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## Collateralization, Bank Loan Rates, and Monitoring

GERALDO CERQUEIRO, STEVEN ONGENA, and KASPER ROSZBACH\*

### ABSTRACT

We show that collateral plays an important role in the design of debt contracts, the provision of credit, and the incentives of lenders to monitor borrowers. Using a unique data set from a large bank containing timely assessments of collateral values, we find that the bank responded to a legal reform that exogenously reduced collateral values by increasing interest rates, tightening credit limits, and reducing the intensity of its monitoring of borrowers and collateral, spurring borrower delinquency on outstanding claims. We thus explain why banks are senior lenders and quantify the value of claimant priority.

**COLLATERAL REDUCES THE RISK of debt in two important ways. First, it facilitates enforcement against a defaulting debtor. In the case of default, the creditor can**

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seize the secured assets to satisfy the obligation. Second, it offers protection against competing claims by other creditors when an insolvent debtor faces liquidation. Collateral is therefore an important contractual device that affects the behavior of borrowers and lenders, as well as the design of debt contracts.<sup>1</sup>

Although the economic functions of collateral are well understood in theory, direct empirical evidence is relatively scant. Any attempt to analyze the role of collateral in debt contracts faces two immediate empirical challenges. The first challenge is an econometric one. Collateral is likely to be jointly determined with all other terms of a debt contract. Therefore, it is difficult to draw strong inferences about its role in the absence of experimental evidence. The second challenge is a steep data requirement. Understanding how collateral affects debt contracts requires that one can actually observe how the creditor values the particular security interest on the debtor's assets. However, the value of the collateral may depend not only on the value of the secured assets, but also on the legal mechanisms and institutions that define when and how a creditor can seize those assets.

In this paper, we aim to take a step forward in identifying the role that collateral plays in debt contracts, credit availability, and bank monitoring. To do so, we exploit a quasi-experimental setting and a rich proprietary data set, which together enable us to overcome the two empirical challenges above.

In particular, we exploit a legal change in Sweden on January 1, 2004, that reduced the value of all floating liens. The floating lien is a general security interest that pertains to specific categories of assets. These assets are not individually identified, however, and thus the floating lien carries over to future assets present in the specified categories. For instance, suppose that a firm provides as collateral a security interest on its accounts receivable. The firm is allowed to freely dispose of the secured assets as long as it meets its debt obligations. As a result, the actual items in the claim will constantly change due to the turnover in accounts receivable. In the event of a default, the creditor obtains a claim on any of the present accounts.

Before 2004, floating liens were special priority claims that enabled creditors to seize a firm's property outside bankruptcy and without court intervention. The legal change on January 1, 2004, abolished the special priority rights of all floating liens and in effect reduced the pool of eligible assets under them. The loss of special priority rights implied that the holders of floating liens could seize the secured assets only following a court order declaring the debtor's bankruptcy.

The second ingredient in our empirical strategy is a rich data set from a major Swedish bank that contains all records from its entire portfolio of business loan contracts. This data set includes monthly updated estimates of the

<sup>1</sup> Asset market fluctuations, particularly real estate prices, influence the debt capacities, and investments of firms through the so-called collateral channel (Gan (2007), Chaney, Sraer, and Thesmar (2012)). Collateral can also generate business cycles (Bernanke and Gertler (1989)), and can become critical during a crisis. "Collateral is the grease that oils the lending system. [...] If the grease starts to freeze or run out, the loan cogs won't run as well" (*Financial Times*, November 28, 2011, "Financial System Creaks as Loan Lubricant Dries Up").

value of the assets pledged to secure each loan, the bank's internal records on borrower-specific lending limits, all adjustments to each individual loan interest rate, and key information needed to construct sensible measures of bank monitoring activity. The unique quasi-natural experiment combined with the comprehensive bank data set enables us to address the usual econometric identification challenge.

We study the effects of the legal change using a differences-in-differences method that compares a treated group of loans with a control group. Treated loans are those for which the borrower pledged the bank a floating lien that is still outstanding around the time of the legal reform. We compare the treated loans with a group of similar control loans granted to borrowers in the same industry that did not pledge floating liens during our sample period.

We establish four main findings, which we obtain by comparing the same set of loans and/or borrowers before and after the legal change. First, following the change in the law, the bank reduces the assessed value of the outstanding collateral. The collateral coverage ratio—that is, the bank's internal and frequently updated estimate of the value of the assets pledged over the loan balance—drops by six percentage points on average following the legal change, a sizeable drop with a semielasticity of almost 13% from its unconditional mean and standard deviation (which both equal around 47%).

Second, following the loss in collateral value, the bank increases the interest rate on outstanding treated loans by 20 basis points. We are able to identify the causal relationship from collateral to the interest rate sharply because all business loans carry a quarterly adjustable interest rate while all other contract terms are fixed. The bank further reduces its internal credit limit to affected borrowers (i.e., the total amount of credit a loan officer can grant to the firm without any further internal approval) by 11%.

Third, following the legal change, the bank reviews the condition of both borrowers and the assets pledged as collateral less frequently. In particular, the bank lengthens the review interval of borrowers by around 25 days and the review interval of collateral by more than two months.

Fourth, following the abolishment of the special priority rights, the tightening of credit, and the reduction in bank monitoring, 12 percentage points more borrowers start missing payments to tax authorities and other creditors. On average, around 20% of these payment delays are court injunctions.

Overall, our findings are consistent with the theoretical prediction that, to compensate for ex post moral hazard, riskier borrowers are more likely to be required to pledge collateral.<sup>2</sup> While extant empirical evidence largely confirms this to be the case,<sup>3</sup> our findings that collateral value negatively affects the loan

<sup>2</sup> This theoretical literature emphasizes the role of collateral as an effective loan contracting tool aimed at ameliorating information asymmetries in the credit market (Freixas and Rochet (2008)). Collateral may also compensate for ex ante adverse selection problems, predicting that unobservably safer borrowers are more inclined to pledge collateral. Seminal theoretical contributions on the role of collateral include Bester (1985), Chan and Thakor (1987), Boot, Thakor, and Udell (1991), and Boot and Thakor (1994).

<sup>3</sup> See Berger and Udell (1990, 1995), Harhoff and Körting (1998), Degryse and Van Cayseele (2000), Lehmann and Neuberger (2001), Jiménez, Salas, and Saurina (2006), Agarwal

rate<sup>4</sup> and that borrowers start missing payments following the legal change are especially meaningful.

Note that our third finding suggests that collateral may complement monitoring. This result is in line with Rajan and Winton (1995), who model how collateral can improve lenders' incentives to monitor when the value of the assets pledged is risky.<sup>5</sup> In particular, they argue that, in the presence of other claimants, monitoring is valuable because it allows the lender to demand (additional) collateral if the firm is at increased risk of distress. As a result, collateral should improve a bank's monitoring incentives.

To our knowledge, Ono and Uesugi (2009) is the only other empirical study that assesses the relation between collateral and monitoring. Using the frequency with which firms submit documents to their main bank in a survey data set of Japanese small and medium enterprises as a proxy for banks' monitoring intensity, the authors find that firms that are more intensely monitored are less likely to pledge collateral.<sup>6</sup> By combining a unique experimental setting and a comprehensive data set we overcome the fundamental econometric challenge that this and other existing studies have faced in identifying the value of collateralization and its impact on borrower quality and bank monitoring.

Our paper also adds to an empirical literature that examines the effects of liquidation value on financial contracts (Benmelech, Garmaise, and Moskowitz (2005), Benmelech (2008), Benmelech and Bergman (2009, 2011), and Gavazza (2010)). Our paper differs from these studies in two important ways. First, we have access to precise collateral values as assessed by the creditor. Second, we analyze a separate determinant of liquidation value. While the cited studies focus on the redeployability of assets, we also analyze the role of the priority structure of claims. Specifically, our study contributes to the literature by providing an estimate of the value of creditor seniority. Although the

and Hauswald (2010), Berger, Frame, and Ioannidou (2011), and Berger et al. (2011), among others. Degryse, Kim, and Ongena (2009) review the empirical evidence on collateral and bank-firm relationships.

