are similar to those of outside banks. This is not consistent with borrower hold-up. It also supports the findings of Davydenko and Strebulaev (2007), who report economically small effects of borrower hold-up.

Third, we document intertemporal variation in the benefits of relationship lending, with price and nonprice benefits in normal times and no benefits during distress. Some articles, such as those by Berger and Udell (1995) and Petersen and Rajan (1994), debate whether the benefits of relationship lending to borrowers accrue mainly on the price or nonprice dimension, where the nonprice dimension

[2] In fact, the evidence of increased bankruptcy likelihood and a reduction in financing is very different from the demonstrated benefits of relationship lending after bankruptcy reported by Dahiya, John, Puri, and Ramirez (2003).

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

studied is the quantity of the loan. Adding to this debate, we document evidence of variation in the price benefits as well as nonprice benefits across time for the same borrower. This suggests that further theoretical development is needed in this area.

Lastly, we contribute to the bankruptcy-prediction literature. It is well known that Merton-type models can be improved upon (Bharath and Shumway (2008), Duffie, Saita, and Wang (2007), Duan, Sun, and Wang (2012)). However, neither structural nor reduced-form models suggest a differential role for inside bank debt versus outside bank debt.[3] In fact, we show that this distinction is highly significant, albeit only in distress, suggesting a nonlinear effect of debt capital structure on bankruptcy prediction. This finding provides a further direction for theoretical development in this area, where formal modeling of the different incentives of inside versus outside banks may result in credit-risk models that have better prediction power.

The rest of the article proceeds as follows: In Section II, we survey related literature. In Section III, we describe the construction of the data set and variables used for empirical tests. In Section IV, we conduct the univariate analysis, multivariate tests, and robustness tests. In Section V, we provide a detailed comparison of our results and those obtained in other empirical studies of relationship lending in distress in bank-dominated economies. In Section VI, we present our conclusions.

II. Related Theoretical Literature

In this section, we elaborate on the four hypotheses on the impact of relationship banking in distress: insurance, irrelevance, hold-up by banks, and hold-up by borrowers. We focus on the theoretical side to motivate our empirical tests. We defer a detailed comparison of related empirical work to Section V.

A. Insurance Hypothesis

There are strong arguments that maintaining a banking relationship should minimize the effects of distress (the insurance hypothesis). Intertemporal implicit contracting plays a central role in the provision of such insurance. In a highly influential article, Boot ((2000), p. 12) states, "Relationship lending leaves room for flexibility and discretion in contracts that permits the utilization of subtle, non-contractable information, thereby facilitating implicit long term contracting". In the context of relationship banking, there are several dimensions of implicit contracts between a bank and a firm.[4]

The notion of implicit contracting most relevant to what we study in this article is modeled by Boot et al. (1993). They suggest that banks would want

[3] Although the model by Gorton and Kahn (2000) does suggest that risk-shifting incentives can increase the likelihood of distress, conditional on obtaining a relationship loan, it also predicts that such loans should have higher interest rates relative to outside loans, which we do not find.

[4] For example, Bhattacharya and Chiesa (1995) find that the firm shares inside information with the bank on the understanding that this will not be given to its competitors. Sharpe (1990) finds that the implicit contract is for the bank to not exploit its information monopoly to the fullest extent due to reputation concerns. Petersen and Rajan (1994) find that the implicit commitment problem is for a young firm to commit to not switching banks as it becomes mature.

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to develop a reputation for giving credit even when borrowers have material adverse changes in their financial condition, in order to develop a reputation with other borrowers for helping their relationship borrowers in distress. Dinc (2000) also studies a similar topic theoretically and finds that relationship banks should finance their borrowers in distress. Also relevant for our study, he argues that reputational incentives should strengthen due to competition from bond markets or from other banks that engage in transaction lending. The intuition is that these types of competition decrease the returns to arm's-length lending, which makes the bank focus more on relationship lending.[5]

Berlin and Mester (1999) develop a model where banks with greater reliance on core deposits insure their borrowers against aggregate shocks in the economy in terms of the price of loans. They also find empirical evidence consistent with this model. Bolton et al. (2016) develop a model where banks can engage in both relationship and transaction lending. They predict that relationship loans will carry a higher spread in a normal period but a lower spread in distress, and they also predict that relationship loans should be associated with a lower risk of default. They find evidence consistent with this for a sample of Italian firms.

The foregoing discussion suggests that relationship banks should continue to lend to borrowers in distress at favorable terms to allow them to recover from the distress. To the extent that outside financing is more difficult, the loan volume by relationship banks as a percentage of the total loan volume should also increase. In fact, a greater volume may be an important part of the implicit contract of relationship lending (Elsas and Krahnen (1998), Schäfer (2019)).

B. Irrelevance Hypothesis

Bharath et al. (2007) document that an important benefit of lending relationships from the bank's perspective is the likelihood of repeat business from borrowers. The potential for relationship termination due to an increased likelihood of bankruptcy for a firm in distress may lead relationship banks to reduce any benefits of relationship lending. This suggests that loan terms may become similar for relationship and outside loans, and borrowing firms do not derive any benefits from or pay any costs for relationship lending in distress. Further, from a risk management perspective, this suggests that the loan volume from relationship banks should decrease relative to a normal period.

An alternate reason for the similarity of relationship and outside loans is that relationship banks have incentives to develop a reputation for optimal liquidation and continuation decisions for firms in distress (Chemmanur and Fulghieri (1994)) (i.e., no special treatment for borrowers in distress).

C. Hold-Up by Banks Hypothesis

A third possibility is that the banks may hold up the borrowers. Outside banks may be reluctant to finance a firm due to an informational disadvantage relative to relationship banks (Rajan (1992), von Thadden (2004)). Gorton and Kahn (2000)

[5] In contrast, as argued by Allen and Gale (1997), competition from the markets reduces the incentive for banks to engage in intertemporal smoothing. Likewise, Petersen and Rajan (1995) argue that competition in the lending market will reduce the likelihood of relationship lending. However, both of these articles do not specifically model borrower distress.

theoretically show that a relationship bank will not give any concession to its borrowers in extreme distress, and instead, the bank will charge the highest possible interest rate in a renegotiation. This will lead to asset substitution by the firm, which results in an increase in firm risk.

These arguments imply that the contract terms in distress may be even worse for relationship loans relative to outside loans. The implication of bank hold-up on loan volume is less straightforward. Borrower hold-up may provide a bank with a greater expected return, which should lead to an increase in loan volume. This needs to be balanced against the higher risk of default and policies at the bank level, which may lead the bank to limit exposure to an obligor in distress, notwithstanding the higher profitability of such loans.

D. Hold-Up by Borrowers Hypothesis

Borrowers in distress may derive even greater benefits from relationship lending because they can hold up their banks by threatening to strategically file for bankruptcy (Anderson and Sundaresan (1996), Davydenko and Strebulaev (2007)). This is also the implication reported by Dewatripont and Maskin (1995), who argue that banks may throw good money after bad. At its extreme, this manifests as zombie lending, as documented by Peek and Rosengren (2005) and Caballero, Hoshi, and Kashyap (2008) for Japan. Empirically, borrower hold-up has implications similar to those of the insurance hypothesis discussed previously, except that it would suggest an interest rate in distress that is even lower than what the borrower would be charged in a normal period. Lending volume should also increase because outside banks are not subject to this type of hold-up.

III. Sample Construction

A. Data Source

The data set used for empirical analysis is a cross-sectional time-series loan sample that comes from the DealScan database maintained by Thomson Financial (henceforth, LPC).[6] Borrowers in the LPC database are matched with the Center for Research in Security Prices (CRSP) and Compustat merged database using the link file provided by Chava and Roberts (2008), after excluding financial service companies and real estate companies. The loan data start in 1986 and end in 2011.

Following Drucker and Puri (2005), we use the LPC-reported "all-in-drawn spread" (hereafter FEE) as the measure of the interest rate for a loan. FEE is the coupon spread over the London Interbank Offered Rate (LIBOR), assuming the loan is fully drawn, plus the annual fee. If a loan is classified as "secured" in the LPC database, collateral takes a value of 1, and 0 otherwise.

For several empirical tests, we need accounting information from the Compustat database. We use the most recent accounting information that is publicly available on the starting date of the loan facility. To be conservative, we assume that a firm's accounting information is available 6 months after its fiscal year-end month. We also require the year and the identities of firms filing for

[6]This database was originally maintained by the Loan Pricing Corporation; hence, the acronym LPC has often been used in finance research articles. We follow this convention.

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

bankruptcy. We obtain these by combining the CRSP database and the UCLA–LoPucki Bankruptcy Research Database. In one test, we use probabilities of default, as computed by Duan et al. (2012) from the Risk Management Institute (RMI) Credit Rating Initiative database.[7]

B. Relationship Measures

1. Definition of Lead Bank

Most of the loans in the LPC database are syndicated loans in which many banks are retained in several different roles. Hence, before defining relationship measures, it is important to identify those banks that play a lead role. We follow the methods used by Bharath, Dahiya, Saunders, and Srinivasan (2011) to classify banks into the lead role. In particular, a bank is defined as playing a lead role in a given loan facility if any one of the following conditions is met: i) The bank is given a lead-arranger credit for the given loan facility, or ii) the bank is retained in the role of (a) agent, (b) arranger, (c) administrative agent, (d) lead bank, and/or (e) sole lender. The rationale for this selection is that banks in these roles typically retain a large fraction of syndicated loans (over 25% on average), and for the last role, the given loan is not syndicated. Consequently, it is reasonable to assume that banks retained in these roles are truly lead lenders in the given loan facility. All measures of relationship lending are constructed using only lenders retained in a lead role as just defined.

