Collateral and Bank Monitoring*

Tong Zhao†

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Abstract

I study bank monitoring when loans are collateralized, which involves overseeing projects to update beliefs of firms' default probabilities and evaluating collateral to reduce losses given default. To understand the heterogeneous nature of bank monitoring, I develop a theoretical framework and derive testable predictions on the role of collateral in shaping incentives for monitoring projects and collateral and how these two types complement or substitute. Using administrative credit registry data to directly measure monitoring, I show that both monitoring types are affected by depreciation rates of collateral. In addition, I show that project monitoring and collateral monitoring complement (substitute) when firm risks are high (low) and collateral depreciation rates are high (low).

JEL classification: D8, G21, G33

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†KU Leuven and National Bank of Belgium, tong.zhao@kuleuven.be.

I Introduction

The modern theory of financial intermediation suggests that banks have comparative advantages in producing information about borrowers by ex-post monitoring. Such advantage can be modified in the presence of collateralization, allowing creditors to legally seize liquidation values of the collateral in the event of default (Aghion and Bolton, 1992; Hart and Moore, 1994; Diamond, 2004; Benmelech et al., 2005). In some work, bank monitoring is about inspections of firms' operation and performance (Ono and Uesugi, 2009; Plosser and Santos, 2016; Heitz et al., 2022). While other work suggests that banks review conditions of assets pledged as collateral (Cerqueiro et al., 2020; Gustafson et al., 2021).

Although existing studies provide evidence of the determinant of bank monitoring, less is known about *how* banks monitor and *what* they monitor once loans are collateralized. Crucial questions remain: How do banks ensure that collateral retains sufficient value to cover potential loan losses? Do banks monitor collateral? If so, does it affect banks' monitoring of firm projects and operations? What is the relationship between the two types of monitoring? The answers to these questions have important implications for understanding how debt contracts are shaped by collateral and its further impacts on corporate financing and real economic activities.[1] For instance, one prevailing concern in the literature is that collateralization can weaken information production in the credit market, leading to cyclicality in credit supply and macroeconomic fluctuation (Gorton and Ordonez, 2014; Asriyan et al., 2022; Chousakos et al., 2023).

This paper studies bank monitoring in the presence of collateral. By combining novel data sets with a theoretical model, I show that not all types of monitoring are alike and that collateral influences ex-post monitoring decisions and thus information production. My analysis unfolds in three stages. I first provide causal evidence that collateral reduces bank monitoring by exploiting legal reforms that increase monitoring costs in the syndicated loan setting. Next, I propose a theoretical framework to elucidate the heterogeneous nature of bank monitoring. I distinguish project monitoring to update beliefs about a firm's probability of default (PD) from collateral monitoring to reduce the loss given default (LGD). A key feature of the framework is that I formalize banks' payoffs as a function of both project monitoring and the expected liquidation value of collateral. In particular, I incorporate asset depreciation, where the liquidation value of collateral declines over time but increases with more intensive collateral monitoring. My model predicts that collateral depreciation rates play an important role in shaping the incentives for

[1] Macro-finance research centers on valuation of collateral in determining firm collateral constraints and its implications for macroeconomic fluctuations (Bernanke, 1983; Bernanke and Gertler, 1986; Kiyotaki and Moore, 1997; Chaney et al., 2012; Catherine et al., 2022).

two types of monitoring. Moreover, it predicts that project monitoring and collateral monitoring complement (substitute) each other when firm risks are high (low) and collateral depreciation rates are high (low). To empirically test these predictions, I exploit administrative credit registry data from AnaCredit in France. My data set covers more than 10 million secured loans from 1,163,597 firms issued by 386 banks from 2018q3 to 2023q4. The primary advantage of this data set is that it contains confidential loan-by-loan information on bank credit and the collateral securing these loans. In particular, I can observe firms probability of default estimated by banks and collateral value, as well as the date when banks update these two values. This enables me to overcome challenges in measuring bank monitoring activities and capturing the intrinsic nature of collateral. My findings provide empirical support for the model's predictions.

My paper makes three contributions to the existing discussion on the relationship between collateral, monitoring, and credit contracts. First, I underscore the distinction between project monitoring and collateral monitoring and their implications for corporate borrowing and macroeconomic fluctuations. My results help to understand how banks allocate monitoring efforts depending on firm and collateral characteristics, shedding light on the heterogeneous effects of collateralization on lending dynamics and ex-post information production. This distinction is particularly relevant for understanding how credit conditions evolve over the business cycle. Second, I highlight the pivotal role of asset nature, particularly collateral types and depreciation rates, in shaping bank monitoring incentives. A key feature of collateral is its liquidation process, which involves asset seizure, repossession, and resale. Each step varies substantially across collateral types and requires different expertise from creditors. This insight contributes to a broader understanding of how collateral influences financial intermediation and how banks manage credit risk beyond borrower characteristics. Third, I document a set of empirical facts on how collateral is used in corporate lending and how it relates to the two types of monitoring. These stylized facts carry profound implications for credit allocation, financial stability, and the design of loan contracts. By unveiling patterns in monitoring across firms, loan types, and collateral classes, my findings offer a insights for studying the interplay between collateral, corporate financing and bank information production in credit market.

I begin by studying whether collateral affects bank monitoring. By exploiting legal reforms that introduced nonpossessory security interests over movable collateral, I can overcome the identification challenge that omitted variables may jointly influence the use of collateral and banks' monitoring behavior. Before the reform, banks had full physical control over movable collateral, meaning that the monitoring costs of loans backed by movable or immovable assets are very similar. After the reform, banks are forced to lose physical control over movable collat-

eral, and thus *exogenously* inducing higher costs in monitoring loans backed by movable assets relative to before and other loans. I combine the legal change with a difference-in-difference strategy in a syndicated loan setting, enabling me to isolate confounding factors that may drive bank monitoring. To measure bank monitoring, I follow Sufi (2007) and use the lead arranger share. My results show that banks respond to legal reforms by reducing monitoring. Specifically, I find that lead arranger shares decrease by 46 percentage points (henceforth pp) for loans likely backed by movable assets issued to treated firms after the legal change. The significance level and economic magnitude are robust for controlling various sets of fixed effects, using alternative samples, and employing different estimation methods.

The identification strategy relies on two assumptions. First, the timing of the legal change in a country should be exogenous. I conduct two exercises to support this assumption. I estimate a hazard model to examine the timing of the reform by including a rich set of variables. I find that most macroeconomic variables play no role in determining the timing of the reform. Further, I include country-level averages of the propensity of being lead arrangers, lead shares, and firm characteristics as explanatory variables. I do not find evidence that these variables affect the timing of reforms. Moreover, I employ data from Claessens and Van Horen (2015) to identify whether the fraction of distant banks in the banking industry matters since distant banks may have incentives to lobby for postponing the reform. The results suggest that it has no impact on the timing of the reform. Second, in absence of the legal change, banks should not exhibit differences in monitoring. I estimate the dynamic effects and detect no significant difference.

Two natural questions arise after confirming that collateral plays a role in bank monitoring. That is, how do banks monitor and what do they monitor if loans are collateralized? Three possibilities emerge. First, banks choose to only monitor firms' projects and operations, where the goal is to minimize a firm's PD by ensuring the firm's business activities generate sufficient income to meet loan obligations. Second, banks choose to only monitor assets pledged as collateral, where the goal is to reduce the LGD by ensuring the asset is available for liquidation if needed. Third, banks choose to monitor both. To further understand the heterogeneous nature of bank monitoring. I propose a framework and decompose bank monitoring into project monitoring and collateral monitoring. The key feature of the model is that banks' payoffs depend on (i) firms' repayments that are determined by project success probability and (ii) the expected liquidation value of the collateral if the project fails. To capture the intrinsic nature of assets as collateral, I incorporate depreciation rates of collateral that affect expected liquidation value. The model yields several predictions. It predicts that the depreciation rates of the collateral affect optimal monitoring of projects and collateral. Furthermore, my model predicts that project monitoring

and collateral monitoring are complement (substitute) if and only if project quality that is measured by the prior successful probability of the project is less (greater) than the depreciation rate of the collateral.

To empirically test model predictions, I exploit administrative credit registry data of France from AnaCredit.[2,3] The dataset covers a large fraction of small loans issued to small and medium-sized enterprises (SMEs), which is distinct from data used in the US context, where loans tend to be large, as noted in Gustafson et al. (2021) and Luck and Santos (2023). AnaCredit contains confidential loan-level information on bank credit to enterprises and the corresponding collateral. My data set enables me to overcome the measurement challenges related to bank monitoring. Commonly used proxies such as the loan shares of lead arrangers in syndicated loan settings or the strength of firm-bank relationships often reflect ex-ante bank incentives to monitor rather than ex-post monitoring activities (e.g., Sufi, 2007).

I construct *direct measures* of both project monitoring and collateral monitoring. For project monitoring, I follow Plosser and Santos (2016) and Weitzner and Howes (2023) and use change in one-year ahead forecast probability of default of firms as the proxy. It is a dummy variable that takes the value of one if a bank revises a firm's PD, and zero otherwise. For collateral monitoring, I construct two measures. The first one, at the extensive margin, is an indicator showing whether the collateral is revalued in a reporting quarter. The second one, at the intensive margin, is the natural logarithm of the number of months between the latest valuations and the reference period. The main advantage of my measures over existing ones is their representativeness, reflecting monitoring activities across various types of firms, loans, and collateral. It is because my sample includes the universe of loans, which differ substantially from the syndicated and construction loans studied in Gustafson et al. (2021) and Heitz et al. (2022). Loans in my sample also differ from loans with security rights in the form of a floating lien, as in Cerqueiro et al. (2016). To capture the depreciation rates of assets, I categorize assets into two types, real estate and movable assets.

To get an initial look at collateral and bank monitoring, I present three stylized facts. First, I find a correlation between depreciation rates and both project monitoring and collateral monitoring.

[2]AnaCredit reports all loans granted by credit institutions residing in euro area Member States. The data is maintained by the ECB and the Eurosystem National Central Banks and are harmonized across Member States. A credit instrument is subject to reporting if the borrower is a legal entity and if the total committed amount at the creditor-debtor level is greater than or equal to 25,000 EUR at any point within the reference period. Counterparties operate across all institutions and reside globally. Data are available beginning in September 2018.

[3]Two reasons motivate the choice. First, the floating lien was not introduced in France. This allows me to investigate the effects of collateral types, focusing on assets as *stand-alone* collateral. Second, France has quality legal institutions, which helps to reduce concerns about how legal institutions may interact with collateral types and affect banks' monitoring costs.

In particular, banks are more likely to inspect the projects of firms that pledge real estate as collateral compared to firms using movable assets. Moreover, banks tend to monitor real estate more frequently than movable assets. These findings are consistent with the model's predictions. Second, I find that the two types of monitoring can vary depending on loan types. Firms borrowing with revolving credit are much more likely to be inspected than firms borrowing with term loans and revolvers, while the collateral of term loans has the highest likelihood of being inspected relative to others. Third, I find an association between firm size, collateral nature, and the two types of monitoring. Specifically, loans secured by movable assets to micro firms undergo more intensive project monitoring and collateral monitoring. This directly supports the complementarity between the two types of monitoring when collateral depreciation rates are high, but the ex-ante success probability of projects is low.

To identify the association between collateral types on bank monitoring, I rely on the identification strategies exploiting *within-firm across banks* and *within-bank across firms* variations. Specifically, I compare bank monitoring outcomes for two secured loans from the *same firm* but issued by *different banks* at the same point in time, where one loan is secured by movable assets and the other by immovable assets. The primary assumption of this strategy is that there is no correlation between two individual loans backed by different types of assets across banks. In other words, having a loan secured by real estate with one bank is not related to the monitoring of a loan secured by machinery with another bank. This assumption is likely to hold since France does not allow floating liens, which are security rights over the entirety of a firm's assets. Consequently, security rights over a house for one loan and machinery for another loan are separate.

For project monitoring, I find that the probability of a PD change decreases by 1.5 pp for loans secured by real estate relative to loans backed by movable assets, which is around 4% of the unconditional mean. The intuition is that the expected liquidation value of collateral with high depreciation rates will be low. As a result, banks have more incentive to monitor firms to ensure they can repay the loan rather than going to liquidation. For collateral monitoring, the estimates suggest that real estate is 1.3 pp more likely to be revalued, and the monitoring duration is approximately 50% shorter relative to movable assets. The explanation is that the expected liquidation value of the collateral is low, reducing the marginal benefit of monitoring collateral, and thus reducing banks' collateral monitoring.

Recall my model predicts that there can be a positive or negative relationship between collateral monitoring and project monitoring depending on the depreciation rates of collateral and prior success probability. My goal is to understand how two monitoring types are related, rather than

identifying a causal link between them. I find that collateral monitoring is positively correlated with project monitoring when firms are ex-ante risky pledging movable assets as collateral. The results are substantially reversed for situations where firms are ex-ante not risky pledging real estate as collateral. In this case, I show that collateral monitoring is negatively correlated with project monitoring, suggesting substitutability between the two monitoring types.

My results help to understand the puzzle in the relationship between collateral value and monitoring. Cerqueiro et al. (2020) find that a negative shock to collateral value leads to a decline in both collateral monitoring and project monitoring. On the other hand, Gorton and Ordonez (2014) and Asriyan et al. (2022) predict that lower collateral value should increase bank screening. I uncover two key factors that may determine this force. First, it is essential to distinguish between the market value and the liquidation value of collateral. The liquidation value of collateral can be a function of its market value, which in turn depends on banks' collateral monitoring. Second, it is crucial to account for the relationship between firms' success probabilities and the depreciation rates of collateral. When the market value of collateral goes down, project monitoring will also go down if firms are ex-ante less likely to succeed but pledging risky assets. By contrast, when the market value of collateral goes down, project monitoring can go up if firms are ex-ante very likely to succeed and pledge safe assets.

A Related Literature

This paper contributes to several strands of literature. First, it contributes to recent debates about the role of collateral in corporate financing and macroeconomics dynamics. Several studies distinguish "asset-based lending" from "cash-flow lending" and challenge the importance of firm assets and collateral in corporate borrowing (Kermani and Ma, 2020; Lian and Ma, 2021). In addtion, research in macroeconomics suggest that collateralization can weaken information production in the credit market, leading to cyclicality in credit supply and macroeconomic fluctuation (Gorton and Ordonez, 2014; Asriyan et al., 2022; Chousakos et al., 2023). The focus in these literature is that collateralization will reduce banks' incentive to do ex-ante costly screening. Yet, one missing part is how fluctuations in collateral values affect *ex-post* bank monitoring.

By decomposing bank monitoring into project monitoring and collateral monitoring and showing the interplay between the two, my analysis provide insights into the nuanced role of collateral in shaping bank monitoring. Specifically, the impact of collateral depends on both its characteristics and responses of banks. Furthermore, I distinguish the market value of the collateral with liquidation value of the collateral. It is crucial since the liquidation value will depend on the intensity of bank monitoring, which helps reconcile conflicting views on the association

between collateral value and bank screening and monitoring.

Second, it extends research on bank monitoring (e.g., Besanko and Kanatas, 1993; Datta et al., 1999; Diamond, 1991; Gustafson et al., 2021; Heitz et al., 2022). Cerqueiro et al. (2016) uncover the relationship between collateral value and monitoring and find that following the reform, banks reduce the assessed value of collateral and the frequency of monitoring. Gustafson et al. (2021) construct two direct measures on bank monitoring activities using US syndicated loans data. Heitz et al. (2022) rely on construction loans from one failed US bank and construct bank monitoring measures based on on-site inspections. I contribute to the literature in three dimensions. First, I differentiate project monitoring from collateral monitoring which have distinct aims. This has important implications for understanding debt contracts and the consequences of collateralization. Second, my monitoring measure is more representative and reflects monitoring activities on various types of firms, loans, and collateral since my data covers almost the universe of corporate secured loans in France, including a very large fraction of small and micro firms. Third, I shed light on collateral types as a determinant of both ex-ante monitoring incentives and ex-post monitoring activities. For the first time, I can analyze the monitoring at *loan-collateral level* rather than *loan level*.