<sup>4</sup> Our setting takes an additional step toward meeting the econometric challenge of loan contract terms being determined jointly (Melnik and Plaut (1986)). Dennis, Nandy, and Sharpe (2000), Brick and Palia (2007), Bharath et al. (2007), and Godlewski and Weill (2011) study different U.S. data sets using an instrumental variables approach and find a positive and statistically significant effect of their collateral dummy on the loan rate, in line with *ex ante* collateral theories (see also John, Lynch, and Puri (2003)).

<sup>5</sup> From the lender's perspective, inside collateral grants a higher position on the seniority ladder and therefore reduces the lender's expected losses given a borrower's default. Berglöf and von Thadden (1994), Repullo and Suarez (1998), Gorton and Kahn (2000), Longhofer and Santos (2000), and Park (2000), among others, demonstrate that seniority improves a lender's incentives to monitor the firm and liquidate the firm if it enters financial distress.

<sup>6</sup> Ono and Uesugi (2009) measure the incidence of collateral with an indicator variable. About 72% of the firms in their sample responded that they pledged collateral to their main bank. They measure monitoring with an ordinal variable that ranges from one (documents submitted to the borrower once every one to two months) to four (documents submitted on an annual basis). In a related study, Argentiero (2009) employs data from Italy to analyze the relation between collateral value and firm screening, measured as the number of bank employees in the lending branch scaled by the loan amount. See also Stroebel (2013).

priority structure of creditors is key in corporate finance theory, direct empirical evidence on the actual value of debt seniority is scant. Our quasi-natural experimental setting based on an exogenous decrease in the value of a special priority right claim and the availability of an actual value assessment by the creditor offers a unique opportunity to provide such evidence. In this regard, our findings also contribute to a growing literature investigating how legal reforms affect credit markets.<sup>7</sup>

The remainder of this paper is organized as follows. Section I describes the legal change. Section II details the data and variables. Section III explains the empirical methodology. Section IV discusses the impact of the legal change on collateralization, loan rates, borrower limits, bank monitoring effort, and borrower delinquency. Section V concludes.

## I. Institutional Background

### A. *The Floating Lien*

A floating lien is a general security interest that is recognized in many jurisdictions around the world, including nearly all English-based jurisdictions, for example, the United States, the United Kingdom, and Australia.<sup>8</sup> The floating lien is a security interest in prespecified classes of “movable” property, such as inventories or accounts receivable, in which the individual assets are not specifically identified. The property underlying the lien can therefore change over time. The floating lien extends to any property that is acquired by the company while the debt is outstanding. For instance, a company can obtain loans and provide as collateral a general security interest in its accounts receivable. The actual items of this property can change over time due to the creation and collection of accounts receivable.

The floating lien is not attached to any particular asset. The borrower is allowed to use, collect, or dispose of the covered assets, and the floating lien automatically attaches to any new similar property item. The floating lien does

<sup>7</sup> Haselmann, Pistor, and Vig (2010), for example, show that the strengthening of legal rules designed to protect individual creditors' claims outside bankruptcy increased bank lending in transition countries, while Vig (2013) finds that the strengthening of creditor rights in the 2002 Indian bankruptcy reform reduced secured credit, because borrowers anticipated a greater liquidation bias in bankruptcy. von Lilienfeld-Toal, Mookherjee, and Visaria (2012) document how an Indian judicial reform that increased banks' ability to recover nonperforming loans reduced credit access for small borrowers but expanded it for wealthy borrowers. See also Rodano, Serrano-Velarde, and Tarantino (2013). This literature follows La Porta et al. (1997, 1998), Levine (1999), Djankov et al. (2003), and Beck, Demirgüç-Kunt, and Levine (2005), among others, who provide evidence on the importance of the legal system for financial and economic outcomes.

<sup>8</sup> Gennaioli and Rossi (2013) show that, in the presence of strong creditor rights, the optimal contractual resolution of financial distress involves the use of a floating lien. Franks and Sussman (2005) document that the floating charge in the United Kingdom works well as the basis of foreclosure of small and medium-sized companies (Djankov et al. (2008) generalize this result to a broad set of countries). Banks in the United Kingdom manage to divert the direct costs of bankruptcy (to other creditors) and increase their recovery rate, by reallocating these direct costs from their (often-present) fixed to floating charges.

not provide the creditor legal rights to the firm's existing assets until some "crystallizing event" occurs, for instance, the debtor files for bankruptcy. The floating lien then fixes itself (or "crystallizes") to the existing assets covered by the lien and the creditor takes control of these assets.

### *B. The Floating Lien in Sweden*

Before 2004, floating liens enabled Swedish companies to pledge as collateral particular categories of movable property. "Real" property such as land, buildings, and machinery, as well as financial assets such as cash, bank deposits, stocks, and bonds, could not be covered by floating liens before 2004.<sup>9</sup>

An official register maintained by the Swedish Companies Registration Office records each floating lien and its issuer. The holder of the lien can voluntarily list himself in the register. Registering a floating lien does not guarantee that nominally sufficient collateral is present in the business. For example, the registration office does not have any responsibility to verify the degree of collateral coverage. If a business has registered multiple floating liens, these claims have relative seniority ordering depending on the calendar date of their registration. Businesses pay a 1% annual registration fee on the outstanding amount of the floating lien plus a nominal fee upfront.

Before 2004, floating liens were *special priority* claims that could be activated outside bankruptcy. In particular, the lien could be activated in the event that any other creditor seized the firm's property. Floating liens were therefore senior to: (1) *general priority claims*, which included costs incurred in bankruptcy or reconstruction procedures, taxes, and most of the wage claims by employees (a limited part has special priority rights), and (2) *ordinary claims*—the enforcement of both general priority claims and ordinary claims requires a court order declaring the debtor's bankruptcy.<sup>10</sup>

### *C. The 2004 Legal Change*

On January 1, 2004, the law that regulates floating liens (or, "the law") was changed.<sup>11</sup> Floating liens granted after January 1, 2004, were immediately governed by the new rules, while those granted before that date legally converted by January 1, 2005. The conversion could occur anytime between January 1, 2004, and January 1, 2005, provided that the lender and the borrower agreed on the new contract terms.

<sup>9</sup> The Internet Appendix provides more details on the Swedish floating lien and banking market. The Internet Appendix may be found in the online version of this article.

<sup>10</sup> Sweden adopted an auction bankruptcy system that requires the immediate sale of the company (Thorburn (2000), Strömberg (2000), Eckbo and Thorburn (2003)). Eckbo and Thorburn (2009) compare the Swedish auction bankruptcy system with U.S. Chapter 11.

<sup>11</sup> The "Lag (2003:528) om företagsinteckning" replaced the "Lag (1984:649) om företagshypotek."

The new law introduced two important changes. First, it abolished the special priority rights of floating liens, which were converted into general priority claims. Consequently, under the new regime lien holders can seize the debtor's assets only in bankruptcy. The new law reduced the liquidation payoff of lien holders, since the assets covered by the floating lien had to also satisfy other general priority claims, such as costs of bankruptcy or reorganization procedures, and taxes.

Second, the new law reduced the share of total eligible assets that could be covered in a floating lien from 100% to 55% of a debtor's total eligible assets that remain after senior creditors have been paid. At the same time, the new law expanded the categories of assets that could be pledged in the floating lien to comprise all asset types, including cash, bank deposits, financial assets, and real estate. Overall, most businesses experienced a decline in pledgeable assets and the floating lien lost value in most cases. In fact, the official records of the Parliamentary Committee on Civil Law explicitly mention that collateral of lower quality should "Give stronger incentives for banks in credit granting decisions to analyze profitability, [...] and weaken incentives to secure collateral."<sup>12</sup>

Given the quasi-experimental setting this legal change provides, involving an exogenous and rather sudden loss in the value of all floating liens, we study its impact on all outstanding loans and a bank's collateralization requirements, loan rates, and monitoring activity.<sup>13</sup>

## II. Data and Variables

### A. Data

For our analysis, we use a unique and comprehensive database containing all corporate accounts of one of the major Swedish commercial banks (henceforth, "the bank").<sup>14</sup> The database contains all loan files the bank maintains for each borrower at a monthly frequency between 2003:01 and 2005:09. These data are classified into several broadly defined types of loans, such as credit cards, other credit facilities, mortgages, term loans, leases, and other asset-based loans. These broad categories are further disaggregated into more specific loan types (e.g., operating leases and capital leases). Our analysis focuses on a particular loan type defined at the highest disaggregation level, which we label "business

<sup>12</sup> *Sveriges Riksdag, Lagutskottets Betänkande* (Report by the Swedish Parliamentary Committee on Civil Law) 2002/03: LU17, page 10. From 2003 to 2004 the number of floating liens registered decreased by 32% (Source: Swedish Companies Registration Office).