2. Definition of Relationship

Next, we elaborate on the construction of relationship measures. For each loan, we have a look-back period of 5 years from the starting date of the loan. A given loan is classified as a relationship loan (REL_LOAN = 1) if any of the lead lenders retained in the given loan facility was retained as the lead lender in any loan taken by the same borrower over the last 5 years. As additional variables, we include the relationship strength between the borrower and the bank, based on the number (REL_LOAN_NUM) and dollar value (REL_LOAN_DOL) of loans, where a given bank is retained relative to the total number and dollar values of the firm in the 5-year period (Schenone (2010)). For borrowers where there was no loan in the past 5 years, neither of these variables is defined. A detailed description of the construction of relationship measures is given in Appendix A.

C. Definition of Distress

The first step in the construction of the firm-specific distress dummy is to compute the expected default frequency (EDF) as developed by Merton (1974). The implementation of computing EDF follows the method used by Bharath and Shumway (2008). The exact methodology for computation is explained in Appendix B.[8] For each month, we compute the EDF as implied by the Merton model for all firms in the merged CRSP–Compustat database. Subsequently, for each calendar year, we count the number of months where the EDF of each

[7] Data are obtained from https://rmicri.org/en/.

[8] Shumway (2001) and Hillegeist, Keating, Cram, and Lundstedt (2004) provide evidence that market-based measures of financial distress provide better predictive power for bankruptcy relative to accounting-based measures, such as the Altman score and the Zmijewski score.

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borrowing firm in the LPC database lies in the top 10% of the unconditional EDF distribution for all firms for all years and all months.[9] If this number is equal to or greater than 6, we classify the given firm-year as one where the borrowing firm is distressed. At the end of this process, each firm-year for which the firm has sufficient trading and accounting data available is classified as either distressed (DISTRESS = 1) or not distressed (DISTRESS = 0). Given this classification of firm-years, the classification of normal loans and distressed loans is relatively straightforward. A loan facility with a starting date in a normal year is classified as a normal loan, and one made during a distressed year is classified as a distressed loan. We use the filing year of bankruptcy as the year of bankruptcy. For firms that filed for bankruptcy after delisting, we use the year of delisting as the year of bankruptcy (Chava and Jarrow (2004)).

One possibility is that this procedure creates a look-ahead bias; that is, a bank that makes a loan in an earlier part of the year does not have the complete information about distress. This biases against finding significant differences between loans made in normal periods and distress. Nevertheless, as an additional robustness check, we also define distress using rolling windows 1 year prior to the actual month of the loan and find similar results.

IV. Empirical Analysis

A. Univariate Analysis

The total sample size consists of 27,394 loan facilities with 1,970 distressed loans (991 unique firms) and the remaining 25,424 loans (5,177 unique firms) made during a normal period. We exclude all debtor-in-possession (DIP) loans because these are not the focus of this article.[10] A definition of all variables used in the empirical analysis is provided in Appendix C.

Panel A of Table 1 provides firm characteristics for firms classified as normal or distressed. The difference in firm characteristics in these categories provides an independent justification for the distress measure because it is constructed based solely on the dynamics of the firm's stock price, the total assets of the firm, and total debt of the firm. For example, the coverage ratio, defined as earnings before interest, taxes, depreciation, and amortization (EBITDA) divided by interest expense, is 4.92 for the distressed sample, whereas it is 31.7 for the normal sample. Likewise, the profitability of firms for the normal-period sample is 12%, whereas it is 3.3% in the distressed period. Furthermore, firms classified as distressed also have a lower current ratio. These summary statistics suggest that the measure of distress is reasonable when evaluated using the firm's accounting variables that measure firm performance or liquidity.

[9] Note that the distribution of EDFs for the entire universe of CRSP–Compustat merged firms is used in the computation of this percentile.

[10] The reason for focusing on distress (and not bankruptcy) is that the existing literature (e.g., Dahiya et al. (2003), Li and Wang (2016)) studies DIP lending during bankruptcy. In an earlier version of the article, we included DIP loans in bankruptcy. We found that DIP loans by relationship banks have lower fees and collateral, consistent with the results of Dahiya et al. (2003) and Li and Wang (2016).

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TABLE 1
Summary Statistics

Table 1 presents the summary statistics for firm and loan characteristics. The sample period is from 1986 to 2011. Panel A provides firm characteristics for firms classified as normal or distressed. Panel B reports differences in loan characteristics (fee, collateral, maturity, and size) across firms in two conditions. DISTRESS is a dummy variable that equals 1 if the loan is issued during a year when the firm is in distress, and 0 otherwise. NORMAL is a dummy variable that equals 1 if the loan is issued during a year when the firm is in normal financial status, and 0 otherwise. FEE (in basis points) is the all-in-drawn spread from the LPC DealScan database. COLLATERAL is a dummy variable that takes a value of 1 if the loan is classified as "secured" in the LPC database, and 0 otherwise. MATURITY is the duration (in months) between the facility activation date and the maturity date. See Appendix C for a detailed definition of all variables used in this table. All variables are adjusted for inflation. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	NORMAL		DISTRESS			
	Mean	(Median)	Mean	(Median)	Mean Difference (*t*-Value)	Median Difference (*z*-Value)
Panel A. Firm Characteristics						
COVERAGE_RATIO	31.70	(6.19)	4.92	(1.85)	−1.81	−30.33***
CURRENT_RATIO	2.11	(1.69)	1.82	(1.54)	−2.47*	−5.86***
LEVERAGE	0.28	(0.27)	0.41	(0.40)	22.30***	20.47***
MARKET_TO_BOOK	1.75	(1.36)	1.43	(1.05)	−4.94***	−19.22***
PROFITABILITY	0.12	(0.13)	0.03	(0.07)	−16.30***	−24.84***
TANGIBILITY	0.34	(0.28)	0.30	(0.23)	−5.25***	−5.82***
TOTAL_ASSET	3,252.00	(478.70)	1,249.90	(183.00)	−6.73***	−16.28***
No. of obs.	15,747		1,158			
Panel B. Loan Characteristics						
FEE	197.7	(175)	363.2	(350)	41.60***	45.23***
COLLATERAL	0.5	(1)	0.8	(1)	20.60***	23.50***
MATURITY	45.7	(48)	38.9	(36)	−9.43***	−12.35***
FACILITY_AMOUNT	295.4	(100)	103.5	(25.4)	−9.42***	−25.39***
No. of loans	25,424		1,970			
Panel C. Other Benefits: Volume and Likelihood of Relationship Lending						
REL_LOAN	0.63	(1)	0.44	(0)	−12.47***	−12.42***
REL_LOAN_DOL	0.61	(1)	0.42	(0)	−12.94***	−12.71***
REL_LOAN_NUM	0.60	(1)	0.42	(0)	−12.79***	−12.69***

Panel B of Table 1 reports differences in loan characteristics (fee, collateral, maturity, and size) across the firms in these two subsamples. As expected, there is a large increase in the fee as a firm goes from a normal condition to a distressed condition. The mean fee during distress is 363 basis points (bps), whereas it is 198 bps in a normal condition. Likewise, the percentage of collateralized loans is 52% in a normal condition, whereas it is 80% in a distressed condition. The size of the loan and its maturity also decrease in distress. Thus, loan-contract terms also reflect the onset of distress. This provides further confirmation that the distress measure does indeed reflect an increasing level of credit risk.

Panel C of Table 1 presents the results for the volume of relationship lending and the likelihood of relationship lending in distress as compared with a normal period. The likelihood of a relationship bank making a loan in a normal period is 63%, whereas it is 44% in distress. Similarly, the fraction of lending (based on dollar value) coming from relationship banks is 61% in a normal period, whereas it is 42% in a distressed period.

In Panel A of Table 2, we compare differences in fees and collateral across relationship and nonrelationship loans. Relationship loans have much lower fees and collateral requirements in a normal period. The magnitudes of the differences are quite significant. For example, in a normal period, a relationship loan has a fee that is 60 bps lower relative to a nonrelationship loan. Likewise, in a normal

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TABLE 2

Effects of Lending Relationships: Univariate Results

Table 2 presents univariate statistics of the effects of lending relationship. The sample period is from 1986 to 2011. DISTRESS is a dummy variable that equals 1 if the loan is issued during a year when the firm is in distress, and 0 otherwise. NORMAL is a dummy variable that equals 1 if the loan is issued during a year when the firm is in normal financial status, and 0 otherwise. FEE is defined as the all-in-drawn spread from the LPC DealScan database. COLLATERAL is a dichotomous variable that takes a value of 1 if the loan is classified as "secured" in the database, and 0 otherwise. MATURITY is the duration (in months) between the facility activation date and maturity date. See Appendix C for a detailed definition of all variables used in this table. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

			Nonrelationship		Relationship			
	Variable	*N*	Mean	(Median)	Mean	(Median)	Mean Difference (*t*-Value)	Median Difference (*z*-Value)
Panel A. Loan Characteristics								
NORMAL	FEE	25,424	234.10	(225)	174.40	(150)	−34.28***	−33.96***
	COLLATERAL	25,424	0.61	(1)	0.47	(0)	−21.46***	−21.27***
	MATURITY	25,424	44.66	(37)	46.31	(52)	4.89***	7.88***
DISTRESS	FEE	1,970	364.20	(350)	362.00	(337.5)	−0.29	−0.40
	COLLATERAL	1,970	0.85	(1)	0.74	(1)	−5.65***	−5.61***
	MATURITY	1,970	39.19	(36)	38.50	(36)	−0.59	0.44
Panel B. Firm Characteristics								
NORMAL	COVERAGE_RATIO	15,747	35.30	(5.50)	29.80	(6.50)	−1.25	10.01***
	CURRENT_RATIO	15,747	2.41	(1.88)	1.94	(1.59)	−7.11***	−17.20***
	LEVERAGE	15,747	0.25	(0.24)	0.30	(0.29)	14.63***	15.70***
	MARKET_TO_BOOK	15,747	1.85	(1.34)	1.69	(1.37)	−4.39***	3.11***
	PROFITABILITY	15,747	0.09	(0.12)	0.14	(0.13)	14.50***	14.70***
	TANGIBILITY	15,747	0.32	(0.26)	0.36	(0.30)	9.58***	9.51***
	TOTAL_ASSET	15,747	1,239.10	(150.50)	4,439.70	(910.30)	19.30***	51.00***
DISTRESS	COVERAGE_RATIO	1,158	5.51	(1.56)	4.51	(2.15)	−0.30	4.64***
	CURRENT_RATIO	1,158	1.92	(1.59)	1.71	(1.46)	−2.53*	−2.33**
	LEVERAGE	1,158	0.39	(0.38)	0.44	(0.43)	3.51***	3.68***
	MARKET_TO_BOOK	1,158	1.51	(1.05)	1.34	(1.05)	−1.60	0.60
	PROFITABILITY	1,158	0.008	(0.059)	0.06	(0.08)	4.31***	5.41***
	TANGIBILITY	1,158	0.29	(0.21)	0.32	(0.26)	2.52*	3.09***
	TOTAL_ASSET	1,158	440.40	(88.10)	2,255.60	(396.70)	6.65***	14.30***

period, the probability that a nonrelationship loan is collateralized is 61%, whereas the probability that a relationship loan is collateralized is 47%.