Third, it is related to the research on the role of collateral in bank credit. An extensive literature underscores how the utilization of collateral can alleviate information asymmetries between principals and agents (Bester, 1985; Besanko and Thakor, 1987; Boot and Thakor, 1994; Ioannidou et al., 2022), influence the terms and quantities of bank loans, and affect bank screening and monitoring as well as firm risks (Rajan and Winton, 1995; Degryse and Van Cayseele, 2000; Manove et al., 2001; Jimenez et al., 2006; Benmelech and Bergman, 2009; Berger et al., 2011; Assunçao et al., 2014; Campello and Larrain, 2016; Cerqueiro et al., 2016; Aretz et al., 2020; Gupta et al., 2021; Benmelech et al., 2022; Luck and Santos, 2023; Barbiero et al., 2024).[4] I incorporate one crucial dimensions, i.e., collateral types, allowing for a comprehensive evaluation of the importance of collateral in firm financing. By highlighting the multifaceted nature of collateral and its impacts on bank monitoring, we contribute to a deeper understanding of how banks and firms may leverage collateral to optimize credit contracts.

Lastly, this paper contributes to the ongoing debates about policies aimed at increasing collateral supply. Theoretically, Donaldson et al. (2020) highlights potential negative impacts on firm financing, while Bernhardt et al. (2020) suggests that expanding pledgeable assets can never hurt firms. Empirically, Aretz et al. (2020) and Campello and Larrain (2016) find that a larger

[4]For a review, see Bilan et al. (2019).

collateral menu is associated with higher firm leverage, whereas Ongena et al. (2025) argue that it improves intermediation but also raises costs. My paper is distinct from these studies in two ways. First, I take a perspective focused on the collateral itself, linking it to both the demand and supply of collateral. Note that I do not take a stance on the overall impacts of the legal change on corporate financing. Instead, I show that the underlying differences between movable assets and real estate are crucial for understanding policy outcomes. I further uncover how collateral monitoring associated with different collateral types shape the effectiveness of policies.

The remainder of this paper is structured as follows. Section II presents the analysis of collateral types and bank monitoring exploiting legal reforms and syndicated loans. Section III proposes a framework to understanding bank monitoring and document project monitoring and collateral monitoring. IV studies the determinants of project monitoring and collateral monitoring, as well as the relationship between the two. Section V concludes.

II Legal Reforms and Bank Monitoring

This section investigates whether collateral influence bank monitoring by exploiting legal reforms in a syndicated loan setting. Section II.A provides the institutional background and describes the data. Section II.B examines the relationship between collateral and bank monitoring.

A Background and Data

A.1 Institutional Background

Collateralization involves a process allowing creditors to establish the security interest over the collateral. Security interest or security right is a legal right granted to creditors over specific collateral, allowing the creditor to seize or sell the collateral if debtors default on their obligations. The type of security interest or security rights differs depending on collateral types. Security interests over movable assets usually are in the form of possessory security interests, which were historically associated with dispossession as a means of perfection or publicity.[5,6] That is,

[5]Perfection (perfect in verb) is a step in establishing security interests over collateral. It specifies how the security interests are publicly notified of creditors' claims over the collateral to make them legally recognized and enforceable against third parties. Registration is a way to provide notice to the public and other creditors about the security interest. The purpose is to establish priority among creditors and to give notice to other parties that there is a claim against the specified assets. Four common methods of perfection include possession, filing or registration, control, and automatic perfection. For more details, see https://uk.practicallaw.thomsonreuters.com/6-381-0551?originationContext=knowHow&transitionType=KnowHowItem&contextData=(sc.Default)&comp=pluk&firstPage=true. Security interests that use registration as a method of perfection are called nonpossessory security interests since they do not require dispossession for perfection.

[6]The term "publicity" is more frequently used in civil law countries, while common law countries use "public notice" more. Publicity refers to principles that make property rights effective vis-à-vis third parties if they are actually public, meaning they can be known by such third parties (Hamwijk et al., 2014). It helps prevent conflicts and disputes over the same assets being used as collateral for multiple loans and provides a framework for establishing

creditors need to physically possess encumbered assets to perfect security interests. Note that possessory security interests do not involve the transfer of ownership. Instead, what needs to be transferred is possession, or equivalently, the *physical control right* of the assets. The necessity of establishing possessory security interests is determined by the nature of the assets. First, the value of movable assets can be easily misappropriated, leading to (i) undervaluation by creditors or (ii) a misapprehension of a borrower's creditworthiness (Aretz et al., 2020). Second, the ownership of such assets can be easily transferred, resulting in misleading ostensible ownership (Morell and Helsen, 2014).

Clearly, possessory security interest has the advantage that it allows creditors to know which assets are encumbered and which are not. The drawback is that it limits credit access by asking firms to relinquish assets they could not. To mitigate such inefficiency and overcome the limitations of dispossession, policymakers amended the legal framework to allow registration as a means of perfection for loans secured by *stand-alone* movable assets.[7] That is, creditors do not need to physically possess encumbered assets to perfect security interests. These is so-called nonpossessory security interests. After the reform, the perfection of security rights over movable assets can be done by registering the agreements in a public register. This means that creditors are forced to give up the physical possession of movable collateral.

One major concern of nonpossessory security interests over movable assets is that it may increase the uncertainty of collateral value. As argued by Castellano (2015),

"*...it is difficult to imagine that lenders would enter into nonpossessory secured transactions with the intention of mitigating credit risk without a legal mechanism that allows for both monitoring collateral and ensuring that priority can be enforced...,* "

which underscores the concern of collateralizing movable assets. In a related vein, Ramalho et al. (2018) document that lending based on movable collateral is often associated with higher credit risk compared to immovable-based lending. This is because movable assets are prone to misappropriation, and there may be uncertainty regarding their true value and condition.

Regardless of the reform, creditors need to monitor the movable collateral more and ensure they are not transferred to third parties before the claim is settled. However, the legal reforms implicitly increase costs on monitoring movable collateral owing to the lose of physical control

priority among competing creditors.

[7] One needs to distinguish loans collateralized by one piece of movable asset from loans collateralized by a basket of assets or business value, i.e., floating lien or floating charge. The object of the floating lien covers a collection of assets that can fluctuate freely until bankruptcy, at which time the secured creditor's rights are "fixated", and whatever assets are part of the "business", as defined in the security agreement at that time, will primarily serve to satisfy the secured claim (Morell and Helsen, 2014).

over assets. Monitoring of collateral can include ongoing assessments and oversights of the collateral to make sure that it remains sufficient to cover the outstanding debt, which differs from monitoring debtor actions aimed at ensuring future repayment (Mester et al., 2007; OCC, 2014). Additionally, the cost of monitoring an individual asset is usually higher than monitoring a group assets due to the fact that audited financial reports provide information about the valuation of a pool of assets (Mello and Ruckes, 2017). Note that the reforms should not affect cost or activities of monitoring firms or its projects since it did not change the probability of project success or firms defaults.

Does a collateral registry help reduce the monitoring costs mentioned above? The answer is no. A public collateral registry can increase transparency on property rights and guard against the threat arising from *bona fide* asset purchases by a third party. This corresponds to the main concern of nonpossessory security interests that is the legal rights *in rem* might not be enforceable against everyone because the third parties can be misled (Gürsel, 2020). A collateral registry would be beneficial in addressing the problem of collateralizability, as in Donaldson et al. (2020). Still, creditors need to monitor to prevent its deterioration and to determine whether the value of collateral is fixed relative to the loan amount.

A.2 Data and Variables

To examine how increasing costs of collateral monitoring affect bank monitoring of secured loans, I exploits rich syndicated loan data that offers several advantages. First, it allows me to combine the data with legal reforms. Second, the unique feature of syndicated loans provides a laboratory for gauging monitoring issues. Third, the richness of the data allows me to sharpen identification with granular fixed effects. By relying on the syndicated loans setting, I focus on firms that can already access loan financing, enabling me to compare the degree of bank monitoring before and after the reform.

Sample Construction. I obtain syndicated loan data from the Refinitiv LoanConnector DealScan database (formerly LPC DealScan). This new database is provided as one table with all variables pre-merged.[8] The DealScan database offers detailed information on loan issuance, including pricing terms such as all-in-spread-drawn, and non-pricing terms, including amount, maturity, and covenant.[9] I follow the convention to clean the data. I only include deals that are closed and with lead arrangers. I drop loans with amendments following Roberts (2015). I

[8]For more information about the differences between LoanConnector DealScan and DealScan Legacy file, please see https://wrds-www.wharton.upenn.edu/pages/support/manuals-and-overviews/thomson-reuters/wrds-reuters-DealScan/wrds-overview-on-DealScan-loanconnector/.

[9]Note that the data does not have a panel structure. It only records the issuance of new loans.

only keep term loans and revolver loans. An important point here is that I assume that lenders will hold each loan on their books until the maturity date reported in DealScan (Gropp et al., 2019).[10] I focus on loans issued by the universe of banks in DealScan. This includes commercial banks, investment banks, financing companies, and other non-bank financial institutions. One concern of this choice is that the business model of different types of lenders may hinder the interpretation of the results.[11]

I focus on non-financial firms in sample countries and exclude financial firms and utility firms with SIC codes 6000-6999 and 4900-4999. I am able to match DealScan borrowers to firms in Compustat using the table thanks to Chava and Roberts (2008). I lose many observations during this procedure, especially for small and/or unlisted firms. Note that the linking table is constantly updated, and the latest version is from April 2018.[12] I identify borrower location using the country where a firm is legally registered based on the Compustat variable: *fic*.

I construct two samples for my purpose. The first one is with the unit of observartion at the facility level. The second one is with the unit of observation at the individual loan level. The granularity of the later sample enables me to control for credit supply shocks.[13]

Bank Monitoring. I follow the literature to measure monitoring using the reported lead arranger share. Two points discussed in the existing literature are relevant to my setting. The first one pertains to how to define a lead arranger. It was challenging to do so using the LPC DealScan database because there is no clear classification indicating the role of each lender. This problem can be resolved by using LoanConnector DealScan, which includes a variable called "Lead Arranger" specifying the names of lenders acting as lead arrangers. This allows me to determine the exact function of each lender and avoid any ambiguity. The second one concerns the reported loan shares among syndicated members. The most common method is to divide the loan amount among members without reported lender shares. Hence, I impute values for missing observations.[14] At the facility level, bank monitoring is measured by the sum of lead arranger shares of a syndicate. At the loan level, bank monitoring is measured by the share of each lead arranger of a syndicate.

[10] Blickle et al. (2020) document that lead arrangers frequently sell their entire loan stake after origination, especially in the case of institutional loans. I deal with this concern in robustness checks, despite that institutional loans only represent a small proportion of the overall sample.

[11] The observations from non-bank financial institutions account for 5.6% of total observations. I show that the results are robust to the case that only banks are included. I also run robustness checks to investigate which lenders are driving the results.

[12] I choose not to extend the linking table to the year 2019 to avoid any imprecision.

[13] An individual loan refers to the contribution of a lender in the facility granted to a borrower.

[14] The observations with non-missing lender share account for 25% of the total observations.

Reform Countries. I use borrower countries to identify the secured transaction law reform.[15] I collect countries' secured transaction law information from different sources, including the Secured Transactions Law Reform Project, Thomson Reuters Practical Law, and other academic publications. I am able to identify 8 European countries that reformed their secured transaction law and their corresponding time.[16] I also include several non-reformed countries as a control group. Importantly, all countries in the control group already have the nonpossessory security interest in place.[17] I define the year of the loan issuance as the year when a facility is active. I then use this information to identify whether a country has a legal reform in place when this new loan is issued. I create a dummy variable *Reform* that equals one if a borrower's country reformed the secured transaction law in a year, and zero otherwise.[18] Figure 1 shows the map of sample countries. Table A1 and A2 provide detailed information on the reforms in sample countries.

Movable Assets Index. To measure the degree to which a firm is exposed to the legal change and is more or less likely to pledge movable assets as collateral, I follow Campello and Larrain (2016) and create a movable assets index using US firms' balance sheet data from 1983 to 1994. The calculation steps are as follows. First, I calculate the movable assets index for each firm within a given year. It is computed as the ratio of the sum of machinery, equipment, and inventory, corresponding to Compustat variables: *ppenme* and *invt*, scaled by a firm's total assets. Next, I compute the movable assets index for each 2-digit SIC industry between 1983 and 1994. This index represents the average index for all firms within the industry over the entire sample period. Lastly, I assign an index to each industry included in the sample firms, regardless of firm nationality. I create a dummy variable, *Treated*, that equals one if a firm in an industry has a movable assets index above the median and zero otherwise.

The choice of index computation is based on the following reasons. First, as argued by Campello

[15]This is intuitive since the law is initiated to facilitate firm credit access. It is in line with the law. For instance, according to UCC Article 9, the location of the debtor determines the perfection of nonpossessory security interests in the collateral. This is also in line with the literature Campello and Larrain (2016) and Aretz et al. (2020).

[16]Note that the year of reform is mostly identified by the year entering enforcement. For countries with missing information, I use the year of passage of the law. Moreover, I can only include 7 countries due to the filter of secured loans.

[17]I manually check the secured transaction for each country in Thomson Reuters Practical Law and academic publications to see if the nonpossessory security interest is in practice or not. This means that I am focusing on whether movable assets can be used as stand-alone collateral in practice, regardless of how security interests over movable assets are created or perfected. For instance, nonpossessory security interests can be established by the acquirer acquiring possession through contractual means in Germany while they need to be registered in Belgium (Morell and Helsen, 2014). For countries with floating charges, the crystallization only concerns the control of assets rather than the possession. If the nonpossessory security interest is in place, I further look at the government's official website to identify when it is in place. Given that I do not find any change in the law over the sample period, I assume that the law was implemented before the sample period.

[18]One concern here is about the multi-national firms that have subsidiaries borrowing in different countries. I deal with this issue by conducting a sub-sample analysis.

and Larrain (2016), using US firms as a benchmark assumes that firms in the US more closely utilize a desired mix of assets, including movables and immovables, in their production processes. Second, the exact information about movable assets in Compustat is only available for the years 1983-1996. This measure offers several benefits. First, it allows me to capture the ex-ante industry characteristics regarding the use of movable assets after the reform. Second, by using US firms as a benchmark, I can control for differences among sample countries that may influence the use of movable assets in different industries. For robustness check, I also construct an firm-level index based on the total amount of fixed assets of firms in 2006.

Macroeconomic Variables. I obtained country-level macroeconomic variables and credit environment from the World Bank Database and Doing Business Reports.

Summary Statistics. The final sample includes 513 firms with 1974 facilities with collateral in 21 European countries from 1995 to 2017, one year prior to the date of the first reformed country and one year after the date of the latest reformed country. It consists of 14,705 individual secured loans. Table 1 provides summary statistics and statistics based on treatment status. In Panel A, the probability of being a lead arranger in a facility is 45% and a bank usually contributes 9% of the facility amount and 14.3% of the facility amount if she is a lead. Panel B shows that there are no noticeable differences in firm characteristics between firms operating in treated sectors and those in control sectors, except for the PPE (Property, Plant, & Equipment) ratio. Table B1 provides all variable definitions.

B Legal Reform and Bank Monitoring

In this section, I empirically study how the legal change affect bank monitoring. The conjecture is that reforms force banks to lose physical control over the movable assets and thus increases the costs of monitoring movable assets relative to other asset types.

B.1 Identification Strategy

I start the analysis using the facility sample. My identification strategy thus exploits the fact that the legal change induces variations along two dimensions: borrowers (firms with high or low movable assets index) and time (before versus after the law reform). I estimate the following equation:

$$\mathrm{Y}_{f,i,t} = \beta \mathrm{Reform}_{c,t} \times \mathrm{Treated}_f + \boldsymbol{\mu}\prime \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \mathrm{FE} + \varepsilon_{f,i,t}, \tag{1}$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. $\mathrm{Y}_{f,i,t}$ is the measure capturing bank monitoring on a loan issued to a firm in a year. Lead arranger share$_{f,i,t}$ is the sum of lead arranger shares of a facility. Treated$_f$ is a dummy variable that equals one if

a firm operates in a sector (defined at the 2-digit SIC level) with a movable assets index above the median value and zero otherwise. $\text{Reform}_{c,t}$ denotes a dummy variable that equals one if the borrower country, where a firm is registered, has reformed its secured transaction laws in a year, and zero otherwise. I restrict the years within a [-10,+10] time window around the reform for reformed countries. I also include a set of firm controls $\mathbf{X}_{f,t}$, including firm size, debt ratio, PPE ratio, and current ratio. Depending on the dependent variable, I add loan controls $\mathbf{Z}_{i,t}$, including loan amount, and maturity. Importantly, I add loan spread as a control to account for potential trade-offs between ex-ante pricing and ex-post monitoring. The unit of observation is at the facility level.

To saturate the specification, I add loan type and loan purpose fixed effects to account for any difference that may affect bank monitoring. Furthermore, I always include country-year fixed effects to account for cross-country differences, meaning that I only exploit variations within a country. I also add sector fixed effects or firm fixed effects to account for time-invariant characteristics that drive the outcomes. Standard errors are clustered at the country level.[19] The coefficient of interest is β. I expect it to be negative, indicating that the legal reforms reduce banks' monitoring because of rising monitoring costs of collateral.