<sup>13</sup> Although an inquiry into the merits of the floating lien and the role of preferential collateral rights preceded the change in the law, the final details of the bill that Parliament later voted on were only announced in January 2003. The parliamentary term for amendments closed on March 6, 2003, and Parliament passed the bill on June 6, 2003. While we present results for 2004:01 as the date of the experiment, findings are similar if we instead use 2003:06.

<sup>14</sup> With this data set Degryse, Ioannidou, and Von Schedvin (2013) investigate the nonexclusivity of Swedish loan contracts.



**Table I**  
**Summary Statistics**

This table displays summary statistics for variables used in the analysis. The sample period is 2003:01 to 2005:09. Data for the internal loan limit are missing for 2003:01 and 2003:02.

	Mean	Median	Standard Deviation	Number of Observations
<b>Loan Characteristics</b>				
<i>Collateral Value</i> (€000)	50.30	4.41	189.23	89,466
<i>Loan Balance</i> (€000)	91.61	27.65	275.09	89,466
<i>Collateral Coverage Ratio</i> (%)	46.55	34.88	46.44	89,466
<i>Loan Spread</i> (%)	4.14	4.12	1.46	89,466
<b>Borrower Characteristics</b>				
<i>Internal Loan Limit</i> (€000)	312.90	88.12	1,017.90	81,300
<i>Internal Rating</i> (0–20)	9.28	10	3.15	46,096
<i>Unassigned Rating</i> (0/1)	0.48	0	0.50	89,466
<b>Monitoring</b>				
<i>Interval Between Borrower Reviews</i> (months)	10.25	11	4.33	89,466
<i>Interval Between Collateral Reviews</i> (months)	12.22	11	9.08	89,466

term loans.” In December 2003, these business term loans represent 6.5% of the bank’s loan portfolio value.

Business term loans can be unsecured or secured, and floating liens can be pledged to secure only this type of loan. These loans can also be secured by other nonstandard types of collateral, excluding cars, real estate, and machinery. Business term loans typically have a predefined quarterly repayment schedule (some loans have unspecified maturity). The loans carry a floating reference interest rate plus a spread that is adjustable on a quarterly basis. For our purposes, it is important that no contract condition other than the interest rate paid on the loan can be altered in response to a change in collateral values.

We supplement the bank’s data with information from the Swedish Companies Registration Office. The Office maintains registered information on all floating liens pledged in Sweden. The data set we employ tracks all floating liens registered between 2000 and 2008. For each floating lien, we obtain the date of registration and, when available, the identity of the creditor. It is not mandatory for the creditors to disclose their identity in the register. However, creditors often provide their identity voluntarily when filing the floating lien, because doing so allows for notification when collateral becomes callable.

## B. Variables

Table I lists the variables used in this study and presents descriptive statistics for each variable based on the entire sample. All variables displayed in Table I are obtained from the bank’s loan files. We analyze three sets of

variables that pertain to the loan contract, borrower creditworthiness, and the bank's monitoring activity.

### *B.1. Loan Characteristics*

First, we analyze the collateral value, loan balance, collateral coverage ratio, and loan spread. The key variable in our analysis is *Collateral Value*, which is the bank's internal and frequently updated estimate of the value of the assets pledged to secure that particular loan (all variable definitions are collected in the Internet Appendix). This estimate could differ from the floating lien's nominal value provided by the debtor to the Swedish Companies Registration Office. The Office does not have the responsibility to verify and update this value.

The collateral value we observe in the data is the bank's assessment of the actual value of the floating lien. This assessment uses two main inputs. The first input is an estimate of the value of the firm's assets that the bank could seize in the case of default. The second input is the seniority of the bank's claims within the firm's debt structure, which determines the bank's ability to preempt other creditors. Because loan officers are required to provide an estimate of the value of each floating lien only in the case of default, the bank's internal records—and consequently our data set—do not contain separate information about these two inputs.

Next, *Loan Balance* is the outstanding balance of the business term loan. Given that most of our business term loans have a predefined amortization scheme, the time series variation in this variable is mostly mechanical. We further define *Collateral Coverage Ratio* as the ratio of the collateral value to the loan balance. The coverage ratio equals 47% on average and its distribution is highly bimodal: while 35% of the loans are fully secured, 44% have a coverage ratio of zero.

The coverage ratio has at least two advantages over the first collateral value measure. First, the coverage ratio is a scaled measure that is directly comparable across firms. Second, the collateral value registered by the bank cannot be higher than the outstanding loan balance. This implies that the collateral value of fully secured loans mechanically decreases over time as the loans are amortized. In such cases, however, the collateral coverage ratio remains unaltered at 100%.

Finally, *Loan Spread* is the interest rate margin over the bank's reference rate. Reference rates decreased significantly in Sweden over our sample period, and thus we prefer to report results with the loan spread. In our sample, the average loan spread equals 4.1% and the average loan rate equals 6.6%.

### *B.2. Borrower Characteristics*

The second set of variables pertains to the bank's internal assessment of borrower creditworthiness. Our first measure, *Internal Loan Limit* is the maximum amount the loan officer is entitled to lend to a firm without further

internal approval. This internal limit, which is not communicated directly to the firm, is based on the repayment ability of the firm. Changes to this limit must be approved by a credit committee that meets regularly (see later for details). This variable is important because a change in the internal limit reflects a change in the loan supply. Notice that the internal limit is an aggregate credit limit for a general class of loans that includes the business term loans we analyze. The bank maintains separate internal limits for other types of credit, such as mortgages or other asset-based loans. We obtain similar results when we analyze a borrower's aggregate internal limit.

For most borrowers, the outstanding loan balance is a fraction of the internal limit. The sample-average ratio of loan balance to internal limit is 43%. Several factors explain why this ratio is much smaller than one. First, loan officers typically lend only a fraction of the internal limit. Second, the loan balance mechanically decreases as a firm pays back the loan, while the internal limit should only change with shifts in creditworthiness. Third, the internal limit may also apply to other outstanding loans in the same general class of loans.

Our second measure of the bank's assessment of borrower creditworthiness is *Internal Credit Rating*. The internal rating ranges from 0 (highest risk category) to 20 (lowest risk category), with a mean of 9.3. Only borrowers with exposure levels above a certain fixed predetermined threshold are assigned an internal rating.<sup>15</sup> We also construct a dummy variable that indicates whether the internal rating is missing, which occurs for almost half of the observations in our sample.

### *B.3. Monitoring*

The third set of variables captures bank monitoring activity. These monitoring measures are based on the frequency with which the bank reviews either the borrower's situation or the collateral value. These measures are consistent with the literature on corporate governance and corporate control. For instance, corporate governance studies often employ the frequency of board meetings as a proxy for CEO monitoring (Vafeas (1999)), and the literature on venture capital financing emphasizes the staging of capital infusions as an important control mechanism for venture capitalists (Gompers (1995)).