In contrast, for the distress sample, the differences in fees are insignificant. However, the collateral requirement for relationship and outside loans continues to differ by approximately 11%. However, this difference is still lower than the difference of 14% for the collateral requirement in a normal period. The results in Table 2 provide support for the reduced incentives for banks to help their borrowers in distress in terms of less preferential loan terms.

Panel B of Table 2 presents a comparison of the firm characteristics of relationship and nonrelationship firms in distress. As expected, there are several significant differences in firm characteristics, which imply that these have to be carefully controlled for in our multivariate tests. However, note that our classification of firms in distress is based on the likelihood of default; thus, these two sets of firms have approximately the same probability of default when default is measured by the Merton model.

B. Multivariate Regression Analysis of Loan-Contract Terms

This subsection examines the impact of relationships after the onset of distress using the fee and collateral as dependent variables. The fee equation is estimated using panel ordinary least squares (OLS) with standard errors clustered at

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the firm level, and the collateral regression is estimated using the logistic model. Firm and year fixed effects are included to account for the unobservable firm and year variation of the dependent variables.

Our main tests focus on the net effect of relationships in distress. The key independent variables of interest are proxies for relationships (REL_LOAN, REL_LOAN_NUM, and REL_LOAN_DOL) and the interaction of these measures with distress. The net effect of relationships during distress is measured by the sum of the coefficients of REL_LOAN (REL_LOAN_NUM or REL_LOAN_DOL) and DISTRESS × REL_LOAN (DISTRESS × REL_LOAN_NUM or DISTRESS × REL_LOAN_DOL). Its significance is measured by an F-test or χ^2 test. If there is a net benefit of relationships in distress, the sum will be negative. Under bank hold-up, this will be positive. If loans made by relationship and outside banks are similar, the net effect will be 0. Under borrower hold-up, the sum should be negative. In addition, the interaction of relationship and distress should be negative, and the discount should be larger in distress.

Several control variables (defined in Appendix C) motivated by prior studies are used to control for the effect of time-varying loan and borrower characteristics on the fee and collateral requirement. Dummy variables for the rating of the borrower, loan type, and distribution method are added to further control for cross-sectional differences in these variables that may impact the fee and collateral requirement.

The results of this analysis are presented in Table 3. All three relationship measures have a significantly negative effect in the nondistress sample, on both fees and the likelihood of collateral. In contrast, the net effect of relationships becomes insignificant on the fee charged in distress.[11] However, the effect of relationships continues to be significantly negative on the collateral requirement. Thus, once firms enter distress, relationship and nonrelationship loans are similar in price terms, but borrowers appear to continue having nonprice benefits in terms of lower collateral requirements. Other variables have expected signs consistent with the prior literature.

C. Time-Series Behavior

The previous subsection examined the behavior of relationship banks in the year of distress. Next, we examine the time series of the evolution of the loan rate as the borrower approaches distress and emerges from it. To implement this approach, we construct a time event dummy for each firm-year in distress. Specifically, we create dummy variables indicating 2 years prior to distress ($T-2$), 1 year prior to distress ($T-1$), and 1 ($T+1$) and 2 ($T+2$) years subsequent to distress.[12]

In Figure 1, we examine the pattern of fees around the distress event dummy. As early as year $T-2$, there is a sharp increase in the fee for loans made by both relationship and by outside banks, relative to all other loans made outside of this time window. This pattern continues until the end of the time window. By year

[11] The last row of Table 3 presents the relevant statistics, F or χ^2, for the fee and collateral regressions, respectively.

[12] Appendix D explains how we treat adjoining distress observations as well as overlaps of the time event dummies of two distress events.

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TABLE 3

Relationship Lending during Distress: Fee and Collateral

Table 3 reports multivariate regression results of the impact of lending relationships on fees and collateral. The sample period is from 1986 to 2011. FEE is defined as the all-in-drawn spread from the LPC DealScan database. COLLATERAL is a dichotomous variable that takes a value of 1 if the loan is classified as "secured" in the database, and 0 otherwise. REL_LOAN is a dichotomous variable that takes a value of 1 if the lead bank in the given loan facility has a prior lending relationship with the borrowing firm based on loans taken by the firm in the 5 years prior to the current loan, and 0 otherwise. REL_LOAN_DOL and REL_LOAN_NUM are computed using the dollar value (number) of the fraction of loans that go to a given lender relative to the total value (number) of loans taken by the borrower, also in the 5-year window prior to the current loan date. DISTRESS is a dummy variable that equals 1 if the loan is issued during a year when the firm is in distress, and 0 otherwise. The models are estimated using panel ordinary least squares (OLS) for FEE and using the logistic model for COLLATERAL. All regressions use fixed effects for firms, ratings, loan type, loan distribution method, and year. See Appendix C for a detailed definition of all variables used in this table. Numbers in parentheses are standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	FEE	FEE	FEE	COLLATERAL	COLLATERAL	COLLATERAL
DISTRESS	63.5***	64.1***	64.1***	0.67***	0.67***	0.69***
	(8.58)	(8.38)	(8.33)	(0.16)	(0.16)	(0.15)
REL_LOAN	−9.73***			−0.30***		
	(2.09)			(0.054)		
DISTRESS × REL_LOAN	16.7			−0.099		
	(10.8)			(0.20)		
REL_LOAN_DOL		−11.3***			−0.45***	
		(2.26)			(0.058)	
DISTRESS × REL_LOAN_DOL		18.7			−0.15	
		(12.0)			(0.22)	
REL_LOAN_NUM			−10.8***			−0.39***
			(2.30)			(0.059)
DISTRESS × REL_LOAN_NUM			19.1			−0.20
			(12.1)			(0.22)
COLLATERAL	33.4***	33.3***	33.4***			
	(2.58)	(2.58)	(2.58)			
ln(MATURITY)	−18.6***	−18.6***	−18.6***	0.21***	0.25***	0.25***
	(1.74)	(1.74)	(1.74)	(0.040)	(0.034)	(0.034)
COVENANT	0.16	0.15	0.13	0.31***	0.32***	0.32***
	(0.34)	(0.33)	(0.33)	(0.0081)	(0.0078)	(0.0078)
LEVERAGE	39.1***	38.7***	38.6***	0.16	0.042	0.042
	(9.81)	(9.80)	(9.82)	(0.21)	(0.21)	(0.21)
MARKET_TO_BOOK	−4.87***	−4.85***	−4.86***	−0.088***	−0.089***	−0.090***
	(1.67)	(1.66)	(1.66)	(0.034)	(0.034)	(0.034)
TANGIBILITY	−23.0*	−22.9*	−23.0*	−0.30	−0.32	−0.33
	(12.9)	(12.9)	(12.9)	(0.32)	(0.32)	(0.32)
PROFITABILITY	−45.5**	−45.4**	−45.4**	−0.81*	−0.79*	−0.80*
	(19.7)	(19.7)	(19.7)	(0.45)	(0.45)	(0.45)
ln(TOTAL_ASSET)	−19.4***	−19.3***	−19.4***	−0.62***	−0.63***	−0.64***
	(2.10)	(2.09)	(2.09)	(0.047)	(0.047)	(0.047)
CURRENT_RATIO	−1.12*	−1.13*	−1.13*	−0.034*	−0.033*	−0.034*
	(0.61)	(0.62)	(0.62)	(0.019)	(0.019)	(0.019)
COVERAGE_RATIO	−14.0***	−14.0***	−14.0***	−0.26***	−0.25***	−0.25***
	(2.10)	(2.10)	(2.10)	(0.041)	(0.041)	(0.041)
Constant	327.6***	330.1***	331.2***			
	(16.5)	(16.4)	(16.4)			
N	27,394	27,394	27,394	16,148	16,148	16,148
Adj. R^2	0.287	0.287	0.287			
Pseudo-R^2				0.232	0.229	0.227
F-test (χ^2 test) for net effect of relationships in distress	0.42	0.39	0.49	4.16*	8.00**	7.65**

$T-1$, the difference in fees for the relationship and nonrelationship loans shrinks to 0, and this continues in the distress year as well.