One concern in such a specification is that one cannot disentangle credit demand from credit supply. Banks may change monitoring behavior due to unobserved credit supply shocks. To deal with it, I also estimate a specification using loan sample,

$$\text{Y}_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t}, \tag{2}$$

where b denotes bank. I follow Khwaja and Mian (2008) and include bank-year fixed effects under the assumption that all borrowers of the same bank in a given year are equally influenced by the bank's credit supply conditions. I am not able to incorporate firm-year or country-sector-year fixed effects since all variations of explanatory variables will be absorbed.

Several points regarding the reform deserve attention. First, the legal reform only affects secured loans, which are likely secured by tangible movable assets. Therefore, I restrict the sample to secured loans only. I do not consider the spillover effects of the reform, i.e., I am not interested in whether and how the reform may change bank monitoring of unsecured loans. Second, bank monitoring may vary depending on whether a firm only borrows secured loans or borrows both loan types. To mitigate the monitoring optimization across loan types, I limit the sample to firms that only have secured loans with their banks in the sample period for some specifications.

[19] This is because the reform occurs at the country level. One concern is the presence of too few clusters. I show that the results are robust to different cluster methods. See results in the Appendix D.

B.2 Results

Core Results. In this section, I investigate the relationship between law reforms and lead arranger shares within the facility. The goal is to understand whether the law reform affects banks' monitoring of secured loans since the reform raises the cost of monitoring tangible movable assets as collateral. The hypothesis is that increasing monitoring costs reduces banks' monitoring. Table 3 reports the results. The estimates of the interaction term from a naive regression in Column (1) are negative and statistically insignificant when I add sector fixed effects, and it becomes statistically significant when I add firm fixed effects. Without including any controls of firm and loan characteristics, the results suggest that lead arrangers contribute less to syndicates after the law reform for loans are likely backed by tangible movable assets relative to other assets. One could argue that loan terms, such as maturity, are very likely to affect bank monitoring. To account for this, I further incorporate loan characteristics in Columns (3) and (4). The estimates remain negative and statistically significant. To further control for the differences in firm fundamentals, I include firm characteristics in Columns (5) and (6) and results remain stable. The economic magnitude is substantial: compared to loans that are less likely backed by movables, the leads' share of loans that are likely backed by movables reduces by approximately 50 pp, after secured transaction law reforms. It means that banks reduce monitoring of those loans due to the rising cost of monitoring movable collateral.

One potential concern is that banks reduce monitoring of secured loans because they shift the monitoring to unsecured loans. Indeed, it is likely that banks optimize the monitoring effort jointly across various loan categories.[20] To mitigate this concern, I restrict the sample to firms that only have secured loans in the sample period. By estimating Eq(1) using this sample, the results reflect changes in monitoring solely due to the increased costs of collateral monitoring. Table 4 reports the results. Consistent with the results in Table 3, I find that banks reduce monitoring of loans likely backed by movable assets when firms do not have any unsecured loans. This suggests that the decrease in monitoring is not driven by an increase in monitoring of unsecured loans.

To further incorporate potential credit supply shocks arising from the bank level, I estimate Eq(2). Table 5 reports the results. Columns (1) and (2) contain bank fixed effects, while Columns (3) and (4) includes bank-year fixed effects. The coefficient estimates of the interaction term remain negative and statistically significant. The magnitude remain quantitatively similar.

[20] For instance, (Ongena et al., 2025) employs the same shock to study the cost of credit. They find that the reform leads to a greater increase in loan spreads for unsecured loans than for secured loans due to concerns about wealth redistribution.

After the legal reform, the leads' share of loans that are likely backed by movables reduces by approximately 47 pp. Together, the results consistently suggest that the legal change inducing higher monitoring costs decreases bank monitoring in syndicates where loans are likely backed by movable assets.

Additional Results. I conduct additional exercises using facility and loan sample to further support my main results.

Loan Types and Purposes. I use the facility sample to explore the heterogeneity across loan types and loan purposes. The estimates in Table C2 suggest that the effects of reduced monitoring incentive is less pronounced for term loans relative to revolvers. The reason can be that the cost of monitoring term loans is lower and thus banks are more willing to monitor. The results for loan purposes shown in Table C2 indicate that banks do not differentially monitor loans across different purposes.

Firmr Heterogeneity. Second, I explore cross-sectional variations along different dimensions for lenders and borrowers. I find that in Table C3, the effect on bank monitoring is driven by distant banks who (i) face higher information frictions and (ii) lend to reformed countries with weaker creditor rights protection.

Syndication Structure. If the increasing monitoring costs reduce bank monitoring, it is likely that the syndicate concentration will decrease as well. Sufi (2007) suggest that a more concentrated syndicate is likely to support more monitoring. Table C4 presents the results. The outcome variable is the ratio of the number of lead arrangers divided by the number of lenders of a facility. The coefficient estimates are negative and statistically significant. This suggests that banks reduce monitoring and thus syndicate concentration.

Syndication Locations. One concern about my setup is that the law of the borrower's country doesn't play a role, whereas the law in the syndicating country does. The definition of DealScan variable "Country of Syndication" is the country where the loan was syndicated, meaning that a loan is issued under the law of this country. Suppose a French firm borrows from a US bank syndicated in the UK in 2004. Although nonpossessory security interest is not valid in France, it does not concern the lender because the law will apply to a firm based on the UK regime, where nonpossessory security interests are allowed. If this is the case, the monitoring efforts and costs do not bother lenders because they already needed to increase monitoring efforts before the reform. The lender may reduce lending to French firms after the 2006 reform because it might be more familiar with the UK regime. This could also invalidate the results. I do two exercises. First, I remove all observations where the borrower country and country of syndication are

different and re-estimate Eq(2) to examine whether the results still hold. I find that the estimates shown in Columns (1) and (2) of Table C5 remain largely the same. Second, I redefine $\text{Reform}_{c,t}$ based on "Country of Syndication" rather than the borrower's country. Table C5 Columns (3) and (4) reports the results. It suggests that the only factor that plays a role is whether the debtor can retain possession of the asset under the law of a given country, irrespective of the borrower's country or the country of syndication.

Borrower Quality. Another possible explanation for the results is that the risk of secured loans borrowed by treated firms increased after the reform, subsequently leading to an increase in bank monitoring costs within syndicates. This would imply that the rise in costs of monitoring collateral cannot be solely attributed to the law reform but rather to a deterioration in the risk profiles of treated sector firms. Because I lack access to internal ratings assessed by lenders and default rates for borrowers, I present a plot of the average "All In Spread Drawn" across all firms in both treated and control groups during the sample period. The literature typically categorizes borrowers as risky based on their loan spreads. If a firm has a relatively high loan spread, such as being in the 75th percentile of all firms, it is considered risky. Figure E3 shows that there is no significant difference in spreads of secured loans issued to borrowers in treated sectors and control sectors. This suggests that it's unlikely for treated sector firms to have become riskier following the legal change.

Lender Locations. One could argue that the location difference between banks and bank parents may contribute to decline in bank monitoring. For instance, some banks are distant relative to borrowers while their parents are in the same countries as the borrowers. To address such concerns, I undertake two additional exercises. First, I re-estimate Eq(2) by only including loans where banks are in the same location as their parents. This allows me to examine cases where banks are distant and cannot obtain local information from their parents. Table C6 presents the results. The estimates remain quantitatively the same. Furthermore, I exclude firms that have different locations recorded in DealScan and Compustat.

Other Robustness Checks. I conduct a battery of robustness checks to further validate the baseline results. First, I use alternative standard error computation to deal with concerns of small standard error clusters. Second, I do a weighted least square (WLS) estimation to address the concern of observation imbalance. Third, I recheck baseline results using France as the only reform country and firm-level treatment definitions. Fourth, I re-estimate Eq(2) by excluing UK and Ireland to address the concern of differences in institutional contexts. For all results on robustness checks, see Appendix D.

B.3 Identification Assumptions

Timing of Law Reform: The Hazard Model. The variation of country timing in reforming secured transaction laws raises a concern about the exogenous nature of the reform. One could argue that the reforms might be driven by the economic environment. To mitigate such concerns and explain why countries reformed laws at different time points, I estimate the following hazard model at the country-year level:

$$\mathbb{1}(\text{Reform})_{c,t} = \phi(\boldsymbol{\delta}'\mathbf{M}_{c,t} + \boldsymbol{\zeta}'\mathbf{F}_{c,t} + \boldsymbol{\pi}'\mathbf{C}_{c,t}), \tag{3}$$

where c denotes country, t denotes year, $\mathbf{M}_{c,t}$ $\mathbf{F}_{c,t}$ and $\mathbf{C}_{c,t}$ represents average degree of bank monitoring incentives, a range of aggregated firm characteristics, and a range of country characteristics, respectively. I estimate a hazard model with a hazard rate following a Weibull distribution. The dependent variable is the natural logarithm of the expected time to enter secured transaction law reform.

Table 2 reports the results. In Columns (1) and (2), I only include the proxy for bank monitoring separately, and I find that the pre-existing degree of bank monitoring incentives in a country does not predict the timing of reforming the law. In Column (3) I regress the dependent variable on two measures of bank monitoring and in Column (4) I further add aggregate firm characteristics by averaging the value for all firms within a country in a year. Still, I do not find a significant role for pre-existing bank monitoring degrees. Interestingly, the estimate of the aggregate level of PPE shows that PPE is a significant predictor of entry time. In Columns (5)-(6), I include macroeconomic variables to investigate whether the economic environment is correlated with the reforming time. The results in Column (6) show that most of the variables, including Domestic credit to private sectors (%GDP), GDP per capita growth, Export to GDP, Import to GDP, Inflation, Ln(population), and Population growth have no predictive power for reforming secured transaction laws. The result is intuitive in the sense that economic development varies substantially across several reformed countries.

Parallel Trend. The precondition for a difference-in-difference (DD) analysis is the parallel trend, which requires treated firms and control firms to behave the same without policy implementation. To validate the parallel trend assumption, I investigate the monitoring in the syndicates lending to *treated sectors* before and after the law reform between distant banks and local banks using dynamic DD regression:

$$\text{Y}_{b,f,i,t} = \sum_{n=-6, n\neq -1}^{n=9} \beta_n \text{Reform}_{c,n} \times \text{Treated}_f + \text{FE} + \varepsilon_{b,f,i,t}, \tag{4}$$

where Reform$_{c,n}$ includes a set of dummy variables that equals one when the reform is n (where n = -6, -5, ..., -2, -1, 0, 1, ..., 9) years lead or lagged relative to new collateral regime implementation. I set the benchmark year n = -1. That is, I omit the time group one year before the law reform in order to set the estimated coefficients relative to the prior reform year. Note that Reform$_{c,n}$ equals zero for all unreformed countries. I plot estimated coefficients for each year and examine whether they are statistically and significantly different from zero.

Figure 2 displays the coefficients for a dynamic treatment effects estimation. The dependent variables is the loan share a lead arranger contributes to a syndicate. The estimated coefficients prior to the law reform are not significantly different from zero. This suggests that, before the law reform, there was no noticeable difference in the degree of bank monitoring within the syndicates when loans were granted to treated and control firms. Thus, I conclude that the parallel trend assumption holds.

III A Framework for Bank Monitoring

I have documented that increasing costs of monitoring collateral results in reduction in total monitoring effort. The remaining question is that how does it happen? Put differently, how should we think of bank monitoring given the loan is collateralized. One could argue that banks exert less monitoring effort since they are lazy and they know default losses can be covered by the collateral value, as in Manove et al. (2001). If this is the case, the question becomes how can banks ex-ante know the collateral value remain sufficient if there is a default? On the other hand, macro-finance literature suggests a relationship between collateral value and bank information production. Higher collateral value will lead to less screening in firms' projects (Asriyan et al., 2022) and collateral (Gorton and Ordonez, 2014). If this is the case, one could ask how do banks manage two types of screening or monitoring and what are the relationships between the two?

In this section, I propose a framework to understand bank monitoring by decomposing it into project monitoring and collateral monitoring. Section III.A explain the definition and property of two monitoring types. Section III.B provides simple model to analyze the connection between the attributes of firms and collateral and bank monitoring, as well as the relationship between two monitoring types.

A Monitoring Types

Project Monitoring.

- General definition. It refers to the process by which banks assess the financial health,

cash flow, and operational progress of borrowing firms, involving reviewing financial statements, tracking key performance indicators, and conducting site visits or audits. The goal is to learn a firm's probability of default (PD) that is determined by firm's business activities generating income to meet loan obligations.

- Enforcement. For project monitoring, banks are able to take actions before default occurs. By observing project performance, banks can adjust interest rates, loan terms, or credit limits based on updated risk assessments.
- General example. An example is for project finance. In project finance, loans are typically non-recourse or limited-recourse, meaning banks rely on the project's expected revenue. Given that there is no strong collateral fallback, learning the project's financial and operational progress is crucial to make decisions on rollover and adjusting loan rates.

Collateral Monitoring.

- General definition. Collateral monitoring refers to the process by which banks track the value, condition, and enforceability of assets pledged as collateral for a loan. It involves asset revaluation, legal verification, and risk assessment of assets based on market conditions. The goal is to ensure that collateral retains sufficient value to recover losses in the event of borrower default. Put differently, banks monitor collateral to reduce the loss given default (LGD) by ensuring the asset is available for liquidation if needed.
- Enforcement. Collateral enforcement occurs after borrower default. If a borrower fails to repay, the lender seizes and liquidates the collateral to recover losses. Enforcement actions include asset seizure and asset liquidation. Banks will takes legal possession of the collateralized asset, which requires legal foreclosure proceedings in many jurisdictions. Then banks sell the collateral to recover loan losses, while the speed and efficiency of liquidation depend on legal frameworks and market conditions.
- General example. Concrete examples can be found in Gustafson et al. (2021) which observe textual discussion of monitoring, *"This senior credit facility is secured by A/R, inventory and RE. The bank receives and uses a quarterly borrowing base certificate, generated by the company, to monitor collateral values. The bank performs periodic field examinations conducted by independent contractors. The most recent onsite inspection was conducted in March 2006 by [Auditing Company]. It covered accounts receivable audit, inventory testing at several of the company's manufacturing facilities, accounts payable and cash verifications, and borrowing base calculation validation"*.

B Model

I provide a simple model to differentiate and understand two monitoring types and how they are related.

B.1 Setup

I consider a model with two agents: a firm and a bank. The firm with zero wealth but owns a unit of asset and access to a long-term project. The firm pledges the asset to let the project to be financed by bank credit. The outcome of the project can be high (H) or low (L).

The model has three periods. At $t = 0$, a firm borrows $\$1$ from a bank through a secured debt contract and invests in a long-term project. The prior successful probability of the project is $\Pr\{\tilde{\omega} = L\} = p \in [0, 1]$. The project payoff has the form

$$\tilde{v}_F = \begin{cases} R, & \text{if } \tilde{\omega} = H, \\ 0, & \text{if } \tilde{\omega} = L, \end{cases}$$

where $R > 1$ and $\tilde{\omega}$ represents the state of the project. The collateral value firm pledges to the bank has the form

$$v_c(t) = m(1 - \phi t)\bar{v}_0, \;\; t = 0, 1, 2,$$

where $m \in [0, 1]$ captures the bank's intensity of collateral monitoring, $\phi \in [0, \frac{1}{2})$ is the rate of depreciation, and $\bar{v}_0$ is the collateral value under full monitoring (i.e., $m = 1$) at $t = 0$. This equation shows the relationships between collateral value, depreciation rate, and collateral monitoring of banks. Several points deserve discussions. First, collateral value depreciates over time. Since $\phi \in [0, \frac{1}{2})$, it captures asset types with varying degree of depreciation rate. A real estate will generally have a lower rate than a car. Depreciation rates also tend to be associated with liquidation value. For example, Degryse et al. (2020) finds that movable collateral with a high depreciate rate has a significantly lower expected liquidation value relative to immovable collateral. The intuition on collateral value and depreciation is straightforward for all kinds of tangible assets, while it might not be the case for intangible assets. I argue that ϕ actually captures the feature of intangible assets to large extent. Consider a patent, the value at today can be higher than value at tomorrow since the likelihood of having more similar patents will increase as time goes which will decrease the value of the patent.[21]

Second, collateral value increases as banks' collateral monitoring increases. The idea being

[21] Note that the decrease in asset value at $t = 2$ is driven by natural depreciation of assets rather than the uncertainty in value itself. One could argue that an asset worth more today than tomorrow because the uncertainty of value increase. It can be true for my setting, but the key point is to use ϕ to capture the difference in asset nature and collateral types.

that, keep the depreciation rate and time fixed, more intensive monitoring allows banks to have higher collateral value. One explanation is that more monitoring may help banks to accumulate information on collateral and benefit resell.[22] Alternatively, more monitoring may prevent potential misappropriation by borrowers in case of tangible movable assets such as machinery, which is a valid concern among both finance and law literature (see, e.g., Aretz et al. (2020)). Third, the value of collateral contains two parts. One is the part firms can control by adjusting the degree of monitoring, captured by $m(1-\phi t)$. Another is the part firms cannot control, reflecting the market sentiment or condition of valuing the assets, captured by $\bar{v}_0$. Note that the functional form I specified for collateral value precludes the possibility that $v_c(t)$ affects m. One should distinguish $v_c(t)$ and $\bar{v}_0$. Cerqueiro et al. (2020) shows that collateral value affects bank monitoring. The collateral value in their setting is likely to be $\bar{v}_0$ rather than $v_c(t)$. It is because the legal changes reduce the market valuation of blanket lien due to the lose of its seniority. This idea can be even more straightforward for studies using the housing price index as the proxy for collateral value. In those studies, housing prices will only be able to reflect $\bar{v}_0$.