Our first monitoring measure is the *Interval Between Borrower Reviews*, defined as the number of months between two consecutive borrower reviews. The average time to the next review is slightly above 10 months, and it ranges between 1 and 24 months. The review outcome may be a change in collateral value, loan spread, internal limit, and/or internal rating. A review of a borrower's situation requires that the loan officer collect and process new

<sup>15</sup> For confidentiality reasons, we cannot disclose what the threshold is. Based on all account activity, the bank assigns each borrower with an exposure below this threshold a so-called "behavioral rating." We do not have access to the behavioral ratings. Evidence on the importance of indications from account activity for loan pricing is provided by Mester, Nakamura, and Renault (2007) and Norden and Weber (2010).

information about the borrower. Thus, more frequent reviews should reflect more intensive monitoring.

Our second monitoring measure is *Interval Between Collateral Reviews*. For all loans that a borrower has outstanding at the bank, we calculate this measure as the average number of months that elapses between two consecutive collateral revaluations, both before and after the change in the law.<sup>16</sup>

To address the concern that small adjustments in collateral value may be unrelated to monitoring and instead reflect noise, we measure the percentage of loans with a change in collateral value above the 10<sup>th</sup> percentile, 25<sup>th</sup> percentile, and median of the distribution of collateral revaluations. In the Internet Appendix we show that our conclusions for collateral monitoring remain unchanged when we use these variables instead of *Interval Between Collateral Reviews*.

While some infrequent additions or subtractions of collateral could also result in changes in collateral value, we note that in the context of floating liens they should largely be a consequence of loan officer monitoring and actions. As explained in Section I, the floating lien is a claim against an unspecified pool of assets. Because this pool of assets may change over time, the loan officer needs to reevaluate the company's assets to update its estimate of the collateral value. As a result, more frequent asset revaluations should reflect higher monitoring effort by loan officers in evaluating the assets pledged as collateral.

#### B.4. Borrower Delinquency

Finally, we create an indicator variable that equals one if the borrower received a notice, faced a court injunction, or missed any tax payment. We observe these payment notices at the end of each quarter. The Swedish tax authorities and courts communicate these tax notices to the public, and the registered events refer to various tax arrears, including back taxes, value-added tax (VAT), social security contributions for employees, parking tickets, and road taxes.

### III. Methodology

#### A. The Legal Change as a Natural Experiment

We examine the effects of the legal change using a differences-in-differences approach. This methodology compares the effect of the change in the law on two groups: a group that should be directly affected by the event, which we call “the treated group,” and a group that should not be directly affected by the event, which we call “the nontreated group” or “control group.” The differences-in-differences approach measures the differential effect of the change in the law across the two groups.

<sup>16</sup> Because our sample period is finite and our observation of monitoring is therefore censored, we estimate the last observation for this monitoring variable as the number of months between the mandatory latest review date imposed by internal bank rules and the last observed collateral review date.

**Table II**  
**Industry Composition of Control and Treated Groups**

The treated group contains borrowers that pledged floating liens to the bank before 2004 that are outstanding on January 1, 2004. The control group contains borrowers that did not register floating liens before 2004. The sample period is 2003:01 to 2005:09. Differences in means are assessed with the *t*-test. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

Industry	% in Control Group	% in Treated Group	Difference	<i>p</i> -Value
Agriculture	2.8	7.2	4.4***	0.00
Construction	8.6	9.2	0.6	0.17
Finance	1.2	0.5	-0.7***	0.00
Hotels and restaurants	4.4	4.0	-0.4	0.19
Manufacturing	15.9	21.9	6.0***	0.00
Other services	14.5	12.9	-1.6***	0.00
Real estate	14.2	2.1	-12.1***	0.00
Retail	25.5	31.4	5.9***	0.00
Transport	7.3	9.0	1.7***	0.00
Utilities	0.4	0.0	-0.4***	0.00
Unclassified	5.2	1.8	-3.4***	0.00

Our identification strategy exploits the 2004 legal change that decreased the value of floating liens. Using the data from the Swedish Companies Registration Office, we define the treated group as all borrowers that pledged at least one floating lien to the bank before 2004. Since the change in the law focused only on this particular type of collateral, borrowers that did not have floating liens outstanding in January 2004 should not have been directly affected by the change. We therefore assign these borrowers to the nontreated group. We further require that the nontreated borrowers have loans outstanding that originated prior to the legal change and mature thereafter (relaxing this requirement by including all loans outstanding during the sample period does not alter the results).

#### *B. Treated and Control Groups: Industry Composition and Descriptive Statistics*

Table II presents the industry composition of the treated and control groups for the entire sample. The treated group has relatively fewer firms in real estate, and somewhat more in manufacturing and retail. These differences in industry composition result from the different asset structures in these industries and from the nature of the floating lien. Before 2004, floating liens were a security interest in particular categories of movable property, such as inventories and accounts receivable. These current assets are particularly important in the asset structure of manufacturing and retail firms. In contrast, fixed assets, such as real estate, were outside the scope of floating liens before 2004. This explains why very few firms in the real estate sector belong to the treated group.

**Table III**  
**Summary Statistics for the Treated and Control Groups**

The treated group contains borrowers that pledged floating liens to the bank before 2004 that are outstanding on January 1, 2004. The control group contains borrowers that did not register floating liens before 2004. The treated and the control groups are matched exactly on industry (at the four-digit NACE level). The sample period is 2003:01 to 2005:09. Data for the internal limit are missing for 2003:01 and 2003:02. Differences in means are assessed with the *t*-test. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	Control	Treated	Treated – Control	<i>p</i> -Value
<b>Loan Characteristics</b>				
<i>Collateral Value</i> (€000)	53.82	36.20	–17.62	0.15
<i>Loan Balance</i> (€000)	86.92	56.05	–30.86**	0.04
<i>Collateral Coverage Ratio</i> (%)	46.53	65.73	19.20***	0.00
<i>Loan Spread</i> (%)	4.17	4.28	0.11	0.13
<b>Borrower Characteristics</b>				
<i>Internal Loan Limit</i> (€000)	250.21	177.80	–72.42**	0.04
<i>Internal Rating</i> (0–20)	9.62	6.88	–2.74***	0.00
<i>Unassigned Rating</i> (0/1)	0.52	0.43	–0.09***	0.00
<b>Monitoring</b>				
<i>Interval Between Borrower Reviews</i> (months)	9.49	9.99	0.50**	0.01
<i>Interval Between Collateral Reviews</i> (months)	11.00	11.37	0.37	0.45

Differences in industry structure across the two groups may raise the concern that the control group might not be a proper counterfactual. To ensure that the treated and control groups are comparable, we perform exact matching on industry as follows. The initial sample contains 176 treated firms and 3,361 control firms. For each treated firm, we select all control firms with the same industry classification using the narrowest industry classification available in the bank's files (four digits). This procedure ensures that the treated and control groups have similar industry composition. Our findings are quantitatively unaffected when we do not conduct exact matching.

Table III provides sample means of our main variables for the treated and control groups, after matching on industry, and over the entire sample. The table also provides differences-of-means tests. Although the treated loans have higher collateral coverage ratios than the control loans, the two groups display very similar loan spreads. Treated borrowers have on average lower internal limits and lower internal ratings, and the bank reviews the condition of treated borrowers less frequently.