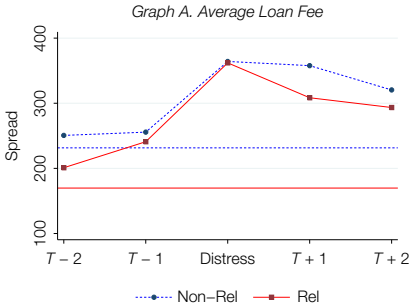
Similar to the fee, there is a dramatic increase in the likelihood of collateral 2 years prior to distress. Although the difference in collateral between relationship and nonrelationship loans narrows in year $T-1$, it widens again in the distress

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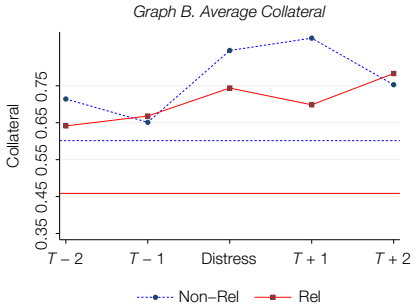
FIGURE 1

Time Pattern of Loan Fee, Collateral, and Expected Default Frequency

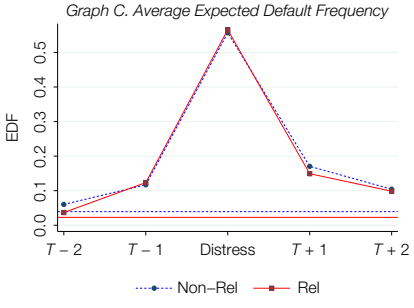
Figure 1 shows the average loan fee, average likelihood of a requirement for collateral, and average expected default frequency (EDF) for relationship and nonrelationship loans around borrower distress. FEE is the all-in-drawn spread from the LPC DealScan database. COLLATERAL is a dummy variable that takes a value of 1 if the loan is classified as "secured" in the LPC database, and 0 otherwise. DISTRESS is a dummy variable equal to 1 if the loan is issued during a year when the firm is in distress. $T-1$ ($T-2$) is an indicator variable for 1 (2) year(s) before distress. $T+1$ ($T+2$) is an indicator variable for 1 (2) year(s) after distress. The horizontal line is the average fee, collateral, and EDF for the loans outside the [−2, +2] distress window. See Appendix C for a detailed definition of all variables.



Horizontal dash/solid line is the average spread of Non–Rel/Rel loans outside [–2, +2] distress window



Horizontal dash/solid line is the average collateral of Non–Rel/Rel loans outside [–2, +2] distress window



Horizontal dash/solid line is the average EDF of Non–Rel/Rel loans outside [–2, +2] distress window

year and year $T+1$, and then it narrows again in year $T+2$. Thus, the pattern for collateral does not reflect a consistent pattern of a reduction of or an increase in the differences between relationship and outside loans in the time window around distress.

It is interesting that bank loan contracts react to the onset of distress well prior to the distress event. To test if banks can anticipate oncoming distress, we examine the pattern of EDF for the distressed firms prior to the distress year. This pattern mirrors that of the loan-contract terms, suggesting that banks react to increasing default probabilities by increasing the loan rate and collateral requirement.

Overall, the time-series pattern of relationship lending around distress reveals an interesting dichotomy in the behavior of relationship banks. On the one hand, there is a convergence of the price of relationship and outside bank loans. On the other hand, there is a divergence in the collateral requirement.

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Next, we examine the extent to which the intuition from Figure 1 is valid using a multivariate regression adding the distress and time event dummies, as well as their interaction with REL_LOAN, to the regression specification in Table 3. The results of this regression are provided in Table 4. First, the pattern of the event year dummies follows a strong inverted-U pattern, with the fee peaking in the distress year. The increase in the likelihood of collateral follows a similar pattern, although the increase is significant only in the distress year and 1 year subsequent to distress. Further, when we examine the interactions of relationship variables with the event year dummies, we find an interesting pattern. The net effect of relationships on the fee becomes insignificant *2 years prior to distress* and continues to be so *2 years subsequent to distress*.

TABLE 4

Time Pattern of Relationship Lending around Distress

Table 4 reports the time pattern of relationship lending around the distress. FEE is defined as the all-in-drawn spread from the LPC DealScan database. COLLATERAL is a dichotomous variable that takes a value of 1 if the loan is classified as "secured" in the database, and 0 otherwise. REL_LOAN is a dichotomous variable that takes a value of 1 if the lead bank in the given loan facility has a prior lending relationship with the borrowing firm based on loans taken by the firm in the 5 years prior to the current loan, and 0 otherwise. $T-1$ ($T-2$) is an indicator variable for 1 (2) year(s) before the distress. $T+1$ ($T+2$) is an indicator variable for 1 (2) year(s) after distress. The models are estimated using panel ordinary least squares (OLS) for FEE and using the logistic model for COLLATERAL. All regressions use fixed effects for firms, ratings, loan type, loan distribution method, and year. See Appendix C for a detailed definition of all variables. All firm characteristics in Table 3 are included in the empirical estimation but not reported to conserve space. Numbers in parentheses are standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Relationship Loan

	FEE	COLLATERAL
$T-2$	0.34	−0.11
	(10.1)	(0.28)
$T-1$	26.1**	0.32
	(12.8)	(0.30)
DISTRESS	73.0***	0.87***
	(8.97)	(0.17)
$T+1$	48.5**	0.89**
	(24.7)	(0.43)
$T+2$	30.2*	0.61
	(17.1)	(0.44)
REL_LOAN	−10.0***	−0.32***
	(2.07)	(0.056)
$T-2\times$REL_LOAN	0.79	0.11
	(12.5)	(0.35)
$T-1\times$REL_LOAN	−12.3	0.58
	(15.3)	(0.36)
DISTRESS × REL_LOAN	17.0	−0.084
	(10.9)	(0.20)
$T+1\times$REL_LOAN	1.95	−0.39
	(25.7)	(0.47)
$T+2\times$REL_LOAN	18.9	0.48
	(23.8)	(0.53)
Adj. R^2	0.29	
Pseudo-R^2		0.25
N	27,394	16,148
F-test (χ^2 test) for Net Effects		
Relationship in $T-2$	0.55	0.37
Relationship in $T-1$	2.18	0.54
Relationship in distress	0.41	4.11**
Relationship in $T+1$	0.098	2.26
Relationship in $T+2$	0.14	0.089

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TABLE 4 (continued)
Time Pattern of Relationship Lending around Distress

Panel B. Alternative Measures of Relationship Loan

	FEE	COLLATERAL	FEE	COLLATERAL
$T-2$	−3.46	−0.16	−8.44	−0.16
	(13.5)	(0.42)	(13.6)	(0.41)
$T-1$	20.1	0.98**	19.3	0.92**
	(15.0)	(0.40)	(15.0)	(0.40)
DISTRESS	81.6***	1.39***	80.3***	1.43***
	(12.9)	(0.26)	(12.8)	(0.25)
$T+1$	46.5*	1.32***	42.1	1.30***
	(26.7)	(0.45)	(27.0)	(0.44)
$T+2$	68.7**	3.23***	56.4*	3.44***
	(34.1)	(0.66)	(31.3)	(0.68)
REL_LOAN_DOL	−16.5***	−.41564***		
	(3.43)	(.085)		
$T-2\times$REL_LOAN_DOL	6.53	0.12		
	(16.8)	(0.54)		
$T-1\times$REL_LOAN_DOL	−10.4	−0.0059		
	(19.3)	(0.53)		
DISTRESS × REL_LOAN_DOL	10.0	−0.70**		
	(15.8)	(0.31)		
$T+1\times$REL_LOAN_DOL	2.13	−0.98*		
	(30.9)	(0.55)		
$T+2\times$REL_LOAN_DOL	−45.6	−3.06***		
	(39.0)	(0.83)		
REL_LOAN_NUM			−16.76***	−.33***
			(3.52)	(0.087)
$T-2\times$ REL_LOAN_NUM			14.7	0.11
			(18.3)	(0.55)
$T-1\times$ REL_LOAN_NUM			−9.41	0.069
			(19.5)	(0.54)
DISTRESS × REL_LOAN_NUM			12.4	−0.78**
			(15.9)	(0.31)
$T+1\times$ REL_LOAN_NUM			9.62	−0.94*
			(31.4)	(0.55)
$T+2\times$ REL_LOAN_NUM			−23.8	−3.38***
			(35.9)	(0.87)
Constant	324.1***		324.6***	
	(23.6)		(23.6)	
Adj. R^2	0.31		0.31	
Pseudo-R^2		0.29		0.29
N	20,986	11,935	20,986	11,935
F-test (χ^2 test) for Net Effects				
Relationship in $T-2$	0.36	0.30	0.013	0.17
Relationship in $T-1$	1.99	0.66	1.84	0.24
Relationship in distress	0.17	14.0	0.080	13.8
Relationship in $T+1$	0.22	6.46	0.052	5.39
Relationship in $T+2$	2.55	17.8	1.28	18.2

In contrast to the fee results, relationship loans have a significantly lower likelihood of collateral in the year of distress. However, when using alternative measures of relationship, based on dollar value and number of loans, the collateral differences also become insignificant (i.e., the net effect of relationships in distress for the collateral requirement is also 0). Thus, this result also confirms that the graphical pattern in Figure 1 is also statistically significant. We believe that this is the first article that documents this interesting time pattern of relationship bank behavior prior to and after distress.

Prior literature (e.g., Petersen and Rajan (1994)) argues that relationship lending benefits to borrowers are primarily concentrated in nonprice terms such as

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greater loan size. However, Berger and Udell (1995), using a subsample of lines of credit, find evidence for price benefits in terms of lower loan rates. Our article adds a third dimension to this debate. In particular, we document an intertemporal variation in the benefits of relationship lending based on the financial condition of the borrower, which has not been studied earlier.

D. Other Potential Benefits of Relationship Lending in Distress

So far, we have focused on the fee and collateral as the main benefits of relationship lending to the borrowing firm. In this subsection, we examine other contractual and noncontractual benefits that may offset some of the documented lack of price benefits during distress. Specifically, we examine four other dimensions of lending that may benefit borrowing firms. We report only variables of interest in this table. Other control variables are included in the regressions but are not reported because they are not the focus of this study.