At $t=1$, the bank observes a signal $\tilde{s} \in \{H, L\}$ about the project. The precision of the signal is $\rho \in [\frac{1}{2}, 1]$, i.e.,

$$\Pr\{\tilde{s}=H|\tilde{\omega}=H\} = \Pr\{\tilde{s}=L|\tilde{\omega}=L\} = \rho.$$

The signal precision ρ can be interpreted as the bank's intensity of firm (project) monitoring. The idea is that higher intensity of project motioning allows the bank to better inform the final outcome. For instance, banks can do periodic audit to know firms' operations. Higher frequency of audit should allow firms to gather more information and increase the precision of the signal predicting project outcomes.

Upon observing the realization of $\tilde{s}$, the bank decides whether to rollover the debt or ask the firm to repay. Note that the firm cannot repay the money at $t=1$ because its project does not generate any cash flow at $t=1$. Therefore, if the bank decides not to rollover, then it liquidates the collateral and receives $v_c(1)$. If the bank decides to rollover, it will receive a cash flow $R_B \in [1, R]$ if $\tilde{w}=H$ at $t=2$. We also assume that $R_B > v_c(1)$. In contrast, if $\tilde{w}=L$ at $t=2$, then the firm cannot repay the debt and the bank will liquidate the collateral, receiving $v_c(2)$.

Denote the bank's action at $t=1$ by $a(\tilde{s}) \in \{\textbf{rollover}, \textbf{liquidate}\}$, then obviously the optimal

[22] Cao et al. (2023) proposes capital allocation engagement of banks. It captures a bank's experience with a firm's capital reallocation opportunities in the industry. Their model illustrates that lenders with more capital allocation experience can more easily identify suitable asset buyers in the sector, and choose the most appropriate timing and location for asset liquidation.

strategy is

$$a(\tilde{s}) = \begin{cases} \textbf{rollover}, \text{ if } E[\tilde{\Pi}_2|\tilde{s}] > v_c(1), \\ \textbf{liquidate}, \text{ if } E[\tilde{\Pi}_2|\tilde{s}] \leqslant v_c(1). \end{cases}$$

where

$$\tilde{\Pi}_2 = \begin{cases} R_B, & \text{if } \tilde{\omega} = H, \\ v_c(2), & \text{if } \tilde{\omega} = L. \end{cases}$$

and

$$E[\tilde{\Pi}_2|\tilde{s}] = \Pi_1^{rollover}(\tilde{s}) = \Pr\{\tilde{\omega} = H|\tilde{s}\} \times R_B + \Pr\{\tilde{\omega} = L|\tilde{s}\} \times v_c(2),$$

Assumption 1. $\frac{m\bar{v}_0}{\rho p}[\phi(1-p) - \rho(\phi - p)] < R_B < \frac{m\bar{v}_0}{(1-\rho)p}[p(1-\phi) + \rho(\phi - p)]$.

Note that m and ρ can be functions of other parameters. This assumption is equivalent to $\Pi_1^{rollover}(\tilde{s} = L) < v_c(1) < \Pi_1^{rollover}(\tilde{s} = H)$. It ensures that the bank will always chooses rollover as long as it observes $\tilde{s} = L$

B.2 Bank Decision of Rollover and Liquidation

Lemma 1. *Assume that Assumption 1 holds. At $t = 1$, the bank's optimal decision is*

$$a(\tilde{s} = H) = \textbf{\textit{rollover}}, \;\; a(\tilde{s} = L) = \textbf{\textit{liqudation}}.$$

Intuitively, the bank rolls over the debt if it receives a good signal about the firm's project and liquidate the collateral if it receives a bad signal.

At $t = 0$, anticipating its optimal strategy at $t = 1$, the bank's ex ante expected revenue is

$$\Pi_0 = \Pi_1^{rol}(\tilde{s} = H) \times \Pr\{\tilde{s} = H\} + v_c(1) \times \Pr\{\tilde{s} = L\}.$$

Recall that $v_c(1) = m(1-\phi)\bar{v}_0$ and ρ is the precision of $\tilde{s}$. Therefore, both the intensities of collateral monitoring (m) and project monitoring (ρ) affect the bank's revenue.

B.3 Optimal Monitoring Decisions

Assume that the cost of monitoring project (information acquisition) is $C_I(\rho) = \frac{k}{2}(\rho - \frac{1}{2})^2$ and the cost of monitoring collateral is $C_M(m) = \frac{c}{2}m^2$, where $c, k > 0$. At $t = 0$, the bank chooses m, ρ by solving the following problem,

$$\max_{m \in [0,1],\ \rho \in [\frac{1}{2}, 1]} \Pi_0(m, \rho) - C_M(m) - C_I(\rho),$$

where the expression of bank's ex ante expected revenue $\Pi_0(m, \rho)$ can be expressed as the following.

$$\Pi_0(m, \rho) = \bar{v}_0 \left[(1 - 2\phi + p\phi)m + \left(\frac{pR_B}{\bar{v}_0} \right) \rho + (\phi - p)m\rho \right]. \tag{5}$$

An interior solution (m^*, ρ^*) to this problem must satisfy the first-order condition,

$$\bar{v}_0 \left[(1 - 2\phi + p\phi) + (\phi - p)\rho^* \right] - cm^* = 0, \;\; \bar{v}_0 \left[\left(\frac{pR_B}{\bar{v}_0} \right) + (\phi - p)m^* \right] - k \left(\rho^* - \frac{1}{2} \right) = 0.$$

Therefore, the bank's optimal collateral monitoring and project monitoring must have the following relationship,

$$\rho^* = \frac{1}{2} + \frac{pR_B}{k} + \frac{\bar{v}_0(\phi - p)}{k} m^*. \tag{6}$$

Eq(6) suggests that, when $\phi < p$ ($\phi > p$), if there is an exogenous shock to m^* (e.g., a change in the collateral monitoring cost c), then ρ^* and m^* will move in the opposite directions (same direction).

The optimal intensity of monitoring the collateral can be expressed as

$$m^* = \frac{\bar{v}_0[(1 - 2\phi + p\phi) + (\phi - p)(pR_B k^{-1} + \frac{1}{2})]}{c - \bar{v}_0^2(\phi - p)^2 k^{-1}}.$$

Therefore, a higher cost of monitoring the collateral c decreases the intensity of monitoring the collateral.[23] Interestingly, from Eq(6), one can notice that the cost of monitoring the collateral c also has non-trivial impacts on the intensity of monitoring the project ρ^*. If $\phi > p$ ($\phi < p$), then ρ^* is decreasing (increasing) in c. Figure 4 illustrates the relationship between c and $m*$.

In addition, ϕ will have impacts both on m^* and ρ^*. As illustrated in Figure 3a and 3b, m^* is decreasing in ϕ, while ρ^* is increasing in ϕ. The intuition is that high depreciation rates reduce marginal benefits of collateral monitoring, but increase marginal benefits of project monitoring. If a firm pledges a piece of asset depreciates quickly, it can motivate the bank to monitor more intensively on the project of this firm to ensure it can repay the loan since the collateral is less valuable in the event of default.

B.4 Monitoring Types: Complementarity and Subsitutability

After decomposing bank monitoring into collateral monitoring and project monitoring, I study the relationship of these two monitoring types. I define the concepts of complementarity and substitutability between these two types of monitoring.

Definition 1. *Monitoring project and monitoring collateral are substitute (complement) if* $\frac{\partial^2 \Pi_0}{\partial m \partial \rho} < 0$

[23] Note that this result requires the conditions $(1 - 2\phi + p\phi) + (\phi - p)(pR_B k^{-1} + \frac{1}{2}) > 0$ and $c > \bar{v}_0^2(\phi - p)^2 k^{-1}$.

($\frac{\partial^2 \Pi_0}{\partial m \partial \rho} > 0$). *In other words, if monitoring project decreases (increases) the marginal benefit of monitoring collateral, then the two types of monitoring are substitute (complement).*

The following proposition describes the condition that determines the complementarity or substitutability.

Proposition 1. *Assume that Assumption 1 holds, project monitoring and collateral monitoring are complement if and only if* $\frac{\partial^2 \Pi_0}{\partial m \partial \rho} < 0 \iff \phi < p$, *while project monitoring and collateral monitoring are substitute if and only if* $\frac{\partial^2 \Pi_0}{\partial m \partial \rho} > 0 \iff \phi > p$.

Intuitively, monitoring project and monitoring collateral are complement (substitute) if and only if the prior successful probability of the project is less (greater) than the depreciation rate of the collateral. Proposition 1 shows that when the project quality (measured by the ex ante successful probability p) is high, the monitoring of project and the monitoring of collateral are substitute. Notice that a good project leads to a high probability of rollover. Therefore, if the project quality is high, the bank is very likely to receive the cash flow $\tilde{\Pi}_2$ at $t = 2$. I have the following proposition about the uncertainty of $\tilde{\Pi}_2$ for the bank who decides to roll over at $t = 1$.

Proposition 2. *Assume that Assumption 1 holds and that* $R_B > v_c(2) = m(1-2\phi)\bar{v}_0$. *At* $t = 1$, *the cash flow uncertainty for the bank who decides to roll over (i.e., who receives a good signal* $\tilde{s} = H$*) is*

$$Var[\tilde{\Pi}_2 | \tilde{s} = H] = \frac{\rho p (1-\rho)(1-p)}{[\rho p + (1-\rho)(1-p)]^2} [R_B - m(1-2\phi)\bar{v}_0]^2.$$

Moreover, we have $\frac{\partial Var[\tilde{\Pi}_2 | \tilde{s}=H]}{\partial m} < 0$, *i.e., the cash flow uncertainty decreases in the intensity of the monitoring of collateral.*

Proposition 2 shows that a higher intensity of monitoring the collateral decreases the uncertainty of the cash flow at $t = 2$ perceived by the bank. In other words, a higher m reduces the sensitivity of the bank's cash flow $\tilde{\Pi}_2$ to the realization of $\tilde{\omega}$. Therefore, if the bank is very likely to roll over the debt, the marginal benefit of information about the state of the firm's project decreases in the intensity of monitoring the collateral.

In contrast, when the firm's project quality is low (i.e., p is small), the monitoring of project and the monitoring of collateral are complement. Notice that the probability of a bad signal is $\Pr\{\tilde{s} = L\} = 1 - \rho p - (1-\rho)(1-p)$, so $\frac{\partial \Pr\{\tilde{s}=L\}}{\partial \rho} = 1 - 2p < 0$ if $p \in [0, \frac{1}{2})$. Intuitively, if the project quality is low, the probability of a bad signal is increasing in the signal precision.

In other words, when the signal becomes more precise, the bank is more likely to liquidate the collateral, so the collateral liquidation price $v_c(1) = m(1-\phi)\bar{v}_0$ becomes more important to the bank. Therefore, under a low project quality, a higher precision of the project signal increases the marginal benefit of monitoring the collateral. Figure 4 provides a numerical illustration of the relationship between two types of monitoring.

B.5 Total Monitoring Activity

Assume that before the shock, the cost of monitoring collateral is $c^- > 0$, and the optimal monitoring of collateral and monitoring of project are m^- and ρ^- respectively. The total cost of monitoring,

$$\zeta(m^-, \rho^-; c^-, k) = \frac{c^-}{2}\left(m^-\right)^2 + \frac{k}{2}\left(\rho^- - \frac{1}{2}\right)^2,$$

measures the intensity of total monitoring activity. After the shock, the cost of monitoring collateral becomes $c^+ > c^-$, and the the optimal monitoring of collateral and monitoring of project become m^+ and ρ^+ respectively. Notice that the total cost of monitoring after the shock, $\zeta(m^+, \rho^+; c^+, k)$, cannot be used as a measure of total monitoring activity because it is not comparable with $\zeta(m^-, \rho^-; c^-, k)$. Instead, I use

$$\zeta(m^+, \rho^+; c^-, k) = \frac{c^-}{2}\left(m^+\right)^2 + \frac{k}{2}\left(\rho^+ - \frac{1}{2}\right)^2$$

to measure the total monitoring activity after the shock because it rules out the direct impact of the cost of monitoring collateral on the total cost of monitoring.

C Discussions

The model in section is stylized, while it captures key factors that can play a role in bank decisions of monitoring secured loans. First, I decompose total bank monitoring into project monitoring and collateral monitoring. Without collateral monitoring, all efforts will be allocated to project monitoring. This is not consistent with existing literature that highlights banks indeed care about the collateral value that can further affect both collateral monitoring and project monitoring. Second, I also distinguish between collateral types. Assets nature differs substantially across types and may require creditors' different trade-offs. As documented by Rajan and Winton (1995), banks accept a risky collateral from a firm may have higher incentive to monitor firm operations since the collateral is considered as a negative signal.

Banks' ability to enforce the optimal decision at $t = 1$ is key to the model. As such, I set the debt contract is short-term to make sure banks need to act. Another way is to stipulate that banks must act based on the observed signal regardless of the maturity of the contract. It does not

directly affect model conclusions and interpretations.

Note that I do not model firms decision for simplicity. One concern is that pledging a collateral may interact with the degree of firm efforts. The assumption is that firms will not make strategic default since collateral value more for firms than for banks, which holds realistically. The incentive role of collateral is well documented in the literature. In addition, I do not model the bank's financing decision and take the debt contract as given. As a results, it can bring several caveats. Loan pricing is not modeled, and it is likely that banks trade-offs ex-ante price and ex-post monitoring efforts. For example, Gustafson et al. (2021) finds a negative association between loan spreads and monitoring after controlling for other loan and borrower characteristics. Besides, firms debt structure is not modeled. One may wonder what can happen if a firm issues both secured loans and unsecured loans. The question becomes how banks allocate monitoring into two types of loans. This again depends on the expected cash flow of both loans at $t = 2$ and is correlated with prior success probability and collateral liquidation value. Put differently, understanding banks decision on collateral monitoring would always be the first step to investigate banks optimal monitoring in presence of secured loans. Finally, I do not discuss *ex-ante* screening, i.e., how collateral presence affect bank's screening before making lending decisions.[24] My focus centers on *ex-post* monitoring and banks decisions on optimal monitoring.

D Empirical Implications

Eq(6) suggests a nexus between ϕ and (i) m^* and (ii) ρ^*, leading to the following predictions:

Predictions 1. All else equal, collateral monitoring of loans secured by real estate will be less pronounced relative to loans secured by movable assets.

Predictions 2. All else equal, collateral monitoring of loans secured by real estate will be more pronounced relative to loans secured by movable assets.

The Proposition 1 suggests that the complementarity or substitutability between collateral monitoring and project monitoring depends on the firm's project quality and collateral depreciation rates. In reality, these two factors are not comparable. Given the data availability, it can lead to the following predictions:

Predictions 3a. All else equal, collateral monitoring and project monitoring will complement for firms that pledge collateral with high depreciation rates but whose projects have an ex-ante low probability of success.

Predictions 3b. All else equal, collateral monitoring and project monitoring will substitute for

[24] Manove et al. (2001) shows that collateral can act as a substitute for bank screening.

firms that pledge collateral with low depreciation rates but whose projects have an ex-ante high probability of success.

IV Collateral Monitoring and Project Monitoring

This section empirically test model predictions leveraging corporate credit registry data from France. The goal of this section is twofold. First, I study the association between asset nature, i.e., depreciation rates, and collateral monitoring as well as project monitoring. Second, I investigate whether and how two monitoring types can complement or substitute. Section IV.A presents the data, bank monitoring measures, and stylized facts. Section IV.B investigates the relationship between collateral and bank monitoring.