### C. Empirical Specification

To obtain differences-in-differences estimates for our variables of interest, we aggregate the matched data into two periods. First, we compute averages before (i.e., 2003:01 to 2003:12) and after (i.e., 2004:01 to 2005:09) the event date. We refer to the collapsed periods as “pre” and “post,” respectively. Second,

we compute first-differences as the “post” minus the “pre” values. We estimate by OLS regression models of the form

$$(\bar{y}_{post} - \bar{y}_{pre})_i = \alpha + \beta \times Treated_i + \varepsilon_i, \quad (1)$$

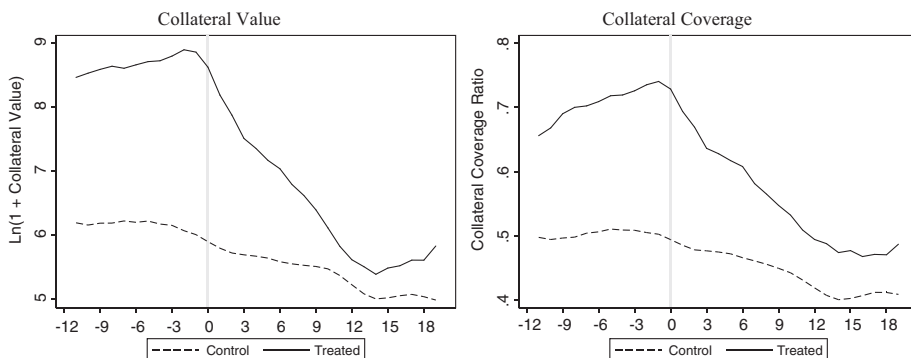
where  $i$  indexes loans. The left-hand side of the equation measures the “post” minus “pre” change in the average level of our dependent variable,  $Treated$  is a dummy variable indicating the treated loans (i.e., those loans secured by floating liens before the change in the law became effective on January 1, 2004),  $\alpha$  is a constant that measures the “post” minus “pre” change in the average outcome for the nontreated loans, and  $\varepsilon$  is the error term. We note that the standard errors in the above specification do not suffer from serial correlation (Bertrand, Duflo, and Mullainathan (2004), Petersen (2009)). The differences-in-differences estimate is given by  $\beta$ , which measures the differential effect of the change in the law across firms that had pledged and firms that had not pledged floating liens before 2004.

The crucial assumption in the differences-in-differences specification is that the treated and nontreated loans/borrowers would have behaved similarly in the absence of the legal change. Although we can never test this assumption perfectly, two important indicators help shed light on the plausibility of this assumption.

The first indicator is the similarity of the treated and control borrowers with respect to observable characteristics. We already removed to the extent possible differences between the two groups in terms of *exogenous* characteristics. In particular, we pulled from the bank’s data repository a homogenous set of loans, namely, business term loans, which makes the investigated loan contracts almost perfectly comparable. Further, for each treated firm, we selected control firms that share (almost) the same economic activity by matching at the four-digit level of the NACE industry classification scheme used by the bank.<sup>17</sup>

The results in Table III suggest that, in contrast to the similarity in loan type and activity, the treated and control groups differ substantially in terms of *endogenous* characteristics, such as collateral value and monitoring intensity. These differences should not come as a surprise, given that we define treated and control groups according to different types of security interests. The differences in security interests per se could explain most differences in the bank’s internal variables and behavior. Our empirical strategy is to analyze how these internal variables respond to the shock in collateral values.

<sup>17</sup> NACE stands for *Nomenclature statistique des Activités économiques dans la Communauté Européenne*, or the Statistical Classification of Economic Activities in the European Community, and it is similar in function to NAICS and SIC. To illustrate the level of detail at the four-digit level, “Agriculture, forestry and fishing” encompasses industry codes 01, 02, and 03. The classification system further divides code 01, “Industry crop and animal production, hunting, and related service activities” into “Growing of non-perennial crops” (011), “Growing of perennial crops” (012), “Animal production” (014), etc. “Animal production” (014) is then further divided into “Milk production and raising of dairy cattle” (0141), “Raising of camels and cameloids” (0144), and “Raising of swine/pigs” (0146). Our matching at the four-digit level means that we allow for firms working in “Raising of piglets” (01461) to be matched with firms active in “Raising of swine for slaughter” (01462).



**Figure 1. Change in the law and collateral value.** This figure plots average values of the variables shown separately for the treated and control borrowers. Treated borrowers pledged a floating lien to the bank before 2004 that is outstanding on January 1, 2004. Control borrowers did not register floating liens before 2004. The two groups of borrowers are matched exactly on industry (at the four-digit NACE level). The sample period is 2003:01 to 2005:09. The horizontal axis displays event time (in months), where  $t = 0$  corresponds to 2004:01.

The second indicator is the similarity between the behavior of the treated and control groups before the event. Fortunately, the monthly frequency of our data generates substantial time series variation that proves helpful to inspect the potential presence of worrying “pre-trends” in our dependent variables. In Section IV, we complement our analysis with time series graphs for our main variables. By way of preview, the treated and control groups behave quite similarly before the change in the law, supporting our identification strategy.

#### IV. The Impact of the Change in the Law

##### A. Collateralization, Loan Rate, Borrower Limit, and Loan Balance

The 2004 legal change abolished the special priority rights of floating liens and reduced the pool of eligible assets under them. In this section, we investigate how the change in law affected collateral values, loan contract terms (loan spread), loan balances, and the bank’s internal lending limits. While the differences-in-differences regressions allow us to assess the overall economic significance of the 2004 law, they ignore the rich (monthly) time series variation in our data. Therefore, we combine these estimation results with time series plots of the sample averages of all our dependent variables, calculated separately for the treated and control groups. In all graphs the horizontal axis denotes time centered on January 2004, which we label as  $t = 0$ .

Figure 1 plots the time series of our two collateral variables,  $\ln(1 + \text{Collateral Value})$  and  $\text{Collateral Coverage}$ , and Table IV presents the differences-in-differences results. The figure shows that, before the legal change, floating liens were substantially more valuable to the bank than other types of collateral pledged. During this period, the average collateral coverage ratio was



**Table IV**  
**Change in the Law and Collateral Value**

In this table we collapse (based on averages) each borrower's time series into two observations—one "pre" and one "post" the change in law on January 1, 2004. "Pre" refers to the period 2003:01 to 2003:12, and "post" refers to the period 2004:01 to 2005:09. The table displays cross-sectional regressions of first-differences ("post" minus "pre") of the variables shown on the indicator variable *Treated*. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

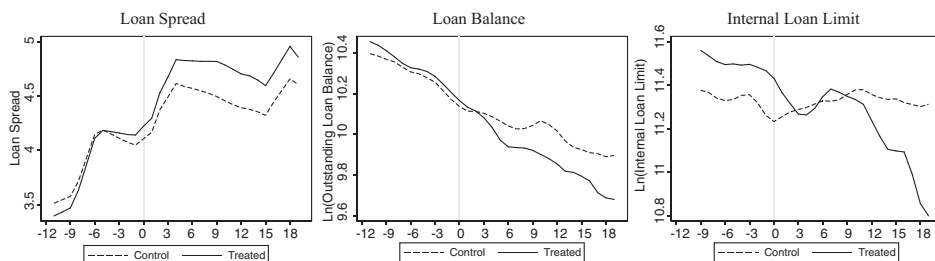
	Dependent Variable: Post – Pre Difference of:	
	<i>Ln(1 + Collateral Value)</i>	<i>Collateral Coverage</i>
<i>Treated</i>	–1.06*** (–4.93)	–6.16*** (–2.98)
Constant	–0.72*** (–12.97)	–3.18*** (–5.96)
Observations	2,580	2,580
<i>R</i> <sup>2</sup>	0.01	0.00

about 70% for treated borrowers and 50% for control borrowers. Following the change in the law, this wedge narrows significantly. On the one hand, treated borrowers suffer a steep reduction in collateral values, confirming that the 2004 law is perceived by the bank to result in a loss of value of floating liens. On the other hand, control borrowers experience a much smaller reduction in collateral values, which could be related to the regular lifecycle of the loan contracts. Our empirical strategy consists of measuring the differential reduction in collateral value of the treated borrowers vis-à-vis that of the control borrowers. This differential is clearly negative in the graphs.

The differences-in-differences estimates we present in Table IV corroborate the diagnosis in Figure 1: following the change in the law in 2004, borrowers with outstanding floating liens suffer a sharper reduction in the bank's estimate of the collateral value. The differences-in-differences coefficients indicate that the reduction in the bank's estimate of the collateral for the treated borrowers is more than 2.5 times (in terms of value), or six percentage points (in terms of coverage ratio),<sup>18</sup> higher than that for the control borrowers.

Next, we examine how the loan spread, the loan balance, and the bank's lending limit adjust to the reduction in collateral value. Figure 2 plots the time series averages of these variables for the treated and control borrowers, and Table V displays the differences-in-differences estimates. The bank can revise the interest rate of the loan every quarter, which explains the lumpy behavior of the loan spread series. In contrast, the internal lending limit is reviewed less frequently (every 10 months on average), generating smoother series. The variation in the loan balance is mostly mechanical and driven by loan amortizations.