First, we examine the likelihood of relationship lending in a given year and the fraction of lending by relationship banks based on the number of loans and the dollar amount relative to lending by all banks in the year of distress. An increase in the likelihood of lending or an increase in the fraction of relationship lending is a benefit of having a relationship because a distressed firm may find itself rationed by outside banks. The results, presented in Panel A of Table 5, actually show the opposite. Both the likelihood of a relationship loan and the fraction of lending by

TABLE 5
Other Potential Benefits of Relationship Lending

Table 5 reports multivariate regression results of the impact of distress on the other potential benefits of relationship lending. All firm characteristics in Table 3 are included in the empirical estimation but not reported to conserve space. All regressions use fixed effects for firms, ratings, and year. See Appendix C for a detailed definition of all variables. Numbers in parentheses are standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Likelihood of Relationship Lending and Relationship Lending Fraction during Distress

	REL_YEAR	REL_YEAR_DOL	REL_YEAR_NUM
DISTRESS	−0.21*	−0.043**	−0.043**
	(0.12)	(0.022)	(0.021)
N	11,126	16,905	16,905
Adj. R^2 (pseudo-R^2)	0.154	0.117	0.117

Panel B. Maturity

	ln(MATURITY)	ln(MATURITY)	ln(MATURITY)
REL_LOAN	−0.0047		
	(0.011)		
DISTRESS × REL_LOAN	−0.16***		
	(0.037)		
REL_LOAN_DOL		−0.012	
		(0.011)	
DISTRESS × REL_LOAN_DOL		−0.15***	
		(0.043)	
REL_LOAN_NUM			−0.015
			(0.011)
DISTRESS × REL_LOAN_NUM			−0.15***
			(0.043)
DISTRESS	−0.012	−0.029	−0.033
	(0.029)	(0.029)	(0.029)
F-test for net effect	21.4***	15.2***	14.5***

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TABLE 5 (continued)
Other Potential Benefits of Relationship Lending

Panel C. Number of Covenants			
	ln(1+COVENANT)	ln(1+COVENANT)	ln(1+COVENANT)
REL_LOAN	0.061***		
	(0.017)		
DISTRESS × REL_LOAN	0.042		
	(0.057)		
REL_LOAN_DOL		0.064**	
		(0.025)	
DISTRESS × REL_LOAN_DOL		0.063	
		(0.082)	
REL_LOAN_NUM			0.040
			(0.026)
DISTRESS × REL_LOAN_NUM			0.090
			(0.082)
DISTRESS	−0.087**	−0.10*	−0.12*
	(0.043)	(0.062)	(0.061)
F-test for net effect	3.42*	2.51	2.57
Panel D. Covenant Strictness			
	STRICTNESS	STRICTNESS	STRICTNESS
REL_LOAN	0.79		
	(1.14)		
DISTRESS × REL_LOAN	4.37		
	(6.68)		
REL_LOAN_DOL		2.70*	
		(1.61)	
DISTRESS × REL_LOAN_DOL		5.25	
		(8.73)	
REL_LOAN_NUM			2.78*
			(1.67)
DISTRESS × REL_LOAN_NUM			5.34
			(9.22)
DISTRESS	−0.99	−1.02	−1.18
	(5.05)	(5.86)	(6.22)
F-test for net effect of relationships in distress	0.61	0.83	0.78

relationship banks decrease in the year of distress. The magnitude of the reduction is also significant: Relative to the unconditional average of 0.61 in a normal period, there is a reduction of 0.043, or approximately 7% reduction relative to the normal lending fraction, in a distressed period.

Second, we examine the maturity of loans made during distress. Because distressed firms are likely to be facing refinancing problems, a longer-maturity loan may help in alleviating this issue. However, we find that relationship loans in distress are shorter in duration (Panel B of Table 5).

Third, we examine the total number of covenants in the loan, an alternative nonprice loan-contract term, to examine whether relationship banks provide loans that have lower covenants. To test this, we adopt the empirical model of covenants from Demiroglu and James (2010). We construct a covenant intensity index, which is defined as the sum of 6 covenant indicators: collateral, dividend restriction, more than two financial covenants, asset-sales sweep, equity-issuance sweep, and debt-issuance sweep. Higher values of this covenant index imply more restrictive covenants. We estimate the impact of lending relationships on

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the covenant intensity index (Panel C of Table 5). We do not observe any strong pattern of lower covenants by relationship banks during distress; in fact, in one specification, relationship loans have a greater number of covenants.

Last, we construct the covenant strictness index following Murfin (2012). Specifically, we calculate the probability that the lender will receive contingent control via a covenant violation, which is the distance between the value of a given borrower's accounting variables at the time the contract is written and the values of the same set of variables that are allowable under the covenants specified. For example, a covenant may specify a maximum leverage ratio or minimum equity (net worth ratio). A covenant that specifies a leverage ratio that is close to the firm's current leverage ratio would be a strict covenant. A strict covenant is likely to give the lender an option to renegotiate in more states of the world. Given that firms in distress are not performing well, having lower strictness of covenants would be a significant benefit for the borrowing firm. In Panel D of Table 5, we do not find any difference between relationship and nonrelationship loans in terms of covenant strictness.

Overall, these results show that relationship banks do not provide preferential treatment to the distressed firms in the four nonprice dimensions that we examine: the fraction of relationship lending, the maturity of loans, the number of covenants, and the strictness of covenants.

E. Future Likelihood of Bankruptcy

Another potential benefit of relationship lending is that the financing obtained from relationship banks during distress may enable a borrower to avoid a potentially costly bankruptcy. This can happen through two channels. First, inside banks should have better information about a borrower's prospects. To the extent that they make better liquidation and continuation decisions, a relationship bank's decision to finance a firm in distress should be positively related to a borrower's quality (even if this is unobservable). Second, when observing a relationship bank's financing decision in distress, outside financiers should be more willing to finance the firm due to a positive signal.[13] Conversely, if a relationship bank is captured by the firm and lends in the hope of resurrection (throwing good money after bad, as noted by Dewatripont and Maskin (1995)), or the relationship bank charges higher fees for lending and induces risk shifting (Gorton and Kahn (2000)), the opposite may be true.

To test this, we run a model of prediction of bankruptcy using a logistic model. The dependent variable is a dummy variable that takes a value of 1 for a firm-year where the firm files for bankruptcy, and 0 otherwise. The key independent variable (REL_YEAR) takes a value of 1 in a firm-year where the borrowing firm receives at least one relationship loan, and 0 otherwise. Panel A of Table 6 presents the results of this estimation. Unconditionally, REL_YEAR does not have any impact on the likelihood of bankruptcy. However, the interaction of DISTRESS and REL_YEAR has a positive effect on bankruptcy filing. The positive effect of relationship loans in distress on bankruptcy likelihood continues for the other two relationship measures (REL_YEAR_NUM and REL_YEAR_DOL).

[13] Recall that our univariate results (Table 2) suggested the reverse.

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TABLE 6

Relationship Banking and Bankruptcy Filing

Table 6 reports the logit regression results of the impact of relationship banking on bankruptcy filing. The dependent variable is the dummy variable FILING, which takes a value of 1 if the borrower files for bankruptcy in the next year, and 0 otherwise. REL_YEAR is an indicator that takes a value of 1 if at least one loan in the given year comes from a relationship bank, and 0 otherwise. REL_YEAR_DOL is the ratio of the sum of the loan-facility amounts of all relationship loans to the sum of the facility amounts of all loans taken by the same borrower in a given year. REL_YEAR_NUM is the ratio of the total number of relationship loans in the given year to the total number of loans by the borrower in the same year. DISTRESS is a dummy variable equal to 1 if the loan is issued during a year when the firm is in distress, and 0 otherwise. RMI_DEFAULT_PROBABILITY is computed by Duan et al. (2012) from the Risk Management Institute (RMI) default database. The expected default frequency (EDF) is computed using the Moody's KMV implementation of Merton's model. See Appendix C for a detailed definition of all variables. The models are estimated using a logistic model, controlling for firm fixed effects. All firm characteristics in Table 3 are included in the empirical estimation but not reported to conserve space. Numbers in parentheses are standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A. Dummy and Volume Measure of Relationship

	FILING	FILING	FILING
DISTRESS	0.078	0.077	0.083
	(0.51)	(0.50)	(0.50)
REL_YEAR	0.22		
	(0.29)		
DISTRESS × REL_YEAR	1.07**		
	(0.48)		
REL_YEAR_DOL		0.23	
		(0.29)	
DISTRESS × REL_YEAR_DOL		1.11**	
		(0.48)	
REL_YEAR_NUM			0.22
			(0.29)
DISTRESS × REL_YEAR_NUM			1.10**
			(0.48)
EDF	2.58***	2.58***	2.58***
	(0.52)	(0.52)	(0.52)
Z_SCORE	0.0083	0.0084	0.0084
	(0.019)	(0.019)	(0.019)
Constant	−6.00***	−5.99***	−5.99***
	(0.36)	(0.36)	(0.36)
F-test for net effect of relationships in distress	11.0***	11.9***	11.6***

Panel B. RMI Probability of Default

	FILING	FILING	FILING	FILING	FILING
DISTRESS	1.44***	1.12**	0.063	0.25	
	(0.38)	(0.48)	(0.45)	(0.57)	
REL_YEAR	0.32	0.12	0.38	0.18	0.087
	(0.28)	(0.35)	(0.28)	(0.35)	(0.36)
DISTRESS × REL_YEAR	1.01**	1.12**	1.01**	1.11**	
	(0.43)	(0.54)	(0.43)	(0.53)	
RMI_DEFAULT_PROBABILITY		7.49***		5.24***	4.43***
		(1.46)		(1.61)	(1.61)
EDF			2.81***	2.04***	2.15***
			(0.51)	(0.77)	(0.74)
REL_YEAR × EDF					1.69**
					(0.78)
χ^2 test	15.2***	8.83***	16.8***	9.74***	8.67***
N	15,855	10,288	15,855	10,288	10,288
Pseudo-R^2	0.15	0.18	0.16	0.19	0.18

This is also consistent with the strong univariate results (Table 2), where we find a *positive* impact of relationship lending in distress on the probability of bankruptcy. We include distress and EDF as control variables for the bankruptcy prediction model, to account for a potential nonlinear effect of EDF on the

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bankruptcy likelihood. Other control variables that are used but not reported are leverage, profitability, market to book, and tangibility. In further unreported results, we reestimate the same model for the distress subsample and continue to find the same results.