A Data and Facts

A.1 Data Source

I employ French corporate loan data from AnaCredit, a euro-area corporate credit registry established by the European Central Bank. The dataset provides detailed information at the individual loan level, including loan commitment amounts, outstanding amounts, maturity, loan rate, loan type, and whether it is secured or not. It also contains information on borrowers, including estimated probability of default, firm assets, number of employee. More importantly, the datasets record information on collateral if a loan is secured, including collateral type, value, type of value, the valuation counterparty, and the date of valuation.

The dataset includes loans issued by banks to nonfinancial corporations with exposure toward firms above 25,000 EUR. I exclude loans that are syndicated and for project finance. I also exclude loans and/or firms that are in default. I limit the sample to loans in EUR, and where firms and banks are in the same country and drop loans with more than one borrower and creditor.[25] For simplicity, I only include loans with one collateral that backs one loan. I drop loans with outstanding amounts equal to 0. I only include loans that fall into three groups: (1) loans; (4) credit lines; (5) revolving credit, including overdrafts, credit card debt, revolving credit other than overdrafts, and credit card debt.

I build a loan sample with the unit of observation as firm-bank-loan-quarter. The loan sample includes 10 million secured loans from 1,163,597 firms issued by 386 banks from 2018q3 to 2023q4. Table 6 Panel A describes the summary statistics. On average, the loan commitment amount is around 0.247 million, while the outstanding amount is around 0.184 million. It suggests that loans in my sample are typically small loans relative to syndicated loans and

[25] The excluded loans only account for a very small fraction of the sample.

construction loans in Gustafson et al. (2021) and Heitz et al. (2022). The annualized loan rate is 0.054, and the average maturity is 113 months. In the sample, the average collateral value is around 0.201 million.

A.2 Collateral Types

To measure depreciation rates, I classify assets into two category.[26] The idea is to capture the relative differences in depreciation rates between asset categories rather than directly measure the rates.

- **Real estate.** This category includes residential real estate collateral, offices and commercial premises, and commercial real estate collateral. It is in line with the notion from previous literature on real estate. More importantly, it captures commercial real estate, which functions differently for firms relative to residential real estate.

- **Movable assets.** It includes the following assets: other physical collateral, currency and deposits, securities, loans, equity and investment fund shares or units, credit derivatives, financial guarantees other than credit derivatives, life insurance policies pledged, trade receivables, gold, and all assets that are not in the above categories.[27]

  I do not bundle physical movable assets and real estate together as fixed assets. Physical movable assets tend to be less redeployable because such assets can be highly specific. Most importantly, their values can be volatile as these assets are subject to decay, which results in typically low pledgeability. In addition, I interpret assets that are not in the above categories as one including intellectual property (IP) such as patents, trademarks, copyrights, and trade secrets, which can be used as collateral in several countries. One common feature of those assets exhibit faster depreciation relative to real estate, which is an important dimension for understanding bank monitoring.

This classification allows me to focus on the differences in the underlying characteristics of different assets. For instance, my analysis will not benefit from comparing commercial real estate and residential assets, even though they indeed differ from each other in some aspects. In contrast, identifying real estate and movable assets as two categories will give us a better idea of how they can play different roles in bank monitoring.

[26] AnaCredit records fourteen types of assets.

[27] Loans secured by gold account for less than 0.01% of total loans. Categorizing gold into different groups does not affect the results.

A.3 Project Monitoring Measures

Measures. Following Plosser and Santos (2016) and Weitzner and Howes (2023), I use the change in a firm's one-year-ahead forecasted probability of default (PD) as a proxy for project monitoring. It is a dummy variable that takes the value of one if a bank revises a firm's PD and zero otherwise. This measure captures project monitoring related to the act of auditing firm operations, regardless of whether the revision occurs, indicating whether monitoring took place in a given quarter. Table 6, Panel B, reports project monitoring at the loan level. It shows that the average probability of a borrower's PD being revalued in a given quarter is 0.34, suggesting that approximately one-third of loans undergo an assessment of repayment ability each quarter.

Discussion on Measures. The change of PD is a typical measure of project monitoring in the literature (e.g., Plosser and Santos, 2016; Weitzner and Howes, 2023; Beyhaghi et al., 2023, 2024). However, some points deserve attention. As argued by Plosser and Santos (2016), two sources can drive the change of PD. One is banks' incorporation of new information about the borrower, another is banks' changes to their default models. The first source can be disentangled from the second one by including bank-time fixed effects in the regression specification. Moreover, project monitoring can be active or passive. The active one consists of banks' efforts in gathering information to estimate PD. The passive one refers to the incorporation of available information into estimating PD. Information on public firms is likely readily available, while this is not the case for SMEs. For now, I do not further distinguish between project motoring and the two types. I do some exercises for large and small firms separately as robustness checks.

A.4 Collateral Monitoring Measures

Measures. I construct two direct measures. The first measure captures collateral monitoring at the extensive margin. It is a dummy variable that equals one if the collateral of a loan is revalued in a reporting quarter and zero otherwise. This measure captures monitoring related to the act of checking collateral value, regardless of whether the value changes. It indicates whether monitoring occurred in a given quarter. The second measure captures collateral monitoring at the intensive margin. It is the natural logarithm of the number of days between the current valuation date and the reference quarter. This measure focuses on monitoring associated with changes in collateral value. Table 6 Panel A reports collateral monitoring activities at the loan level. It shows that the average probability of a loan being revalued in a given quarter is 0.13, indicating that approximately 10% of loans undergo collateral revaluation each quarter. Furthermore, the average duration between the latest valuations and reference time is 15 months.

Discussion on Measures. Two previous studies provide direct measures of bank monitor-

ing. Gustafson et al. (2021) exploit U.S. syndicated loan data from the Shared National Credit (SNC) program. The first measure is an indicator for active monitoring, which includes borrower site visits or the use of third-party appraisers. The second measure captures the frequency with which the bank acquires borrower or collateral-related information within a year. Heitz et al. (2022) rely on data from construction loans issued by a failed U.S. bank and construct bank monitoring measures based on on-site inspections. They observe the frequency at which the bank conducts on-site inspections as well as the content of the inspection reports.

The commonality between the measures in these two studies lies in their close connection to bank monitoring of collateral. For example, 93% of the syndicated loans in the sample used by Gustafson et al. (2021) are secured, which requires extensive monitoring of collateral value by banks. Similarly, the analysis in Heitz et al. (2022) focuses on construction loans, where inspections primarily address two aspects: monitoring of firms, such as firm operations and project progress, and monitoring of collateral, such as the building under construction that serves as collateral. In this regard, my measure of bank monitoring follows a similar logic, capturing monitoring activities related to both the borrower and the collateral.

My measures have one main advantage over existing studies. First, the data covers almost the universe of corporate secured loans in France, including a very large fraction of small and micro firms. The composition of my sample differs substantially from Gustafson et al. (2021) and Heitz et al. (2022). The early one only includes syndicated loans normally involving large firms and banks, while the later one only includes one special loan type from one failed bank. This difference implies that the monitoring measure is more representative and reflects monitoring activities on various types of firms, loans, and collateral. Of course, there are several potential concerns regarding the two measures. First, my sample excludes unsecured loans, which may limit the generalizability of the measure to unsecured lending contexts. Second, I cannot observe how banks update collateral values. Put differently, I cannot know whether the information is collected directly by the banks or through third-party consulting firms, nor can I determine who ultimately determines the updated value. Third, there might be a mechanical relationship between loan outstanding amounts and collateral values. In some cases, banks may adjust collateral values to align with changes in outstanding loan amounts. If this occurs, the informational content generated through collateral revaluation could be diminished.

A.5 Stylized Facts

Figure 5 presents the time variation in project monitoring and collateral monitoring. Figure 5a illustrates the likelihood of PD revisions based on collateral types (ϕ), indicating that banks

are more inclined to inspect firms pledging real estate compared to those using movable assets. Figure 5b depicts the likelihood of collateral revaluation by collateral type, showing that real estate revaluations occur more periodically, though the difference in overall likelihood is less clear-cut. Notably, Figure 5c reveals a striking contrast in the duration of collateral revaluation depending on asset type. The divergence between the two lines suggests that banks monitor real estate more frequently than movable assets.

I further make plots to see how two types of monitoring can vary depending on loan types. Figure 6a plots the mean likelihood of project monitoring for different loan types. Revolving credits are much more likely to be inspected relative to term loans and revolvers. One possible explanation is that the project funded by revolvers tends to be risky. Figure 6b shows that the collateral of term loans has the highest likelihood to be inspected relative to other ones and Figure 6c exhibits a consistent pattern.

Firm size can also play a crucial role in shaping bank monitoring. Figure 7a illustrates the likelihood of project monitoring across firms of different sizes, with the x-axis representing firm size categories. Irrespective of the collateral securing the loans, the probability of project monitoring decreases monotonically as firm size declines, from large firms to micro firms. Figures 7b and 7c explore the relationship between collateral type, firm size, and both the likelihood and duration of collateral revaluation. Notably, loans secured by movable assets for micro firms exhibit more intensive project and collateral monitoring. This provides direct evidence supporting the complementarity between the two types of monitoring when ϕ is high and p is low.

B Determinants of Monitoring

B.1 Identification Strategy

To test the model predication, I estimate the following equation:

$$\text{Monitoring}_{f,b,i,t} = \beta \text{Real estate}_i + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \theta_{f,c,t} + \mu_{b,t} + \varepsilon_{f,b,i,t}, \tag{7}$$

where f, b, i, c, and t denote firm, bank, loan, loan type, and time, respectively, $\text{Monitoring}_{f,b,i,t}$ represents one of the two monitoring types at time t for loan i issued by bank b to firm f. It corresponds to m and ρ in the model. Real estate_i is an indicator variable equal to one if a loan is secured by real estate, and zero otherwise. It corresponds to ϕ in the model. Ideally, I should use the real depreciation rate of each asset class. Since I cannot infer that from the data, I use Real estate_i as a proxy. The assumption is that the depreciation rates between real estate and other movable assets are different. Furthermore, it implies that the depreciation rates within movable assets are the same. $\mathbf{Z}_{i,t}$ denotes a set of loan-level controls, ensuring that

differences in monitoring are not driven by variations in collateral value, outstanding amounts, loan maturity, and interest rates. For identification, I include $\theta_{f,c,t}$, which represents firm-time-loan type fixed effects. Also, I add $\mu_{b,t}$, which is the bank-time fixed effects. The identification is from differences in monitoring between loans secured by real estate versus other loans issued to the *same firm* for the *same loan type* at the *same time* and by the *same bank* at the *same time*. The coefficient of interest, β, captures the effect of depreciation rates of collateral on monitoring. Robust standard errors are clustered at the sector (2-digit NACE code) level.

B.2 Results

Table 7 presents the results where the outcome variable is project monitoring, measured as a dummy indicating whether a loan's probability of default (PD) is revised in a given reporting quarter. Column (1) includes firm-time fixed effects, bank fixed effects, and loan type fixed effects, but does not account for the possibility that PD changes stem from adjustments in banks' risk modeling. Nevertheless, I find a negative and statistically significant coefficient on Real estate. To further isolate potential differences in project monitoring across loan types, Column (2) introduces firm-time-loan type fixed effects. The coefficient remains quantitatively similar, reinforcing the robustness of the finding. In Column (3), I replace bank fixed effects with bank-time fixed effects to account for potential noise in the project monitoring measure. Consequently, β captures the impact of depreciation rates on project monitoring when incorporating information into PD estimates. The coefficient on Real estate remains negative, though its significance level drops slightly, and the magnitude decreases, likely due to reduced variation. In Column (4), I further control for loan purpose fixed effects. The results remain consistent, indicating that banks are less likely to monitor firms and their projects when loans are secured by real estate, compared to loans backed by other assets, even after accounting for loan and collateral characteristics. Specifically, the probability of a PD change declines by 1.5 pp for real estate-backed loans, which corresponds to approximately 4% of the unconditional mean. These findings support Figure 3b, suggesting that banks engage in more intensive monitoring for firms and projects associated with high-depreciation collateral. The underlying intuition is that when collateral depreciates rapidly, its expected liquidation value declines, strengthening banks' incentives to monitor firms more closely to ensure repayment rather than relying on liquidation.

Table 8 reports the results where the outcome is the collateral monitoring. In Columns (1)-(3), the outcome variable is a dummy indicating if the collateral of a loan is revalued. In Columns (4)-(6), the outcome variable is the natural logarithm of the duration between the latest valuation time and reference time. The specification is gradually saturated. I find the coefficient

estimates are positive and statistically significant across three specifications. It means that banks are more likely to monitor real estate collateral relative to other collateral types. Turning to the monitoring duration as the outcome variable, I find the estimates are in the opposite direction. It suggests that the duration between the latest valuation and reference time is lower for real estate collateral compared to other collateral types. In terms of economic magnitude, real estate is 1.3pp more likely to be revalued, and the monitoring duration is approximately 50% shorter. The results support Figure 3a, suggesting that banks monitor less (more) collateral with high (low) depreciation rates. The intuition is that the expected liquidation value of the collateral is low, reducing the marginal benefit of monitoring collateral, and thus decreasing banks' collateral monitoring.

I further estimate Eq(7) using an alternative proxy for depreciation rates. Table 9 presents the results. The outcome variables are project monitoring in Columns (1) and (2) and collateral monitoring in Columns (3)-(6). Similar to previous results, I find that firms are less likely to have changes on PD if they pledge real estate as collateral. Instead, those firms will have a shorter duration of revaluing the collateral. This again confirms that asset nature plays a role in both types of monitoring.

C Complementarities or Subsitutibility

The model predicts that there can be a positive or negative relationship between collateral monitoring and project monitoring depending on the depreciation rates (ϕ) and prior success probability (p). In this section, I empirically test the model prediction. I start by looking at the correlation between two monitoring types. To further sharpen the identification, I use a set of fixed effects. The goal of this section is to understand how two monitoring types are related, rather than identifying causal links between them.

Table 10 presents the results, where the outcome variable is project monitoring and the key explanatory variable is collateral monitoring. Since I do not aim to establish causal identification in this analysis, the direction of the relationship between the two variables is not a primary concern. Columns (1) and (2) report results for firms characterized by high ϕ but low p, that is, firms that are ex-ante risky and pledge movable assets as collateral. I find that collateral monitoring is positively correlated with project monitoring. More specifically, the likelihood of monitoring a project increases when the corresponding collateral is revalued, indicating a complementarity between the two monitoring types. In contrast, the results shift when considering firms with low ϕ and high p, firms that are ex-ante less risky and pledge real estate as collateral. As shown in Column (3), collateral monitoring is negatively correlated with project monitor-

ing, suggesting that the two monitoring types act as substitutes in this setting. This reversal in the relationship highlights the role of collateral type in shaping banks' monitoring incentives.

My results contribute to understanding the puzzle in the relationship between collateral value and bank monitoring. Cerqueiro et al. (2020) find that a negative shock to collateral value leads to a decline in both collateral monitoring and project monitoring. In contrast, Gorton and Ordonez (2014) and Asriyan et al. (2022) predict that lower collateral value should induce banks to intensify screening efforts. The key to reconciling these divergent findings lies in incorporating the interaction between ϕ and p, as formalized in Eq(**??**). When the initial collateral value $\bar{v}_0$ declines, the optimal level of project monitoring ρ^* also decreases if ϕ exceeds p, holding other factors constant. This is likely the case in Cerqueiro et al. (2020), where loans are secured by blanket liens, making collateral liquidation less responsive to depreciation. By contrast, when $\bar{v}_0$ declines and ϕ is lower than p, ρ^* increases, reinforcing the prediction that project monitoring rises as collateral value falls. This aligns with the empirical evidence in Asriyan et al. (2022), where the authors use a real estate price index as a proxy for collateral value, likely capturing loans backed by assets with low depreciation rates.

V Conclusion

This paper studies bank monitoring when loans are collateralized. By distinguishing between project monitoring, which learns a firm's probability of default, and collateral monitoring, which preserves the liquidation value of pledged assets. I find that banks reduce total monitoring efforts in response to legal reforms that increase costs of one type of monitoring. To understand the heterogeneous nature of bank monitoring, I develop a theoretical framework and derive testable predictions on the role of collateral in shaping incentives for monitoring projects and collateral and how these two types of monitoring complement or substitute. Using ad- ministrative credit registry data to directly measure monitoring, I show that both monitoring types are affected by depreciation rates of collateral. In addition, I show that project monitoring and collateral monitoring complement (substitute) when firm risks are high (low) and collateral depreciation rates are high (low). Overall, this study emphasizes the importance of collateral in shaping bank monitoring, including both project and collateral monitoring. My findings provide a new perspective on how collateral influences credit dynamics and has broad implications for credit contracting and credit allocation.