<sup>18</sup> Its semielasticity equals almost 13% from its unconditional mean and standard deviation, which both equal around 47%.



**Figure 2. Change in the law and loan contract terms.** The figure plots average values of the variables shown separately for the treated and control borrowers. Treated borrowers pledged a floating lien to the bank before 2004 that is outstanding on January 1, 2004. Control borrowers did not register floating liens before 2004. The two groups of borrowers are matched exactly on industry (at the four-digit NACE level). The sample period is 2003:01 to 2005:09. The horizontal axis displays event time (in months), where  $t = 0$  corresponds to 2004:01.

**Table V**  
**Change in the Law and Loan Contract Terms**

In this table we collapse (based on averages) each borrower's time series into two observations—one "pre" and one "post" the change in law on January 1, 2004. "Pre" refers to the period 2003:01 to 2003:12, and "post" refers to the period 2004:01 to 2005:09. Data for the internal limit are missing for 2003:01 and 2003:02. The table displays cross-sectional regressions of first-differences ("post" minus "pre") of the variables shown on the indicator variable *Treated*. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Post – Pre Difference of:		
	<i>Loan Spread</i>	<i>Ln(Loan Balance)</i>	<i>Ln(Internal Loan Limit)</i>
<i>Treated</i>	0.20*** (5.00)	0.02 (0.47)	-0.11** (-2.29)
Constant	0.61*** (60.76)	-0.48*** (-49.73)	-0.12*** (-10.84)
Observations	2,580	2,580	2,477
$R^2$	0.01	0.00	0.00

In all three panels of Figure 2, the patterns for treated and control borrowers moved roughly together before the legal change. Following the change in the law, borrowers with outstanding floating liens experience a sharper increase in loan spread and a larger reduction in internal lending limit. The differences-in-differences estimates in Table V indicate that these effects are economically meaningful. In particular, the treated group suffers on average a 20 basis point increase in loan spread and an 11% reduction in internal limit. For the loan balance, we find no significant differential effect between the treated and control groups. Overall, these estimates suggest that, for the same loan contract, the bank "charges" the borrower on average around three basis points and reduces credit supply by almost 2% for each percentage point decrease in collateral coverage.

### B. Bank Monitoring

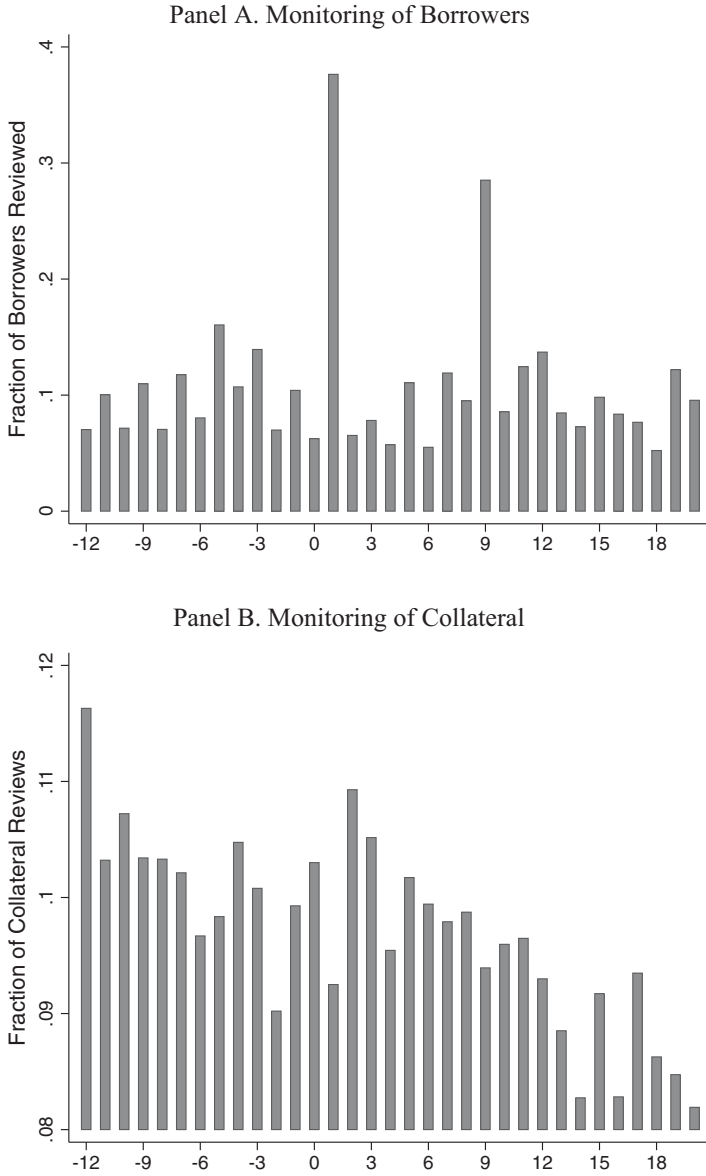
The 2004 law shrank the pool of eligible assets of the floating lien and abolished the special priority rights of this claim. The analysis in Section IV.A confirms that the bank interprets the legal change as a negative shock to the value of floating liens. Next, we analyze how the reduction in collateral value affected the bank's monitoring activities. On the one hand, the legal change reduces the bank's return from monitoring both borrowers with outstanding floating liens and the collateral itself, since the law does not allow the bank to benefit from the collateral prior to bankruptcy. On the other hand, the outstanding loans to these borrowers become relatively riskier (because the loans become less collateralized), which could increase the bank's monitoring of the borrower and collateral. To the extent that the change in the law could have an ambiguous effect on the bank's monitoring incentives, our estimates address the empirical question of which effect dominates for what type of monitoring.

We construct our monitoring measures by exploiting information on the frequency with which our bank reviews the borrower's condition and revalues the assets pledged as collateral. Figure 3 displays the aggregate pattern of reviews during our sample period for borrowers (Panel A) and the collateral (Panel B). Each bar measures the fraction of borrowers or collateral subject to a bank review on that particular date, with  $t = 0$  corresponding to January 2004.

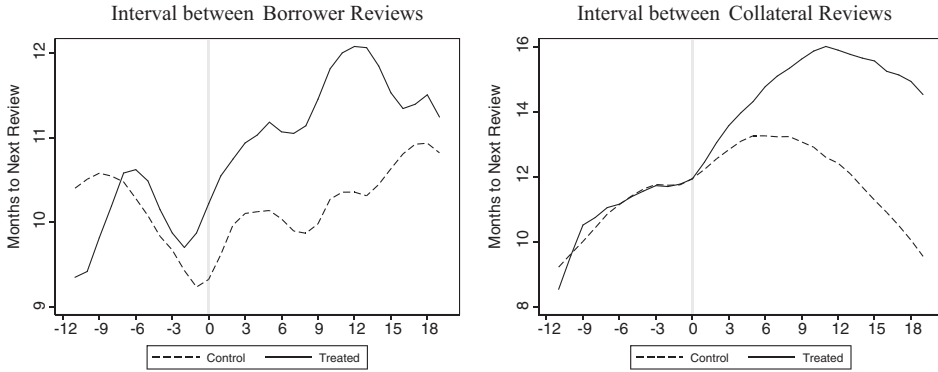
Panel A shows an abnormally high fraction of borrower reviews one month and nine months after the change in the law. We use the firm-specific review dates to compute the *Interval Between Borrower Reviews* as the number of months elapsed between two consecutive borrower reviews. This variable is our first monitoring measure.

Panel B displays the fraction of all loans held by firms that have a business term loan in the bank for which we see a change in the estimated collateral value. The figure shows that the frequency of collateral reviews decreases during our sample period. From this information, we compute the *Interval Between Collateral Reviews* as the number of months elapsed between two consecutive collateral revaluations. The two monitoring measures have similar interpretation. If the bank internally reviews either the borrower's condition or the collateral at shorter time intervals, we interpret this as an indication of greater monitoring effort.