To investigate the robustness of the results, we replace the EDF with the probability of default, computed using the model of Duan et al. (2012). They demonstrate that their estimate of the probability of default outperforms most extant models (e.g., Duffie et al. (2007)) over a 1-year horizon of prediction. Our results continue to hold after this addition. Panel B of Table 6 presents the results of this estimation. The probability of default computed using the measure suggested by Duan et al. (2012) has a much larger marginal impact on default relative to EDF. The interaction of relationships with distress has a similar positive effect. In additional robustness checks, we also interact relationships with EDF (instead of distress) and find similar results.

One conjecture may be that the positive association of bankruptcy (conditional on distress) and relationship lending is indicative of bank hold-up by borrowers. However, the other results that we document (increase of fee and collateral of an inside loan to a similar level as an outside loan and the reduction of lending volume) are not consistent with this conjecture. Viewed in entirety, most of the results are consistent with banks changing loan terms due to the possibility of relationship termination, rather than borrowers holding up banks.

F. Endogeneity of Relationship Bank Financing

One concern is that the decision to form a relationship may be endogenous. In particular, banks may elect to form relationships only with firms that have lower credit risk. Conversely, the reverse may also be true. Firms that form relationships could have a higher degree of credit risk. In this case, the relationship dummy simply proxies for a higher degree of credit risk.

The firm fixed effects, which are included in the main empirical specification, should control for unobservable firm-specific factors that are time invariant and impact the dependent variable. To additionally test for time-varying factors specific to the borrower that may impact the formation of relationships and at the same time impact the loan rate and/or collateral, we use two popular methods suggested in the literature: propensity-score matching and instrumental variables.

1. Propensity-Score Matching

Heckman, Ichimura, and Todd (1997) propose that the propensity-score-matching method (PSM) as a method for treatment evaluation where selection into the treatment is based on observables. This methodology has been used by Drucker and Puri (2005) in the context of bundling of loans and underwriting. In our case, the relevant treatment variable is the relationship dummy. We follow the procedure for the implementation of the PSM method as presented by Drucker and Puri (2005).

To implement this, each relationship loan in distress is matched with another loan in distress that had approximately the same probability of having been a relationship loan but in fact was not. Once the matching is done, the average fees and

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

collateral requirements are calculated for each group of loans.[14] Table 7 shows the results from propensity-score matching. The results show that the differences in fees for the two sets of loans (the treatment group, the ones that received relationship loans in distress, and the control group, the ones that were equally as likely to obtain a relationship loan in distress but did not actually get a loan) are insignificant. However, the difference in the collateral requirement for the treatment and control groups is significant, with a lower likelihood of a collateral requirement for relationship loans during distress. Recall, however, that the collateral results presented a mixed picture earlier as well, with significantly lower collateral in one case (Panel A of Table 3) and insignificant results in another case (Panel B of Table 3).

TABLE 7
Propensity-Score Matching

Table 7 reports the results of borrower matching. The sample period is from 1986 to 2011. The result is reported for matching each loan in distress where a relationship bank was retained to another loan in distress where a relationship bank was equally likely to have been retained but in fact was not. The method used for matching is the propensity-score-matching method proposed by Heckman et al. (1997). The actual implementation follows Drucker and Puri (2005). FEE is defined as the all-in-drawn spread from the LPC DealScan database. COLLATERAL is a dichotomous variable that takes a value of 1 if the loan is classified as "secured" in the database, and 0 otherwise. See Appendix C for a detailed definition of all variables. Numbers in square brackets are standard errors corrected for heteroscedasticity and clustering at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Difference between Relationship Loans and Nonrelationship Loans	
	FEE	COLLATERAL
Mean	2.55	−0.04*
Std. dev.	11.29	0.023
95% confidence interval	[−19.86, 24.96]	[−0.08, 0.008]

2. Instrumental Variable Approach

Next, we use an instrumental variable (IV) approach to control for the potential endogeneity that unobservable borrower characteristics may simultaneously impact relationship formation and loan-contract terms. In the first-stage regression, the likelihood of forming relationships is modeled. We use the geographic distance between the borrowing firm's headquarters city and its relationship bank's headquarters city as an instrument to predict the likelihood of the relationship formation.[15] Distance has been shown to be correlated with the likelihood of relationship formation (Petersen and Rajan (2002), Degryse and Ongena (2005)) but should not affect the fees or collateral directly. In the second stage, the fitted likelihood of relationship formation is used in place of the relationship dummy for testing the impact of relationships on fees and collateral.

[14] For determining the likelihood of a given loan being from a relationship bank, we use the subsample of distressed loans. Specifically, we run a logistic regression for the probability of getting a relationship loan using the same set of control variables as that used in Table 3. However, firm fixed effects are not used.

[15] For cases where the relationship lender was a bank headquartered outside of the United States, we try to ascertain the headquarters of the bank's U.S. subsidiary. In most cases, the headquarters is either New York or San Francisco. In cases where we are not able to unambiguously assign the headquarters for the U.S. subsidiary, we assume that the headquarters city is New York.

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

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Specifically, we use the natural log of the minimum distance between lead lenders and firms as the IV for the presence of a lending relationship. Because we have an interaction term between relationship and distress, this term is endogenous as well, and we use distance multiplied by distress as the second IV. Table 8 shows the results from the IV approach for loans given in distress.[16] Columns 1, 2, 4, and 5 present the results for the first-stage regressions, and columns 3 and 6 present results for the second-stage regressions. The values for DISTANCE and DISTANCE × DISTRESS are all statistically significant, and the F-values are very large in the first-stage regressions, indicating that the distance measure is a strong IV. After controlling for the potential endogeneity of relationships, the result that outside loans and relationship loans are identical to each other after the onset of distress continues to hold for both fees and collateral (columns 3 and 6 of Table 8).

TABLE 8

Impact of Borrower Heterogeneity: 2SLS

Table 8 reports the result for the regression of the loan-contract terms using 2-stage least squares (2SLS). FEE is defined as the all-in-drawn spread from the LPC DealScan database. COLLATERAL is a dichotomous variable that takes a value of 1 if the loan is classified as "secured" in the database, and 0 otherwise. DISTANCE is the natural log of the distance between the borrower and the lender. REL_LOAN is a dichotomous variable that takes a value of 1 if the lead bank in the given loan facility has a prior lending relationship with the borrowing firm based on loans taken by the firm in the 5 years prior to the current loan, and 0 otherwise. Estimation is done using 2SLS. In the first stage, the likelihood of a relationship bank being retained is modeled using the distance between the bank and the borrowing firm as the instrument for relationship formation. The models are estimated using ordinary least squares (OLS) for FEE and COLLATERAL. All firm characteristics in Table 3 are included in the empirical estimation but not reported to conserve space. All regressions use fixed effects for ratings, loan type, loan distribution method, and year. See Appendix C for a detailed definition of all variables. Numbers in parentheses are standard errors corrected for heteroscedasticity and clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	REL_ LOAN	REL_LOAN × DISTANCE	FEE	REL_ LOAN	REL_LOAN × DISTANCE	COLLATERAL
DISTANCE	−0.031***	0.0039***		−0.031***	0.0039***	
	(0.0025)	(0.00076)		(0.0025)	(0.00076)	
DISTANCE × DISTRESS	0.033***	−0.021***		0.033***	−0.021***	
	(0.0092)	(0.0028)		(0.0092)	(0.0028)	
REL_LOAN		0.078***	−122.0***		0.078***	−0.43***
		(0.0019)	(23.9)		(0.0019)	(0.087)
DISTRESS	−0.69***	0.63***	−85.3	−0.70***	0.63***	0.14
	(0.067)	(0.020)	(64.2)	(0.067)	(0.020)	(0.24)
DISTRESS × REL_LOAN	0.84***		344.6**	0.84***		−0.11
	(0.020)		(134.8)	(0.020)		(0.50)
COLLATERAL	−0.050***	−0.0017	54.7***			
	(0.0066)	(0.0020)	(2.50)			
Adj. R^2	0.27	0.51	0.36	0.27	0.51	0.24
N	25,281	25,281	25,281	25,281	25,281	25,281
F-value for first stage	190.7	536.2		193.0	547.4	
Net effect			2.48			1.07

G. Robustness Tests

In this subsection, we conduct a variety of tests to evaluate the robustness of our results. The tests that we conduct are as follows: i) the use of the total cost of borrowing, as opposed to the fees alone (Berg et al. (2016)); ii) the use of the rolling past-12-month EDF to define distress status; iii) different types of distress measures, relationship measures, and heterogeneity among borrowers on

[16] Due to computational problems, we did not include firm fixed effects in this estimation.

distress response; iv) heterogeneity in the types of loans given in distress (term loan vs. line of credit); v) heterogeneity in the types of banks (systemically important banks); vi) the use of technical default to explain the time pattern of fees (Roberts and Sufi (2009)); vii) the use of a firm-year fixed-effect model; and viii) heterogeneity in response to borrower distress due to differences in lenders (Ioannidou and Ongena (2010)).

Table 9 reports a summary of the results, where for each of these tests, the degree of significance for fees, collateral, and lending volume is given. The complete estimation results, along with details on the implementation, are given in the Supplementary Material. Broadly, the fee results are similar to the earlier results. The collateral results are inconclusive, with a negative effect in some specifications, positive in one test, and insignificant in some tests. Thus, our main results are robust to a variety of alternative specifications.