References

Aghion, P. and Bolton, P. (1992). An incomplete contracts approach to financial contracting. *The review of economic Studies*, 59(3):473–494.

Aretz, K., Campello, M., and Marchica, M.-T. (2020). Access to collateral and the democratization of credit: France's reform of the napoleonic security code. *The Journal of Finance*, 75(1):45–90.

Asriyan, V., Laeven, L., and Martin, A. (2022). Collateral booms and information depletion. *The Review of Economic Studies*, 89(2):517–555.

Assunçao, J. J., Benmelech, E., and Silva, F. S. (2014). Repossession and the democratization of credit. *The Review of Financial Studies*, 27(9):2661–2689.

Barbiero, F., Schepens, G., and Sigaux, J.-d. (2024). Liquidation value and loan pricing. *The Journal of Finance*, 79(1):95–128.

Beck, T., Levine, R., and Levkov, A. (2010). Big bad banks? the winners and losers from bank deregulation in the united states. *The Journal of Finance*, 65(5):1637–1667.

Benmelech, E. and Bergman, N. K. (2009). Collateral pricing. *Journal of Financial Economics*, 91(3):339–360.

Benmelech, E., Garmaise, M. J., and Moskowitz, T. J. (2005). Do liquidation values affect financial contracts? evidence from commercial loan contracts and zoning regulation. *The Quarterly Journal of Economics*, 120(3):1121–1154.

Benmelech, E., Kumar, N., and Rajan, R. (2022). The secured credit premium and the issuance of secured debt. *Journal of Financial Economics*, 146(1):143–171.

Berger, A. N., Frame, W. S., and Ioannidou, V. (2011). Tests of ex ante versus ex post theories of collateral using private and public information. *Journal of Financial Economics*, 100(1):85–97.

Bernanke, B. S. (1983). Non-monetary effects of the financial crisis in the propagation of the great depression. *National Bureau of Economic Research*.

Bernanke, B. S. and Gertler, M. (1986). Agency costs, collateral, and business fluctuations.

Bernhardt, D., Koufopoulos, K., and Trigilia, G. (2020). Is there a paradox of pledgeability? *Journal of Financial Economics*, 137(3):606–611.

Besanko, D. and Kanatas, G. (1993). Credit market equilibrium with bank monitoring and moral hazard. *The Review of Financial Studies*, 6(1):213–232.

Besanko, D. and Thakor, A. V. (1987). Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets. *International Economic Review*, pages 671–689.

Bester, H. (1985). Screening vs. rationing in credit markets with imperfect information. *The American Economic Review*, 75(4):850–855.

Beyhaghi, M., Fracassi, C., and Weitzner, G. (2023). Adverse selection in corporate loan markets. *Available at SSRN 3733932*.

Beyhaghi, M., Howes, C., and Weitzner, G. (2024). The information advantage of banks: evidence from their private credit assessments. *Available at SSRN*.

Bilan, A., Degryse, H., O'Flynn, K., and Ongena, S. (2019). Collateral and lending. *Banking and Financial Markets: How Banks and Financial Technology Are Reshaping Financial Markets*, pages 105–132.

Blickle, K., Fleckenstein, Q., Hillenbrand, S., and Saunders, A. (2020). The myth of the lead arranger's share. *FRB of New York Staff Report*, (922).

Boot, A. W. and Thakor, A. V. (1994). Moral hazard and secured lending in an infinitely repeated credit market game. *International Economic Review*, pages 899–920.

Campello, M. and Larrain, M. (2016). Enlarging the contracting space: Collateral menus, access to credit, and economic activity. *The Review of Financial Studies*, 29(2):349–383.

Cao, Q., Degryse, H., Kokas, S., and Minetti, R. (2023). Banking on experience. capital reallocation, asset knowledge, and the structure of lending contracts. *Available at SSRN 4505515*.

Castellano, G. G. (2015). Reforming non-possessory secured transactions laws: A new strategy? *The Modern Law Review*, 78(4):611–640.

Catherine, S., Chaney, T., Huang, Z., Sraer, D., and Thesmar, D. (2022). Quantifying reduced-form evidence on collateral constraints. *The Journal of Finance*, 77(4):2143–2181.

Cerqueiro, G., Ongena, S., and Roszbach, K. (2016). Collateralization, bank loan rates, and monitoring. *The Journal of Finance*, 71(3):1295–1322.

Cerqueiro, G., Ongena, S., and Roszbach, K. (2020). Collateral damaged? priority structure, credit supply, and firm performance. *Journal of Financial Intermediation*, 44:100824.

Chaney, T., Sraer, D., and Thesmar, D. (2012). The collateral channel: How real estate shocks affect corporate investment. *American Economic Review*, 102(6):2381–2409.

Chava, S. and Roberts, M. R. (2008). How does financing impact investment? the role of debt covenants. *The Journal of Finance*, 63(5):2085–2121.

Chousakos, K., Gorton, G., and Ordoñez, G. (2023). Information dynamics and macro fluctuations. *American Economic Journal: Macroeconomics*, 15(4):372–400.

Claessens, S. and Van Horen, N. (2015). The impact of the global financial crisis on banking globalization. *IMF Economic Review*, 63:868–918.

Datta, S., Iskandar-Datta, M., and Patel, A. (1999). Bank monitoring and the pricing of corporate public debt. *Journal of Financial Economics*, 51(3):435–449.

Degryse, H., Ioannidou, V., Liberti, J. M., and Sturgess, J. (2020). How do laws and institutions affect recovery rates for collateral? *The Review of Corporate Finance Studies*, 9(1):1–43.

Degryse, H. and Van Cayseele, P. (2000). Relationship lending within a bank-based system: Evidence from european small business data. *Journal of Financial Intermediation*, 9(1):90–109.

Diamond, D. W. (1991). Monitoring and reputation: The choice between bank loans and directly placed debt. *Journal of Political Economy*, 99(4):689–721.

Diamond, D. W. (2004). Presidential address, committing to commit: short-term debt when enforcement is costly. *The journal of Finance*, 59(4):1447–1479.

Donaldson, J. R., Gromb, D., and Piacentino, G. (2020). The paradox of pledgeability. *Journal of Financial Economics*, 137(3):591–605.

Gorton, G. and Ordonez, G. (2014). Collateral crises. *American Economic Review*, 104(2):343–378.

Gropp, R., Mosk, T., Ongena, S., and Wix, C. (2019). Banks response to higher capital requirements: Evidence from a quasi-natural experiment. *The Review of Financial Studies*, 32(1):266–299.

Gupta, A., Sapriza, H., and Yankov, V. (2021). The collateral channel and bank credit. *Available at SSRN 4023809*.

Gürsel, Y. (2020). Keeping up with the times: The transformation of the publicity regime with new movable property security rights and developments in blockchain technology. *European Property Law Journal*, 9(2-3):73–132.

Gustafson, M. T., Ivanov, I. T., and Meisenzahl, R. R. (2021). Bank monitoring: Evidence from syndicated loans. *Journal of Financial Economics*, 139(2):452–477.

Hamwijk, D. J. Y. et al. (2014). *Publicity in secured transactions law: Towards a European public notice filing system for non-possessory security rights in movable assets?* Optima Grafische Communicatie.

Hart, O. and Moore, J. (1994). A theory of debt based on the inalienability of human capital. *The Quarterly Journal of Economics*, 109(4):841–879.

Heitz, A., Martin, C., and Ufier, A. (2022). Bank monitoring with on-site inspections. *FDIC Center for Financial* [*Research Paper No. 2022-09*]. *http://dx. doi. org/10.2139/ssrn*, 4197344.

Ioannidou, V., Pavanini, N., and Peng, Y. (2022). Collateral and asymmetric information in lending markets. *Journal of Financial Economics*, 144(1):93–121.

Jimenez, G., Salas, V., and Saurina, J. (2006). Determinants of collateral. *Journal of Financial Economics*, 81(2):255–281.

Kermani, A. and Ma, Y. (2020). Two tales of debt. Technical report, National Bureau of Economic Research.

Khwaja, A. I. and Mian, A. (2008). Tracing the impact of bank liquidity shocks: Evidence from an emerging market. *American Economic Review*, 98(4):1413–1442.

Kiyotaki, N. and Moore, J. (1997). Credit cycles. *Journal of Political Economy*, 105(2):211–248.

Lian, C. and Ma, Y. (2021). Anatomy of corporate borrowing constraints. *The Quarterly Journal of Economics*, 136(1):229–291.

Luck, S. and Santos, J. A. (2023). The valuation of collateral in bank lending. *Journal of Financial and Quantitative Analysis*, pages 1–30.

Manove, M., Padilla, A. J., and Pagano, M. (2001). Collateral versus project screening: A model of lazy banks. *Rand Journal of Economics*, pages 726–744.

Mello, A. S. and Ruckes, M. (2017). Collateral in corporate financing. *Unpublished working paper*.

Mester, L. J., Nakamura, L. I., and Renault, M. (2007). Transactions accounts and loan monitoring. *The Review of Financial Studies*, 20(3):529–556.

Morell, A. and Helsen, F. (2014). The interrelation of transparency and availability of collateral: German and belgian laws of non-possessory security interests. *European Review of Private Law*, 22(3).

OCC (2014). *Comptroller's Handbook*. Office of the Comptroller of the Currency.

Ongena, S., Saffar, W., Sun, Y., and Wei, L. (2025). Movables as collateral and corporate credit: Loan-level evidence from legal reforms across europe. *Journal of Banking & Finance*, 170:107331.

Ono, A. and Uesugi, I. (2009). Role of collateral and personal guarantees in relationship lending: Evidence from japan's sme loan market. *Journal of money, credit and banking*, 41(5):935–960.

Plosser, M. C. and Santos, J. A. (2016). Bank monitoring. *Available at SSRN 2697146*.

Rajan, R. and Winton, A. (1995). Covenants and collateral as incentives to monitor. *The Journal of Finance*, 50(4):1113–1146.

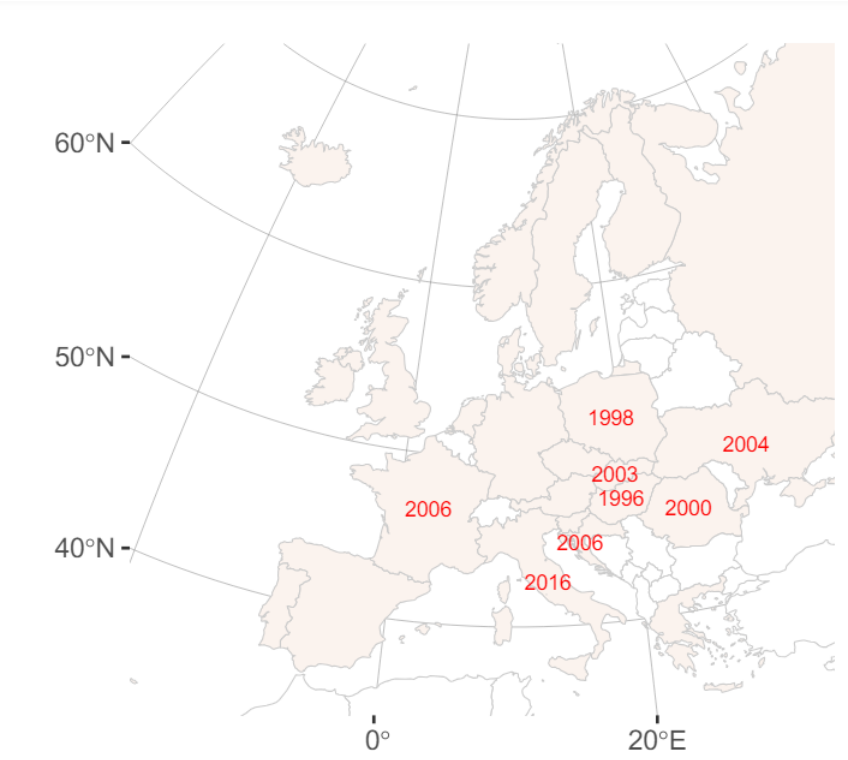
Ramalho, R., Jiang, N., Koltko, O., Chávez, É., Koch-Saldarriaga, K. A., and Quesada Gamez, M. A. (2018). Improving access to finance for smes: opportunities through credit reporting, secured lending, and insolvency practices. Technical report, The World Bank.

Roberts, M. R. (2015). The role of dynamic renegotiation and asymmetric information in financial contracting. *Journal of Financial Economics*, 116(1):61–81.

Sufi, A. (2007). Information asymmetry and financing arrangements: Evidence from syndicated loans. *The Journal of Finance*, 62(2):629–668.

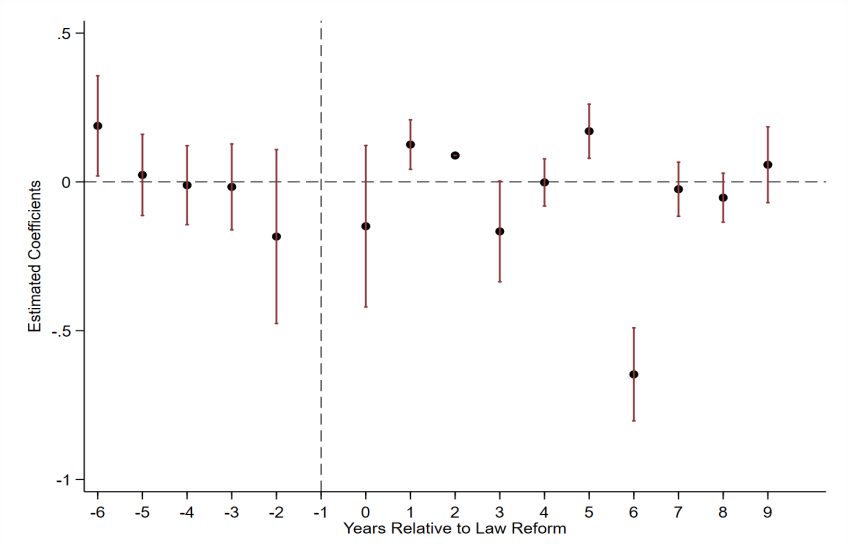
Weitzner, G. and Howes, C. (2023). Bank information production over the business cycle. *Available at SSRN 3934049*.

Figure 1: Map of Sample Countries



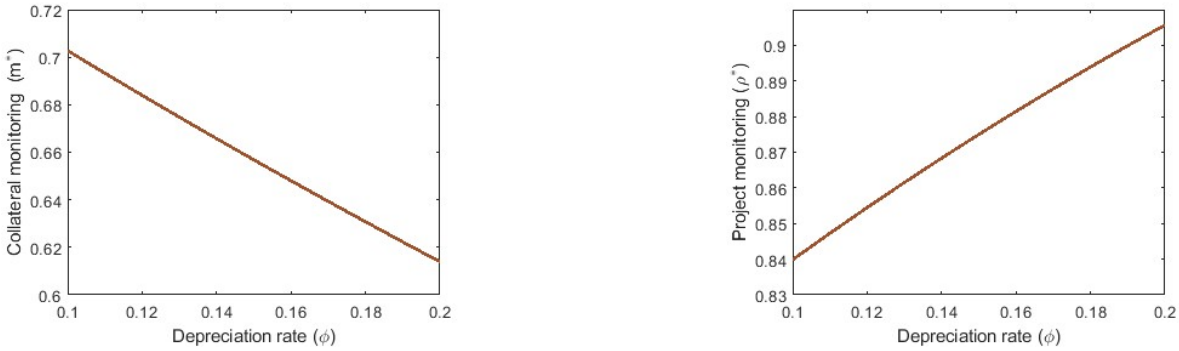
Notes: This figure shows countries included in the sample. The pink-shaded areas represent all sample countries. Countries with numbers have reformed secured transaction laws, with the numbers indicating the years in which the laws entered into force. For more details, see Table A1 and A2.

Figure 2: The Dynamic Effects of Legal Reform on Bank Monitoring



Notes: This figure presents the dynamics treatment effects of the law reform on bank monitoring estimated using Eq(4).