Figure 4 plots the time series averages of our monitoring variables for the treated and control borrowers, and Table VI displays the corresponding differences-in-differences estimates. We first focus on borrower monitoring. Before the legal change, the bank reviewed treated and control borrowers at similar time intervals. Following the change in the law, the borrower review frequency begins to decline. This decline in review frequency is considerably more pronounced for the treated borrowers than for the control borrowers. Our differences-in-differences estimates indicate that the postlegal increase in revision interval is about 25 days more for the treated group than for the control group.



**Figure 3. Frequency of borrower reviews.** Panel A plots the time series of the fraction of borrowers reviewed in a particular month by the bank. Panel B plots the time series of the fraction of all loans that experience a collateral revaluation in a particular month. The sample period is 2003:01 to 2005:09. The horizontal axis displays event time (in months), where  $t = 0$  corresponds to 2004:01.



**Figure 4. Change in the law and monitoring.** This figure plots average values of the variables shown separately for the treated and control borrowers. Treated borrowers pledged a floating lien to the bank before 2004 that is outstanding on January 1, 2004. Control borrowers did not register floating liens before 2004. The two groups of borrowers are matched exactly on industry (at the four-digit NACE level). The sample period is 2003:01 to 2005:09. The horizontal axis displays event time (in months), where  $t = 0$  corresponds to 2004:01.

**Table VI**  
**Change in the Law and Monitoring**

In this table we collapse (based on averages) each borrower’s time series into two observations—one “pre” and one “post” the change in law on January 1, 2004. “Pre” refers to the period 2003:01 to 2003:12, and “post” refers to the period 2004:01 to 2005:09. The table displays cross-sectional regressions of first-differences (“post” minus “pre”) of the variables shown on the indicator variable *Treated*. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Post – Pre Difference of:	
	<i>Interval Between Borrower Reviews</i>	<i>Interval Between Collateral Reviews</i>
<i>Treated</i>	0.84*** (3.04)	2.27*** (4.17)
Constant	-0.25*** (-3.49)	0.71*** (3.84)
Observations	2,580	2,580
$R^2$	0.00	0.01

We now turn to monitoring of the collateral. The right panel of Figure 4 shows that, before the legal change, the bank reviewed collateral pledged by treated and control borrowers at virtually identical frequencies. Following the legal change, collateral is monitored less actively. The differences-in-differences estimates in Table VI indicate that the bank increases the revision interval of the collateral securing treated loans by more than two months. Overall, our results suggest that at least part of the bank’s monitoring activities may be collateral related.

### C. Controlling for Internal Ratings

The basis of our empirical strategy is the idea that the treated and control groups would have behaved similarly in the absence of the 2004 law. Since we already eliminated to the extent possible differences between the two groups in terms of exogenous characteristics (i.e., the type of loan and firm industry), all remaining variables in our data set are internally chosen by the bank. Nevertheless, we further attempt make the treated and control groups alike by controlling for internal ratings.

In the Internet Appendix we show that our results for both the credit terms and the monitoring measures remain unchanged when we control for the average internal rating of the borrower before the legal change.

### D. Alternative Measures of Collateral Monitoring

Our measure of collateral monitoring maps any change in collateral value to a loan officer's effort in monitoring that client. However, our monitoring measure could be contaminated by small adjustments in collateral value made for reasons other than the revaluation of the assets. As a robustness check, we therefore refine our measure of collateral monitoring by gradually increasing the threshold above which we consider a change in collateral value to be meaningful. In particular, we create three separate monitoring variables by varying the minimum size requirement that a change in collateral value should satisfy to be registered as a "monitoring event." As minimum size requirement we use the 10<sup>th</sup> percentile, 25<sup>th</sup> percentile, and median of the distribution of the collateral revaluations. We present the estimation results using these alternative monitoring proxies in the Internet Appendix, with and without controlling for the borrower's "Pre"-Rating. The estimates obtained indicate that the legal change reduced the monthly frequency of small (>10%), moderate (>25%), and large (>50%) collateral revaluations by about four, three, and two percentage points, respectively. These results provide further support for our finding in Section IV.B that the change in the law and the resulting reduction in collateral caused a significant decline in the frequency of collateral revaluations for treated borrowers.

### E. Reverse Treatment via Other Creditors

As a consequence of the change in the priority structure for holders of floating liens from special priority to normal priority, the 2004 law created relative "winners" (the holders of old junior or normal priority claims) and "losers" (the holders of floating liens) in the priority structure. Our analysis so far exploits the effect of the change in the law from the viewpoint of the "losers." We show that the change in the law decreased the bank's estimate of the collateral value, increased the loan spread, reduced credit availability, and decreased monitoring frequency of both the borrower and the collateral.

Next, we investigate the effects of the legal change when we put our bank in the “winner’s” seat. To do so, we identify in the Swedish Companies Registration Office all firms that pledged floating liens to any creditor other than our bank between 2000 and 2003. We also require that these firms have at least one loan, though not a business term loan, outstanding at our bank around January 2004. We call these firms our second treatment group, because these firms are also treated—albeit through loans from other creditors.

Before the legal change, these other creditors held prioritized claims that enabled them to seize the movable property of our borrowers outside bankruptcy and without court order. The 2004 change in the law abolished the special priority rights of their floating liens and hence changed the priority structure in favor of our bank. Moreover, the legal change also reduced the pool of assets that creditors holding floating liens can seize, potentially increasing the asset value our bank can secure in the case of bankruptcy. As a result, we expect to find that the bank increases its estimate of the collateral value and reduces the loan spread for the second treatment sample.

At the same time, we expect the effects of the change in the law on the second treatment group to be smaller in magnitude than those for the main treatment group. Although the Swedish Company Registration Office registers all new floating liens, creditors return liens to a borrower once this borrower has paid back a collateralized loan. Because of fixed registration costs at the Office, it is common for firms to hold onto liens for future loans. We are therefore likely to classify some liens held by other creditors as active when they have in fact been retired. For liens held by our bank, this problem does not occur because we can cross-verify in the bank’s data that a lien is active. Hence, our “reverse treatment” regressions reported in Tables VII and VIII should display smaller effects than in Tables IV to VI.

Table VII displays the differences-in-differences results of all contract terms with two treatment groups. In particular, *Treated “Losers”* refers to the borrowers that pledged to our bank floating liens that are outstanding around the change in the law (our previous treatment sample) and on which we found the bank to “lose,” while *Treated “Winners”* refers to the borrowers with outstanding floating liens pledged to other creditors (the second treatment sample), and on which we expect the bank to “win.”

As expected, the estimates for the second treatment sample are on average symmetric in sign and smaller in magnitude than those for the main treatment sample. As the floating liens pledged to other creditors lose value, our bank raises its estimate of the collateral value by more than three percentage points and reduces the loan spread by six basis points.

We run similar regressions for our monitoring variables, which we report in Table VIII. We find no significant effect of the legal change on the monitoring of borrowers in the second treatment sample. However, we do find some evidence that the bank increases its monitoring frequency of collateral. Specifically, the bank reduces the interval between collateral reviews by one month for the second treatment sample. In the Internet Appendix, we present the results for our alternative monitoring proxies that we restrict to include only the sizeable