TABLE 9
Summary of Robustness Tests

Table 9 summarizes the robustness tests results. Here we report only the statistical significance of the net effect of relationship banking on the distress loan. All firm characteristics in Table 3 are included in the empirical estimation but not reported to conserve space. As defined by Berg et al. (2016), the total cost of borrowing (TCB) incorporates the price options embedded in loan contracts as well as screen borrowers on their likelihood of exercising these options. Specifically, it is estimated as follows: TCB = upfront fee/expected loan maturity in years + (1 − PDD) × (facility fee + commitment fee) + PDD × (facility fee + spread) + PDD × prob(utilization > utilization threshold|usage > 0) × utilization fee + prob(cancellation) × cancellation fee, where PDD, the probability of draw-down, is the ex ante probability that the credit facility is going to be drawn down. The spread, the facility fee, the commitment fee, and the utilization fee are annual cost measures as well, whereas the upfront and the cancellation fees are one-time fees and need to be annualized. The procedure to categorize a firm as being in distress in a given month using a rolling window is as follows: For each month in the year, the expected default frequency (EDF) of the firm is computed using the Moody's KMV implementation of Merton's model. We count the number of months that the firm's EDF lies in the top 10% of the EDF for all firms in the Center for Research in Security Prices (CRSP) and Compustat merged database for all years in our sample. If the number of months that the firm's EDF is in the top decile of default probabilities is greater than or equal to 6 in the past 12 months, we classify the firm as being in distress in the given month. A loan facility with a starting date in a distress month is classified as a distressed loan. See the Supplementary Material for a detailed discussion of the procedures, and see Appendix C for a detailed definition of all variables. 0 denotes that the net effect is statistically insignificant, + denotes that the net effect is significantly positive, and − denotes that the net effect is significantly negative.

Test ID	Appendix Table Number	Robustness Tests	FEE	COLLATERAL
1	IA1	Using TBC as defined by Berg et al. (2016)	0	−
2	IA2	Using rolling past-12-month EDF to define distress status	0	−
3	IA3	Using EDF 70th percentile as cutoff point to define distress status	0	−
4	IA3	Using negative cash flow to define distress status	0	−
5	IA3	Using 3-year window to define relationship banks	0	0
6	IA3	Adding syndicate structure variables as controls	0	−
7	IA3	Using firms that ever experience distressed as subsample	0	−
8	IA4	Credit-line subsample	0	0
9	IA4	Term-loan subsample	0	−
10	IA5	Systemically important banks subsample	0	0
11	IA6	Excluding technical default firms as subsample (Roberts and Sufi (2009))	0	0
12	IA7	Using firm-year fixed-effects model	0	+
13	IA8	Lender matching following Ioannidou and Ongena (2010)	+	0

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V. Differences from Bank-Dominated Economies

Overall, our results do not support the argument that relationship banking is a remedy for the borrowing firm's distress. This contrasts sharply with the results in other countries. Here we elaborate on some potential reasons for the differing results. Hoshi et al. (1990) study the impact of a main bank relationship on investment by distressed firms in Japan and find that firms with a main bank do not cut investment as much as firms without a main bank. We study loan rates and find no benefits in distress. Weinstein and Yafeh (1998) find that the wealth gains of industrial firms in Japan with a main bank are lower relative to those without a main bank, and they suggest that this is partly due to higher interest rates and suboptimal bank-financed inputs. Thus, the support during distress seems to have a cost in a normal period.[17]

Elsas and Krahnen (1998), (2002) use a sample of German firms to answer questions similar to ours. Using a sample of 200 German firms, with approximately 75 in potential distress, Elsas and Krahnen (1998) find that house banks provide liquidity insurance for moderate levels of borrower distress. They do not find any pricing effects in distress. Using the same data set, Elsas and Krahnen (2002) find that relationship loans are more likely to be collateralized, and that relationship banks are more likely to engage in workouts for borrowers in distress.[18] At the same time, they do find that extreme distress events (movement of two or more rating classes) result in the termination of liquidity insurance, which is similar to our results. This suggests that there are limits to the insurance provided by implicit contracting, even in bank-dominated economies.

Schäfer (2019) studies Armenia, which is also a bank-dominated economy, and finds liquidity insurance effects. Relationship loans to the same firm are 70% more likely to become delinquent, yet relationship banks compensate by charging a spread that is over 1.5% higher than that in a normal period. Thus, she finds that banks change to a higher interest rate in a normal period to compensate for greater payment flexibility in distress. In contrast, we find that relationship banks give a discount in a normal period and no discount in distress. One important difference of our study from her study is that the borrowing firms we study are much larger. Thus, they have sources to alternate forms of financing, which makes intertemporal liquidity insurance more difficult. This is also consistent with the findings of Bolton et al. (2016) for Italy.

Another primary difference of our study relative to the three studies in Germany and Armenia is that our sample is based in the United States, where competition among banks, as well as between banks and markets, is quite high relative to both Germany and Armenia. As Allen and Gale (1995) point out, the close relationships that banks share with their borrowers in bank-dominated economies may facilitate greater monitoring and lower borrower switching when conditions

[17] The phenomenon of zombie lending, as documented by Peek and Rosengren (2005) and Caballero et al. (2008), is widespread in Japan. There is no evidence for zombie lending in the United States for the time period of our study.

[18] In contrast, Demiroglu and James (2015) find that the likelihood of an out-of-court restructuring is lower for relationship loans in the United States, consistent with our findings. Their sample consists mainly of defaulted firms, which is different from our sample.

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improve, which allows for the provision of intertemporal liquidity insurance. We believe that this is one important reason for the difference in our results relative to those in bank-dominated economies.

VI. Conclusion

The previous literature has documented significant benefits of lending relationships to borrowing firms. Few studies focus on relationship lending during distress. Prior studies, which are based on bank-dominated economies, tend to find the provision of liquidity insurance, as well as some pricing forbearance, by relationship banks during borrower distress. In contrast, we find lower pricing in a normal period and no liquidity insurance or pricing benefits in a distressed period. The most important reason that could drive these differences is the lack of intertemporal smoothing by banks as theoretically suggested by Allen and Gale (1997). We suggest a potential extension of their model because their model is developed for intertemporal risk sharing by consumers, whereas we document empirically that this insight extends to the intertemporal risk sharing for borrowers from intermediaries in the United States. This suggests that the insights from this model extend even beyond the setting, and further empirical examination would be needed to carefully evaluate the suggestive evidence that we document here in this regard. We leave this for future work.

The results in this article suggest that the notion of "implicit contracting" that exists in the relationship banking literature needs to be refined because one important dimension of the implicit contract, that is, loan-rate smoothing by relationship banks for firms in distress, is not found in our data sample. Thus, a reputation for helping customers in distress, as envisaged by Boot et al. (1993) and Dinc (2000), is not valid for the U.S. lending market. A reputation for insuring borrowers against system-wide shocks to the interest rate, as found by Berlin and Mester (1999), may be the more relevant metric for bank reputation because it is more easily observable by borrowing firms.

Appendix A. Construction of Relationship Measures

Assume that the current loan facility of firm ABC has a start date of Feb. 3, 1995. We take the loan history for firm ABC from Feb. 3, 1990, to Feb. 2, 1995, and identify all lead lenders for loans given to firm ABC during this 5-year period. Let us assume that firm ABC obtained 1 loan from bank X, 2 loans from bank Y, and 5 loans from bank Z (bank X, Y, and Z are all lead lenders in the syndicated loans) during this 5-year period. Bank X, bank Y, and bank Z are all relationship lenders. Bank Z is a strong relationship lender because more than 50% of firm ABC's loans during the last 5 years are from bank Z. If the lead lender of the current loan facility is either bank X, Y, or Z, then the current loan facility is a relationship loan to firm ABC, and the REL_LOAN dummy takes the value of 1. If the lead lender of the current loan facility is neither X nor Y nor Z, then the current loan facility is a nonrelationship loan to firm ABC, and the REL_LOAN dummy takes the value of 0. REL_LOAN_DOL and REL_LOAN_NUM are computed using the dollar value (number) fraction of loans that go to a given lender relative to the total value (number) of loans taken by the borrower, also in the 5-year window prior to the current loan date. For facilities where there are multiple relationship banks retained, we use the maximum value

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of these variables over all relationship banks. If a firm has no loans in the past 5 years, all these measures are set to missing.

REL_YEAR is a dummy variable that measures relationships on a firm-year basis. Using the same example as previously, firm ABC in the year 1995 has three relationship banks: X, Y, and Z. During the year 1995, if any of the three banks (X, Y, and Z) has extended at least one loan to firm ABC, then firm ABC is defined as having a relationship loan in the year 1995, and the REL_YEAR dummy is equal to 1. If firm ABC in 1995 received loans but none of them is from a relationship bank (which is X, Y, or Z), the REL_YEAR dummy is equal to 0. REL_YEAR_DOL (REL_YEAR_NUM) measures the total dollar value (total number) of relationship loans in the given year relative to the total dollar value (total number) of loans taken by the borrower in the given year. If a firm had no loans in the given year, then this measure is set to missing.

The construction of relationship measures is complicated by the fact that the sample period is one where several banks merged with one another. We collect data on such mergers using the Securities Data Company (SDC) merger database and news searches on the bank mergers in our sample. In the case of a merger, we assume that all lending relationships of both the merging banks carry over to the new merged bank. In all merger cases, the effective date of the merger is used for computing the relationships of the new merged bank. In cases where we cannot identify the exact effective date, we use the end of the year in which the merger is effective. Also, there are several subsidiaries of the same bank that may be present in the loan sample. To identify subsidiaries of the same ultimate parent, we search the Web sites of the bank, and we use the National Information Center of the Board of Governors of the Federal Reserve System (http://www.ffiec.gov/nicpubweb/nicweb/nichome.aspx) to identify the ultimate parent. We also search in the company profiles within the Hoover's database, which is a part of Lexis Nexis. Our search procedure is conservative in that we assign subsidiaries to the same parent only if we can identify with a high degree of certainty that a given bank is indeed the subsidiary of a given parent.