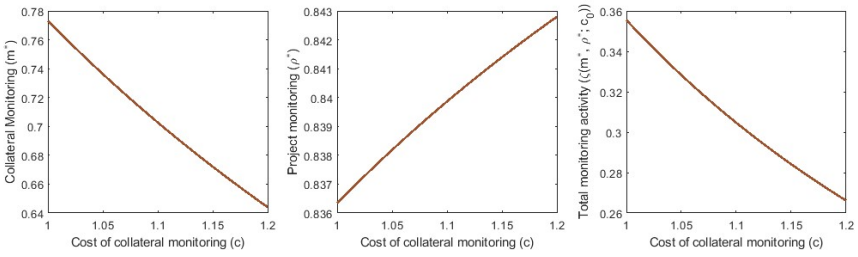
Figure 3: Numerical Illustration: Depreciation Rates and Monitoring



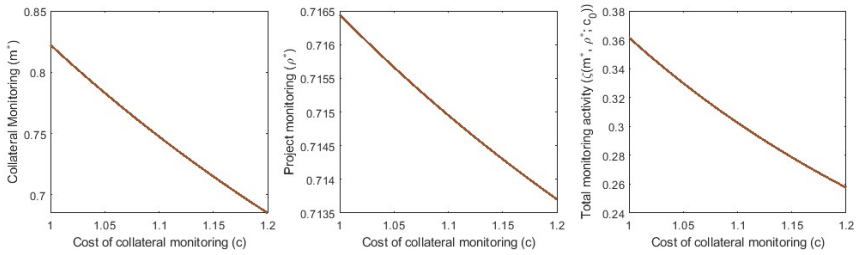
(a) ϕ and m (b) ϕ and ρ

Notes: Figure 3a plots the impacts of the depreciation rates on collateral monitoring. Figure 3b plots the impacts of the depreciation rates on project monitoring. Parameter values: $k = 1$, $p = 0.15$, $R_B = 2.5$, $\bar{v}_0 = 1$, and $c = 1.1$. Notice that Assumption 1 is satisfied under the parameter values.

Figure 4: Numerical Illustration: Monitoring Types



(a) Substitutability

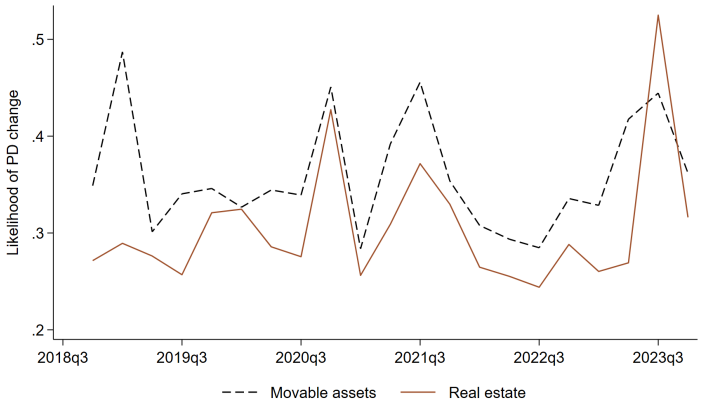


(b) Complementarity

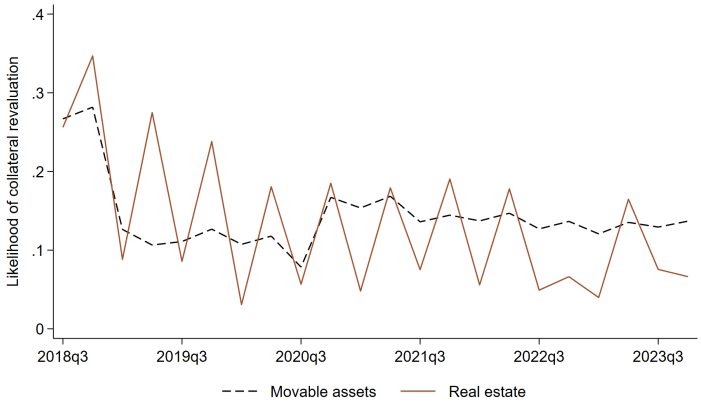
Notes: Figure 4a plots the impacts of the cost of monitoring collateral on monitoring activities for $\phi < p$. Parameter values: $k = 1$, $p = 0.15$, $\phi = 0.1$, $R_B = 2.5$, $\bar{v}_0 = 1$, and $c = 1$. Figure 4b plots the impacts of the cost of monitoring collateral on monitoring activities for $\phi > p$. Parameter values: $k = 1$, $p = 0.08$, $\phi = 0.1$, $R_B = 2.5$, $\bar{v}_0 = 1$, and $c = 1$. Notice that Assumption 1 is satisfied under the parameter values.

Figure 5: Bank Monitoring

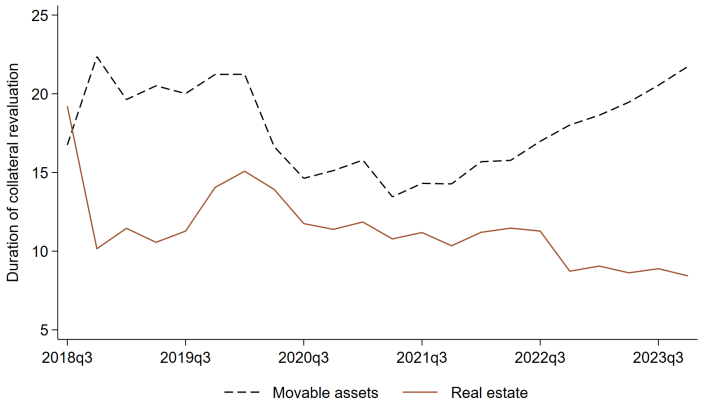
(a) Project Monitoring: Likelihood of PD Change



(b) Collateral Monitoring: Likelihood of Revaluation



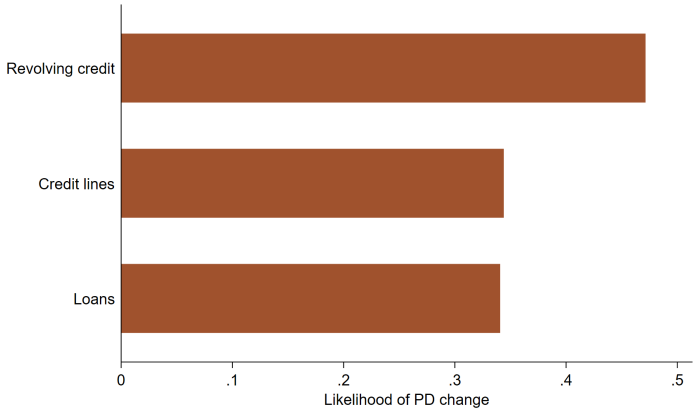
(c) Collateral Monitoring: Duration of Revaluation



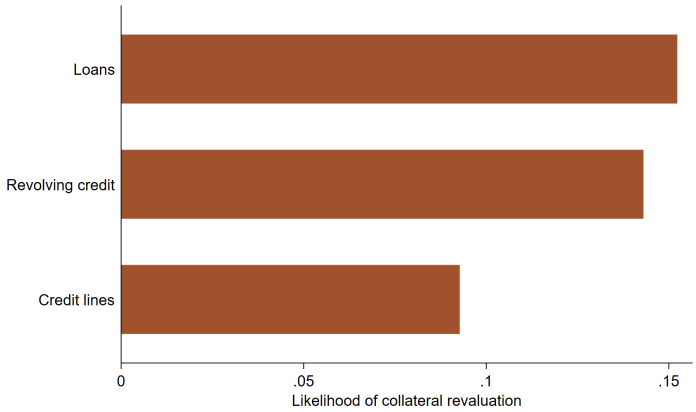
Notes: This figure plots the time-series of bank monitoring activities. Panel 5a shows the likelihood of PD change across firm size. Panel 5b shows the likelihood of collateral revaluation. Panel 5c shows the number of months between latest valuation and reference time.

Figure 6: Bank Monitoring and Loan Types

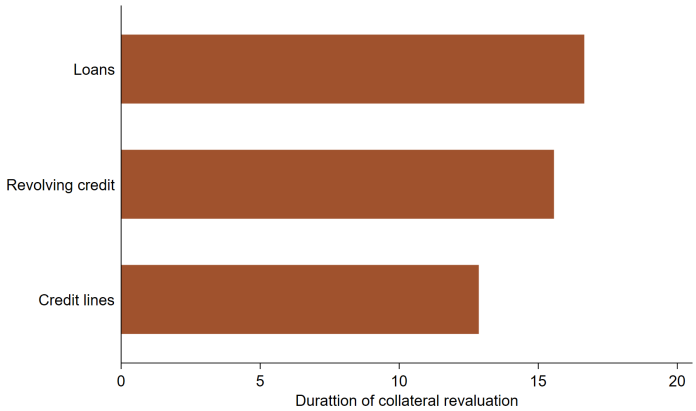
(a) Project Monitoring: Likelihood of PD Change



(b) Collateral Monitoring: Likelihood of Revaluation



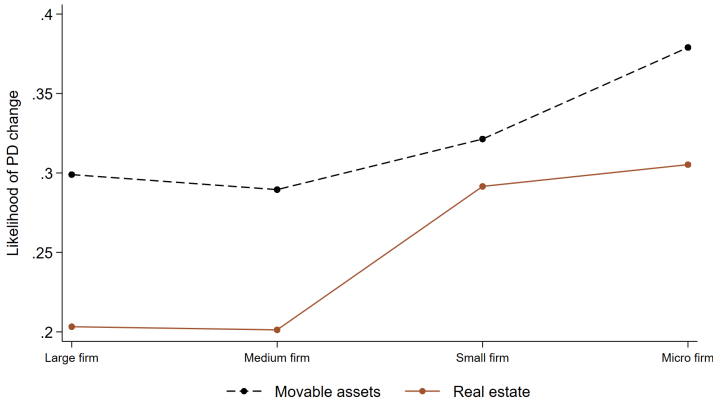
(c) Collateral Monitoring: Duration of Revaluation



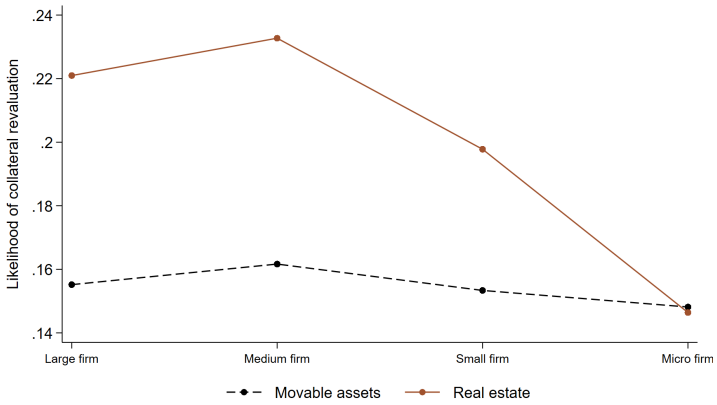
Notes: This figure plots the distribution of monitoring activities across loan types. Panel 6a shows the likelihood of PD change across firm size. Panel 6b shows the likelihood of collateral revaluation. Panel 6c shows the number of months between latest valuation and reference time.

Figure 7: Bank Monitoring and Firm Size

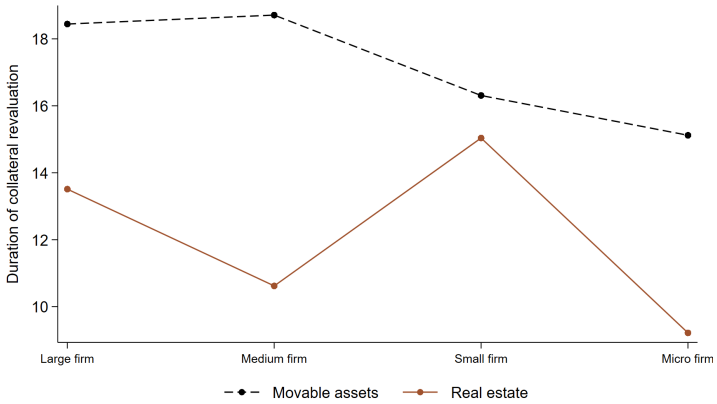
(a) Project Monitoring: Likelihood of PD Change



(b) Collateral Monitoring: Likelihood of Revaluation



(c) Collateral Monitoring: Duration of Revaluation



Notes: This figure plots the distribution of monitoring activities across firm size. Panel 7a shows the likelihood of PD change across firm size. Panel 7b shows the likelihood of collateral revaluation. Panel 7c shows the number of months between latest valuation and reference time.

Table 1: Summary Statistics Syndicated Loans

Variable	#Obs	Mean	Sd	Min	Median	Max
Panel A: Facility Level						
Sum lead arranger share	1974	0.657	0.350	0.000	0.750	1
Reform	1910	0.110	0.313	0	0	1
Treated	1974	0.418	0.493	0	0	1
ln(Facility maturity)	1886	4.240	0.596	1.258	4.277	6.244
ln(Facility amount)	1966	18.724	1.389	12.899	18.731	22.812
ln(AISD)	1366	5.471	0.625	1.099	5.521	7.090
Firm size	1961	19.845	2.171	15.465	19.716	27.452
Debt ratio	1961	0.324	0.218	0.000	0.290	0.847
PPE	1961	0.302	0.236	0.004	0.246	0.912
Current ratio	1961	0.347	0.194	0.040	0.314	0.894
Panel B: Loan Level						
Lead arranger share	14656	0.135	0.143	0.000	0.084	1
Reform	13900	0.116	0.321	0	0	1
Treated	14705	0.364	0.481	0	0	1
ln(Facility maturity)	14365	4.237	0.578	1.258	4.277	6.244
ln(Facility amount)	14656	5.409	1.375	-0.916	5.502	8.997
ln(AIDS)	11196	5.374	0.626	1.099	5.416	7.090
Firm size	14556	8.847	2.171	4.689	8.670	15.939
Debt ratio	14556	0.330	0.215	0.000	0.309	0.822
PPE	14556	0.299	0.228	0.007	0.240	0.912
Current ratio	14556	0.328	0.184	0.045	0.294	0.864

Notes: This table presents descriptive statistics. Panel A reports the statistics for the main variables at the facility level. Panel B reports the statistics for the main variables at the loan level.

Table 2: Timing of Law Reform - Hazard Model

	(1)	(2)	(3)	(4)	(5)	(6)
Avg_$\mathbb{1}$(Lead)	1.032		1.101	1.004	0.759	
	(0.996)		(0.693)	(0.662)	(1.004)	
Avg_Lead share		2.182	0.307	0.482		-0.119
		(1.465)	(0.302)	(0.478)		(0.759)
Firm size				0.444		
				(0.684)		
Debt ratio				-0.166		
				(0.138)		
PPE				0.313***		
				(0.072)		
Current ratio				-0.017		
				(0.203)		
Capex				-0.324*		
				(0.166)		
CEQ				-0.203		
				(0.138)		
Domestic credit to private sector (% GDP)					0.024	0.020
					(0.022)	(0.012)
GDP per capita growth					-0.091	-0.139***
					(0.092)	(0.029)
Export to GDP					0.139	0.071
					(0.172)	(0.077)
Import to GDP					-0.043	-0.012
					(0.278)	(0.102)
Inflation GDP deflator					0.104	0.434**
					(0.132)	(0.199)
Ln(population)					-1.070	-0.517
					(1.662)	(0.456)
Population growth					-0.404	-0.256
					(1.485)	(0.688)
N	337	229	229	226	277	196

Notes: This table presents the results of whether the pre-existing country-level degree of bank monitoring predicts the timing in which a country adopts the secured transaction laws estimating the specification:

$$\mathbb{1}(\text{Reform})_{c,t} = \phi(\boldsymbol{\delta}'\mathbf{M}_{c,t} + \boldsymbol{\zeta}'\mathbf{F}_{c,t} + \boldsymbol{\pi}'\mathbf{C}_{c,t}).$$

It follows Beck et al. (2010) and estimates a hazard model with a Weibull distribution of the hazard rate. The sample period is 1995-2017. The reformed countries include Croatia, France, Hungary, Italy, Poland, Romania, and Slovakia. The dependent variable is the natural logarithm of the expected time to the law change. $Avg_\mathbb{1}(Lead)_{c,t}$ is the average probability of being a lead in country c in year t. $(Avg_Lead\ share)_{c,t}$ is the average share of a lead in country c in year t. The analysis is at the country-year level. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Legal Reform and Bank Monitoring - Baseline