Table VII

**Change in the Law and Loan Contract Terms: Two Treatment Groups**

In this table we collapse (based on averages) each borrower's time series into two observations—one "pre" and one "post" the change in law on January 1, 2004. "Pre" refers to the period 2003:01 to 2003:12, and "post" refers to the period 2004:01 to 2005:09. Data for the internal limit are missing for 2003:01 and 2003:02. The table displays cross-sectional regressions of first differences ("post" minus "pre") of the variables shown on the indicator variables *Treated "Losers"* and *Treated "Winners."* *Treated "Losers"* denotes borrowers that pledged a floating lien to the bank before 2004 that is outstanding on January 1, 2004. *Treated "Winners"* denotes borrowers that pledged a floating lien to any creditor other than our bank before 2004. *Control* borrowers (the omitted category) did not register floating liens before 2004. The two treatment groups are matched exactly on industry (at the four-digit NACE level) with the control group. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Post – Pre Difference of:				
	<i>Ln</i> (1 + <i>Collateral Value</i> )	<i>Collateral</i> <i>Coverage</i>	<i>Loan</i> <i>Spread</i>	<i>Ln</i> ( <i>Loan Balance</i> )	<i>Ln</i> ( <i>Internal</i> <i>Loan Limit</i> )
<i>Treated "Losers"</i>	-1.09*** (-5.09)	-6.24*** (-3.10)	0.19*** (4.88)	0.02 (0.58)	-0.11*** (-2.76)
<i>Treated "Winners"</i>	0.28* (1.90)	3.16** (2.25)	-0.06** (-2.07)	0.04 (1.60)	0.03 (1.21)
Constant	-0.66*** (-12.98)	-2.87*** (-5.98)	0.62*** (67.84)	-0.49*** (-55.21)	-0.12*** (-13.33)
Observations	3,369	3,369	3,369	3,369	3,247
<i>R</i> <sup>2</sup>	0.01	0.00	0.01	0.00	0.00

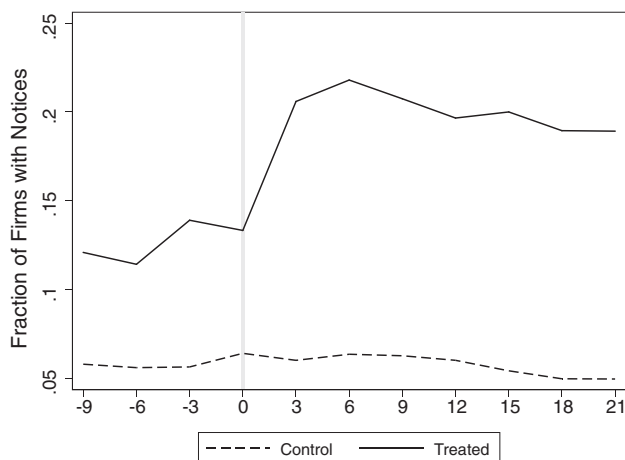
Table VIII

**Change in the Law and Monitoring: Two Treatment Groups**

In this table we collapse (based on averages) each borrower's time series into two observations—one "pre" and one "post" the change in law on January 1, 2004. "Pre" refers to the period 2003:01 to 2003:12, and "post" refers to the period 2004:01 to 2005:09. The table displays cross-sectional regressions of first-differences ("post" minus "pre") of the variables shown on the indicator variables *Treated "Losers"* and *Treated "Winners."* *Treated "Losers"* denotes borrowers that pledged a floating lien to the bank before 2004 that is outstanding on January 1, 2004. *Treated "Winners"* denotes borrowers that pledged a floating lien to any creditor other than our bank before 2004. *Control* borrowers (the omitted category) did not register floating liens before 2004. The two treatment groups are matched exactly on industry (at the four-digit NACE level) with the control group. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Post – Pre Difference of:	
	<i>Interval Between Borrowers</i> <i>Reviews</i>	<i>Interval Between Collateral</i> <i>Reviews</i>
<i>Treated "Losers"</i>	0.85*** (2.99)	2.18*** (3.98)
<i>Treated "Winners"</i>	0.39 (1.53)	-1.01* (-1.80)
Constant	-0.26*** (-3.73)	0.78*** (4.42)
Observations	2,580	2,580
<i>R</i> <sup>2</sup>	0.00	0.01





**Figure 5. Change in the law and borrower delinquency: Firms with notices for missed tax payments or court injunctions to pay.** This figure plots average values of the variables shown separately for the treated and control borrowers. Treated borrowers pledged a floating lien to the bank before 2004 that is outstanding on January 1, 2004. Control borrowers did not register floating liens before 2004. The two groups of borrowers are matched exactly on industry (at the four-digit NACE level). The sample period is 2003:01 to 2005:09. The horizontal axis displays event time (in months), where  $t = 0$  corresponds to the last quarter of 2003.

collateral revaluations. The estimates obtained reinforce the view that the relative seniority gain led the bank to increase its monitoring frequency of collateral. Overall, our results indicate that the bank values its position in the borrower's priority structure, be it as a "loser" or as a "winner," and adjusts its credit terms, credit availability, and monitoring activity accordingly.

#### *F. Resulting Delinquency by Borrowers?*

Given the documented response by the bank to the change in the law, we investigate whether its borrowers react as well. To do so, we assess the fraction of firms that missed tax payments at the end of each quarter. There are multiple advantages to studying missed tax payments. For most firms, tax payments such as VAT and social security contributions are due at a reasonably high frequency and according to a predetermined schedule. Tax collection by the authorities was, as far as we know, unaffected by the change in the law. Missing tax payments is costly for firms because authorities may charge punitive interest rates and claim the delayed tax payments through court action. In addition, missing tax payments are duly recorded and made publicly available through, for example, credit registers.

Figure 5 plots the time series averages of the firms missing tax payments for the treated and control borrowers, and Table IX displays the corresponding differences-in-differences estimates. Before the change in the law, a constant proportion of treated and control borrowers missed tax payments. Following the

**Table IX**  
**Change in the Law and Borrower Delinquency**

In this table we collapse (based on averages) each borrower's time series into two observations—one "pre" and one "post" the change in law on January 1, 2004. "Pre" refers to the period 2003:01 to 2003:12, and "post" refers to the period 2004:01 to 2005:09. The table displays cross-sectional regressions of first-differences ("post" minus "pre") of the variable shown on the indicator variable *Treated*. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Post – Pre Difference of: <i>Borrower Missed a Tax Payment</i>
<i>Treated</i>	0.12*** (5.06)
Constant	0.03*** (4.73)
Observations	2,580
$R^2$	0.01

legal change, the proportion of treated borrowers that missed payments almost doubles, while the proportion of control borrowers remains unaffected. Our differences-in-differences estimates indicate that the proportion of borrowers that missed payments was 12 percentage points higher for the treated than for the control group of borrowers after 2004.

Overall, these estimates vividly demonstrate that, immediately following the legal change, a sizeable portion of treated borrowers start to miss tax payments. Our estimates document the economic importance of the consequences of the drop in collateral values. The bank's tightening of credit and the decline in credit terms are likely to have made liquidity obtained through costly tax payment delays financially more attractive to borrowers, and hence their increased willingness to incur tax payment notices likely explains this change in borrower tax payment behavior.<sup>19</sup>

## V. Conclusion

Collateral is an important feature of many debt contracts that has received much attention in the academic literature. However, the intricate nature of collateral such as its joint determination with other contract terms and its impact on borrower and bank behavior imposes steep empirical identification challenges. Moreover, accurate data on collateral values that would enable researchers to address these challenges have typically not been available.

Our empirical strategy combines two key ingredients that enable us to make progress in empirically assessing the value of collateral. First, we study the impact of a sudden legal change in Sweden that exogenously reduced the

<sup>19</sup> Recall that the loss of special priority rights (due to the change in the law) meant that holders of floating liens would no longer be able to preemptively seize the secured assets in response to tax payment notices, for example, but would need a court order declaring the debtor's bankruptcy.

value of floating liens, a commonly used form of collateral to secure credit around the world. Second, we employ a comprehensive data set from a major Swedish bank that contains detailed information about the loan contracts, including regularly updated estimates of the value of the assets pledged to secure each loan and firm-specific credit limits.

We study the impact of the change in the law on the bank's business loan portfolio using a differences-in-differences approach. We find that, following the change in the law, the bank reduces its assessed value of collateral and contemporaneously increases the interest rate. Moreover, the bank reduces its internal credit limit, that is, its willingness to lend, to the borrower. Concurrently, the frequency with which the bank monitors the condition of the borrower and the value of the collateral falls significantly. Consequently, more borrowers start to miss tax payments.

Our results indicate that collateral is valuable for the borrower and important for the bank. While pledging high-quality collateral enables borrowers to pay lower loan rates and benefit from increased credit availability, our results also suggest that the bank preserves its incentives to monitor the borrower.

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### Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

**Appendix S1:** Internet Appendix.