Appendix B. Calculating the EDF from Merton's Distance-to-Default Model

For each firm-year in the sample, we calculate monthly the EDF from Merton's distance-to-default model following Bharath and Shumway (2008). The Merton-type option-pricing model assumes that the total value of a firm follows geometric Brownian motion:

$$dV = \mu V dt + \sigma_V V dW,$$

where V is the total value of the firm, μ is the expected continuously compounded return on V, σ_V is the volatility of firm value, and dW is a standard Weiner process. The equity of the firm can be viewed as a European call option on the value of the firm's assets with a strike price equal to the face value of the firm's debt with a time to maturity of T, which satisfies:

$$E = V\mathrm{N}(d_1) - e^{-rT}F\mathrm{N}(d_2),$$

where E is the market value of the firm's equity, F is the face value of the firm's debt, r is the risk-free rate, $\mathrm{N}(\cdot)$ is the cumulative standard normal distribution function, d_1 is given by

$$d_1 = \frac{\ln\left(\frac{V}{F}\right) + (r + 0.5\sigma_V^2)T}{\sigma_V\sqrt{T}}, \tag{B-1}$$

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and d_2 is given by

$$d_2 = d_1 - \sigma_V \sqrt{T}.$$

Under Merton's assumptions, the equity volatility and asset volatility are related through the leverage and the degree to which the option value to default is in the money:

$$\sigma_E = \mathrm{N}(d_1)\sigma_V \frac{V}{E}. \tag{B-2}$$

The market value of the firm's equity E is based on the closing price and shares outstanding at the end of each month. The face value of debt F is calculated following the KMV practice. The KMV Corporation has done the empirical research and found that the default point is current liability plus half of the long-term loan. The forecast horizon T is set to be 1 year. The risk-free rate r is the 1-month Treasury bill rate from the Fama–French benchmark factors. The volatility of equity σ_E is estimated from historical daily stock return data over 1 year. To solve for σ_V and V, we follow the practice of KMV by implementing an iterative procedure. The starting values of σ_V and V are defined as

$$\begin{aligned} V &= E + F, \\ \sigma_V &= \sigma_E \frac{E}{E+F}. \end{aligned}$$

Once σ_V and V are obtained, the expected default frequency is calculated as

$$\mathrm{EDF} = \mathrm{N}\left(- \frac{\ln\left(\frac{V}{F}\right) + (\mu - 0.5\sigma_V^2)T}{\sigma_V \sqrt{T}} \right).$$

The SAS code used to calculate the EDF is obtained from the working-paper version of Bharath and Shumway (2008) and is available from the authors.

Appendix C. Definitions of Variables

COLLATERAL: A dummy variable that equals 1 if the loan was secured, and 0 otherwise.

COVENANT: The total number of financial and general covenants in the loan facility.

COVERAGE_RATIO: The natural log of the ratio (1 + EBITDA/interest expenses).

CURRENT_RATIO: The ratio of current assets to current liabilities.

DISTANCE: The natural log of the distance between the borrower and the lender.

DISTRESS: A dummy variable that takes a value of 1 if the firm is in distress in the given year, and 0 otherwise. The procedure to categorize a firm as being in distress in a given year is as follows: For each month in the year, the EDF of the firm is computed using the Moody's KMV implementation of Merton's model. We count the number of months that the firm's EDF lies in the top 10% of the EDF for all CRSP–Compustat firms for all years in our sample. If the number of months that the firm's EDF is in the top decile of default probabilities is greater than or equal to 6, we classify the firm as being distressed in the given year. A loan facility with a starting date in a normal year is classified as a normal loan, and one made during a distress year is classified as a distressed loan. A loan that is made in a year where the firm is in distress as well as files for bankruptcy is classified as a distressed loan unless it is explicitly classified as a debtor-in-possession (DIP) loan.

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EDF: Expected default frequency; computed using the Moody's KMV implementation of Merton's model. Details can be found in Appendix B.

FACILITY_AMOUNT: The dollar amount of the loan facility in millions, adjusted for inflation in year 1986 dollars.

FEE: The all-inclusive cost of a drawn loan to the borrower. This equals the coupon spread over LIBOR on the drawn amount plus the annual fee and is reported in basis points.

FILING: A dummy variable that takes a value of 1 if the firm files for bankruptcy in the next year, and 0 otherwise. If a firm delists and files for bankruptcy in a later year, we use the year of delisting as the year of bankruptcy, following Chava and Jarrow (2004).

LEVERAGE: The ratio of book value of total debt to book value of assets.

ln(MATURITY): The natural log of the maturity of the loan facility measured in months.

ln(TOTAL_ASSET): The natural log of the total asset of the borrower.

MARKET_TO_BOOK: The ratio of (book value of assets − book value of equity + market value of equity) to book value of assets.

MATURITY: The duration (in months) between the facility activation date and the maturity date.

NORMAL: A dummy variable that takes a value of 1 if the firm is not in distress in the given year, and 0 otherwise.

OTHER_CONTROLS: Other control variables include dummy variables for the year of the loan facility, loan purpose, loan type, Standard & Poor's (S&P) senior unsecured debt rating with not-rated firms considered as a separate group, and the industry of the borrower.

PROFITABILITY: The ratio of EBITDA to sales.

REL_LOAN: A dummy variable that takes a value of 1 if the current loan is a relationship loan, and 0 otherwise. A given loan is classified as a relationship loan if any of the lead lenders retained in the given loan facility were retained as the lead lenders in any loan taken by the same borrower over the last 5 years. If there were no loans taken by the borrower in the past 5 years, it is set to missing.

REL_LOAN_DOL: The fraction of loans (in dollar-value terms) in the last 5 years of a given borrower that went to the relationship lender retained in the current loan. If no relationship lender is retained in the current loan, this is set to 0. If multiple relationship lenders are retained, it is set to the maximum value across all relationship lenders. If there were no loans taken by the borrower in the last 5 years, it is set to missing.

REL_LOAN_NUM: The fraction of loans (using the number of loans) in the last 5 years of a given borrower that went to the relationship lender retained in the current loan. If no relationship lender is retained in the current loan, this is set to 0. If multiple relationship lenders are retained, it is set to the maximum value across all relationship lenders. If there were no loans taken by the borrower in the past 5 years, it is set to missing.

REL_YEAR: Takes a value of 1 for firm-years where the firm obtained at least one relationship loan as defined previously, 0 for firm-years with no relationship loan, and missing when there is no loan made to the borrowing firm in the given year or the firm.

REL_YEAR_DOL: The ratio of the sum of the loan-facility amounts of all relationship loans taken by a given borrower in a given year to the sum of the facility amounts of all loans taken by the same borrower in the same year.

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REL_YEAR_NUM: The ratio of the total number of relationship loans taken by a given borrower in a given year to the total number of loans taken by the same borrower in the same year.

RMI_DEFAULT_PROBABILITY: A default probability measure computed by Duan et al. (2012) from the Risk Management Institute (RMI) default database.

STRICTNESS: The probability that the lender will receive contingent control via a covenant violation following Murfin (2012).

$T-2$: A dummy variable that takes a value of 1in the 2 years prior to the distress year.

$T-1$: A dummy variable that takes a value of 1 in the year prior to the distress year.

$T+1$: A dummy variable that takes a value of 1 in the year subsequent to the distress year.

$T+2$: A dummy variable that takes a value of 1 in the 2 years subsequent to the distress year.

TANGIBILITY: The ratio of property, plant, and equipment (PPE) to total assets.

TOTAL_ASSET: The book value of the assets of the borrower adjusted for inflation in year 1985 dollars.

Z_SCORE: Altman's Z_SCORE $= 0.012 \times$ working capital/total assets $+ 0.014 \times$ retained earnings/total assets $+ 0.033 \times$ earnings before interest and taxes/total assets $+ 0.006 \times$ market value of equity/book value of total debt $+ 0.999 \times$ sales/total assets.

Appendix D. Treatment of Overlapping Distress Observations

When constructing the time event dummies, we need to explicitly account for adjoining distress events and overlaps of the time event dummies across two distress events of the same firm. For the first case, when a firm is distressed for 2 or more years consecutively, we treat the entire time period as a single distress observation. Thus, for a firm that is in distress in 1995 and 1996, both years would be treated as the distress year. Furthermore, loans in 1993 and 1994 would be treated as observations in $T-2$ and $T-1$, respectively, for this firm distress event, and loans in 1997 and 1998 would be treated as observations in $T+1$ and $T+2$, respectively. In the second case, when the distress events do not occur in consecutive years, but the time windows surrounding the distress events overlap, which would happen if two firm distress years are separated by less than 4 years, we adopt the following procedure: For two distress events separated by exactly 1 year, we assign the intermediate year to exactly one of the distress events randomly. Thus, if a firm is in distress in 1995 and 1997, all loan observations in 1996 are randomly assigned either to year $T-1$ for the 1997 distress observation or to year $T+1$ for the 1995 distress observation, but not both. Note that loans in the distress year are always assigned to the distress dummy only. Thus, even though the loan observations for 1995 would be the $T-2$ year observations for the distress event in 1997, they are only assigned to the distress event dummy. For distress events separated by 2 years, we again randomly assign each of the intervening-year loan observations to one of the two distress events, but not both. We adopt a similar procedure for distress events separated by 3 years for the 1 year where the time windows overlap. This procedure ensures that any given loan observation is not double-counted in the regression. As a robustness test, we also excluded all the overlapping observations from the estimation, and we obtain similar results.

Supplementary Material

Supplementary Material for this article is available at https://doi.org/10.1017/S0022109018001084.

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

https://doi.org/10.1017/S0022109018001084 Published online by Cambridge University Press

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