	Sum lead arranger share					
	(1)	(2)	(3)	(4)	(5)	(6)
Reform × Treated	-0.091	-0.317***	-0.106**	-0.445***	-0.128***	-0.512***
	(0.054)	(0.011)	(0.044)	(0.019)	(0.039)	(0.046)
ln(Facility maturity)			-0.005	-0.010	-0.002	-0.009
			(0.035)	(0.027)	(0.035)	(0.027)
ln(Facility amount)			-0.014	0.005	-0.008	0.004
			(0.010)	(0.006)	(0.009)	(0.008)
ln(AIDS)			0.016	0.015	0.014	0.002
			(0.020)	(0.023)	(0.019)	(0.028)
Firm size					-0.009	0.032
					(0.014)	(0.044)
Debt ratio					0.129**	0.381
					(0.059)	(0.471)
PPE					0.072	-0.032
					(0.053)	(0.169)
Current ratio					0.333***	0.186
					(0.070)	(0.274)
Facility type FE	✓	✓	✓	✓	✓	✓
Package purpose FE	✓	✓	✓	✓	✓	✓
Firm FE		✓		✓		✓
Sector FE	✓		✓		✓	
Firm country-Year FE	✓	✓	✓	✓	✓	✓
N	1,860	1,732	1,253	1,161	1,241	1,149
Adjusted R^2	0.493	0.756	0.577	0.831	0.592	0.834

Notes: This table presents the estimation results of the specification:

$$\text{Y}_{f,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,i,t},$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the sum of lead arranger share of a syndicate. *Treated*$_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. *Reform*$_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Legal Reform and Bank Monitoring - Limited Sample

	Sum lead arranger share					
	(1)	(2)	(3)	(4)	(5)	(6)
Reform × Treated	-0.223***	-0.813***	-0.300*	-0.819***	-0.387*	-0.979***
	(0.072)	(0.178)	(0.157)	(0.173)	(0.185)	(0.169)
ln(Facility maturity)			-0.001	-0.006	-0.007	0.008
			(0.029)	(0.015)	(0.034)	(0.014)
ln(Facility amount)			-0.014	0.009*	0.006	0.009*
			(0.028)	(0.005)	(0.022)	(0.004)
ln(AIDS)			0.023	0.054**	0.046	0.039**
			(0.036)	(0.022)	(0.033)	(0.016)
Firm size					-0.030	0.055
					(0.025)	(0.186)
Debt ratio					0.126	0.439
					(0.127)	(0.323)
PPE					0.233	-2.329**
					(0.300)	(0.954)
Current ratio					0.378	-0.109
					(0.223)	(0.739)
Facility type FE	✓	✓	✓	✓	✓	✓
Package purpose FE	✓	✓	✓	✓	✓	✓
Firm FE		✓		✓		✓
Sector FE	✓		✓		✓	
Firm country*Year FE	✓	✓	✓	✓	✓	✓
N	1,007	935	646	605	636	593
Adjusted R^2	0.553	0.795	0.633	0.857	0.657	0.870

Notes: This table presents the estimation results of the specification:

$$\mathrm{Y}_{f,i,t} = \beta \mathrm{Reform}_{c,t} \times \mathrm{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \mathrm{FE} + \varepsilon_{f,i,t},$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. The sample only include secured loans and firms that only have secured loans in the sample period. The dependent variable is the sum of lead arranger share of a syndicate. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Legal Reform and Bank Monitoring - Loan Level

	Lead arranger share			
	(1)	(2)	(3)	(4)
Reform × Treated	-0.364***	-0.357***	-0.440***	-0.468***
	(0.041)	(0.061)	(0.049)	(0.050)
ln(Facility maturity)	-0.009**	-0.008**	-0.005	-0.005
	(0.004)	(0.004)	(0.004)	(0.003)
ln(Facility amount)	-0.008	-0.008	-0.010	-0.008
	(0.010)	(0.007)	(0.007)	(0.005)
ln(AIDS)	0.007	0.006	0.024*	0.023**
	(0.010)	(0.009)	(0.012)	(0.009)
Firm size		-0.001		0.009
		(0.036)		(0.025)
Debt ratio		0.051		0.289**
		(0.196)		(0.127)
PPE		0.341		0.360***
		(0.295)		(0.090)
Current ratio		0.118		0.359*
		(0.391)		(0.204)
Loan type FE	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓
Lender FE	✓		✓	
Lender-Time FE		✓		✓
N	4,559	4,496	4,328	4,263
Adjusted R^2	0.862	0.874	0.903	0.910

Notes: This table presents the estimation results of the specification:

$$Y_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t},$$

where f,b, i, c, and t denote firm, bank, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the share a lead arranger contributes to a syndicate. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Summary Statistics Corporate Secured Loans

	#Obs	SD	Mean	Min	P25	P50	P75	Max
Panel A: Variables								
Commit amount	10,471,736	0.457	0.247	0	0.050	0.113	0.250	4
Outstanding amount	10,612,031	0.365	0.184	0.001	0.035	0.077	0.180	3.273
Interest rate	9846935	1.081	1.499	0.023	0.750	1.239	1.900	5.510
Maturity	10,603,352	68.284	113.217	7	62	85	180	301
Collateral value	10,511,759	2.913	0.208	0	0	0.050	0.156	1887
PD	10,411,723	0.127	0.054	0	0.004	0.010	0.034	1
Panel B: Monitoring Measures								
$\mathbb{1}$(Revaluation)	10,669,296	0.341	0.134	0	0	0	0	1
Revaluation duration	10,133,756	24.418	15.446	0	3	7	15	156
$\mathbb{1}$(PD change)	9,099,794	0.475	0.344	0	0	0	1	1

Notes: This table presents descriptive statistics of French corporate secured loans. Variables are winsorized at 0.5th and 99.5th percentiles. Table B1 reports variable definitions. Commitment amounts and Outstanding amounts, Collateral value are in million EUR. Revaluation duration is in months

Table 7: Project Monitoring and Collateral

	PD change			
	(1)	(2)	(3)	(4)
RE	-0.0186***	-0.0192***	-0.0121*	-0.0148**
	(0.0051)	(0.0047)	(0.0067)	(0.0073)
Maturity	-0.0000	-0.0001*	-0.0001**	-0.0001**
	(0.0001)	(0.0000)	(0.0000)	(0.0000)
ln(Collateral value)	0.0001	0.0009	-0.0002	-0.0003
	(0.0012)	(0.0012)	(0.0013)	(0.0013)
ln(ONA)	-0.0001	-0.0026	-0.0010	-0.0004
	(0.0022)	(0.0020)	(0.0022)	(0.0022)
Loan rate	-0.0013	-0.0049*	-0.0035	-0.0048
	(0.0033)	(0.0028)	(0.0032)	(0.0035)
Loan type FE	✓			
Loan purpose FE				✓
Firm-Time FE	✓			
Firm-Time-Loan type FE		✓	✓	✓
Bank FE	✓	✓		
Bank-Time FE			✓	✓
N	323,410	180,075	179,862	179,862
Adjusted R^2	0.2151	0.3017	0.3548	0.3549

Notes: This table presents the estimation results of the specification:

$$\text{Monitoring}_{f,b,i,t} = \beta \text{Real estate}_i + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \theta_{f,c,t} + \mu_{b,t} + \varepsilon_{f,b,i,t},$$

where f, b, i, c, and t denote firm, bank, loan, loan type, and time, respectively, $\text{Monitoring}_{f,b,i,t}$ represents the project monitoring at time t for loan i issued by bank b to firm f, corresponding to ρ in the model. It is a dummy variable taking value of one if a bank modify the PD of a firm in time t, zero otherwise. Real estate_i is an indicator variable equal to one if a loan is secured by real estate, and zero otherwise. It corresponds to ϕ in the model. $\mathbf{Z}_{i,t}$ denotes a set of loan-level controls, including collateral value, outstanding amounts, loan maturity, and interest rates. $\theta_{f,c,t}$ represents firm-time-loan type fixed effects. $\mu_{b,t}$ is the bank-time fixed effects. Robust standard errors clustered at the sector level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Collateral Monitoring and Collateral

	Revaluation			**Revaluation duration**		
	(1)	(2)	(3)	(4)	(5)	(6)
RE	0.0338***	0.0168**	0.0125*	-0.5485***	-0.5559***	-0.5944***
	(0.0094)	(0.0076)	(0.0068)	(0.1048)	(0.0991)	(0.1079)
Maturity	-0.0001	-0.0001	-0.0001	0.0014	0.0014	0.0010
	(0.0001)	(0.0001)	(0.0001)	(0.0009)	(0.0009)	(0.0008)
ln(Collateral value)	-0.0138*	-0.0174**	-0.0176**	-0.0174	-0.0184	-0.0171
	(0.0071)	(0.0073)	(0.0073)	(0.0110)	(0.0112)	(0.0115)
ln(ONA)	0.0083	0.0131**	0.0152**	-0.1840***	-0.1688***	-0.1669***
	(0.0059)	(0.0060)	(0.0058)	(0.0288)	(0.0251)	(0.0242)
Loan rate	0.0126***	0.0113***	0.0065***	0.0027	-0.0002	-0.0063
	(0.0022)	(0.0021)	(0.0023)	(0.0286)	(0.0292)	(0.0282)
Loan purpose FE			✓			✓
Firm-Time-Loan type FE	✓	✓	✓	✓	✓	✓
Bank FE	✓			✓		
Bank-Time FE		✓	✓		✓	✓
N	242,411	241,925	241,925	128,682	128,317	128,317
Adjusted R^2	0.5313	0.6258	0.6313	0.4231	0.4649	0.4722

Notes: This table presents the estimation results of the specification:

$$\text{Monitoring}_{f,b,i,t} = \beta\text{Real estate}_i + \boldsymbol{\gamma}'\mathbf{Z}_{i,t} + \theta_{f,c,t} + \mu_{b,t} + \varepsilon_{f,b,i,t},$$

where f, b, i, c, and t denote firm, bank, loan, loan type, and time, respectively, $\text{Monitoring}_{f,b,i,t}$ represents the project monitoring at time t for loan i issued by bank b to firm f, corresponding to m in the model. In Columns (1)-(3), it is a dummy variable taking value of one if a bank revalue the collateral of a loan in time t, zero otherwise. In Columns (4)-(6), it is the natural logarithm of the duration between latest valuation date and the reference quarter. Real estate_i is an indicator variable equal to one if a loan is secured by real estate, and zero otherwise. It corresponds to ϕ in the model. $\mathbf{Z}_{i,t}$ denotes a set of loan-level controls, including collateral value, outstanding amounts, loan maturity, and interest rates. $\theta_{f,c,t}$ represents firm-time-loan type fixed effects. $\mu_{b,t}$ is the bank-time fixed effects. Robust standard errors clustered at the sector level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 9: Monitoring Types: Alternative

	PD change		**Revaluation**		**Revaluation duration**	
	(1)	(2)	(3)	(4)	(5)	(6)
RE	-0.0238***	-0.0182***	-0.0090	-0.0022	-0.3440***	-0.2585***
	(0.0030)	(0.0042)	(0.0110)	(0.0067)	(0.0359)	(0.0775)
Maturity	-0.0003***	-0.0001*	-0.0002***	-0.0000	0.0018***	0.0018**
	(0.0001)	(0.0000)	(0.0000)	(0.0001)	(0.0005)	(0.0008)
ln(Collateral value)	-0.0121***	0.0003	-0.0116	-0.0171***	0.0551**	0.0700***
	(0.0028)	(0.0011)	(0.0071)	(0.0064)	(0.0260)	(0.0216)
ln(ONA)	-0.0035	0.0007	0.0156***	0.0134***	-0.1047***	-0.1993***
	(0.0056)	(0.0014)	(0.0044)	(0.0050)	(0.0221)	(0.0238)
Loan rate	0.0029	-0.0005	0.0109***	0.0119***	0.0135	-0.0157*
	(0.0055)	(0.0041)	(0.0027)	(0.0021)	(0.0288)	(0.0088)
Firm-Time FE	✓	✓	✓	✓	✓	✓
Bank FE	✓		✓		✓	
Bank-Time FE		✓		✓		✓
N	6,424,022	324,547	7,201,091	446,005	6,733,559	370,403
Adjusted R^2	0.1298	0.2790	0.4656	0.6664	0.4023	0.5675

Notes: This table presents the estimation results of the specification:

$$\text{Monitoring}_{f,b,t} = \beta\text{Real estate}_f + \boldsymbol{\gamma}'\mathbf{Z}_{f,b,t} + \theta_{f,t} + \mu_{b,t} + \varepsilon_{f,b,t},$$

where f, b, and t denote firm, bank, and time, respectively, $\text{Monitoring}_{f,b,t}$ represents average the monitoring outcome at time t for loans issued by bank b to firm f. In Columns (1)-(2), it is a dummy variable taking value of one if a bank modify PD of a firm in time t, zero otherwise, corresponding to ρ in the model. In Columns (3)-(4), it is a dummy variable taking value of one if a bank revalue the collateral of a loan in time t, zero otherwise. In Columns (5)-(6), it is the natural logarithm of the duration between latest valuation date and the reference quarter. Real estate_f is an indicator variable equal to one if a loan is secured by real estate, and zero otherwise. It corresponds to ϕ in the model. $\mathbf{Z}_{f,b,t}$ denotes a set of controls, including collateral value, outstanding amounts, loan maturity, and interest rates. $\theta_{f,t}$ represents firm-time fixed effects. $\mu_{b,t}$ is the bank-time fixed effects. Robust standard errors clustered at the sector level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 10: Monitoring Types: Complementarity or Substitutability

	PD change			
	(1)	(2)	(3)	(4)
	ϕ high p low	ϕ high p low	ϕ low p high	ϕ low p high
Revaluation	0.0467***		-0.0249***	
	(0.0095)		(0.0056)	
Revaluation duration		-0.0259***		-0.0007
		(0.0026)		(0.0040)
Maturity	-0.0005***	-0.0005***	0.0003***	0.0003***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ln(Collateral value)	0.0000	0.0018	0.0054***	0.0045***
	(0.0052)	(0.0047)	(0.0009)	(0.0008)
ln(ONA)	-0.0172***	-0.0172***	-0.0040	-0.0022
	(0.0063)	(0.0062)	(0.0031)	(0.0025)
Loan rate	0.0051	0.0152***	-0.0042*	-0.0049***
	(0.0031)	(0.0028)	(0.0022)	(0.0018)
N	393,346	354,923	409,124	399,243
Adjusted R^2	0.0081	0.0130	0.0018	0.0015

Notes: This table presents the estimation results of the specification:

$$\text{Project Monitoring}_{f,b,t} = \beta \text{Collateral Monitoring}_{f,b,t} + \boldsymbol{\gamma}' \mathbf{Z}_{f,b,t} + \varepsilon_{f,b,t},$$

where f, b, and t denote firm, bank, and time, respectively, $\text{Project Monitoring}_{f,b,t}$ is a dummy variable taking value of one if a bank modify PD of a firm in time t, zero otherwise, corresponding to ρ in the model. The main explanatory variables are (i) Revaluation, which is a dummy variable taking value of one if a bank revalue the collateral of a loan in time t, zero otherwise, and (ii) Revaluation duration, it is the natural logarithm of the duration between latest valuation date and the reference quarter. Robust standard errors clustered at the sector level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendices

A Details on Secured Transaction Law Reforms

Table A1: Overview of Secured Transaction Law in Sample Countries

Panel A: Reformed countries			
Country	Law	Type of Security	Perfection
Croatia	Law on the Registry of Court and Public-Notary Security Interests on Movables and Rights in 2006	Nonpossessory pledge	Registration
France	Ordinance no 2006-346	Nonpossessory pledge	Registration
Hungary	Act XXXVI of 1996		Registration
Italy	Decree n59 of 3 May 2016	Nonpossessory pledge	Registration
Poland	The Law of 6 December 1996 on the Registered Pledge and the Pledge Registry	Nonpossessory pledge	Registration
Romania	Law No. 99 of 26 May 1999	Movable mortgage	Registration
Slovakia	Act No.526/2002 Coll	Nonpossessory security interests (Unspecified)	Registration
Ukraine	Law on Securing Creditors' Claims and Registration of Encumbrances	Nonpossessory pledge	Registration

Panel B: Unreformed countries		
Country	Type of security	Perfection
Austria	Transfer of title	Symbolic delivery
Czech Republic	Nonpossessory pledge, Transfer of title	Registration
Denmark	Chattel mortgage, Floating lien	Registration
Finland	Floating charge	Registration
Germany	Transfer of title	Precise description of the assets
Greece	Nonpossessory pledge, Floating charge	Registration
Iceland	Hypothecation	Registration
Ireland	Floating charge	Registration
Netherlands	Mortgage, Nonpossessory pledge	Registration
Norway	Floating charge	Registration
Portugal	Mortgage	registration
Russia	Nonpossessory pledge	Registration
Slovenia	Unknown	Registration
Spain	Chattel mortgages, Nonpossessory pledge	Registration
Sweden	Floating charge	Registration
United Kingdom	Fixed charge, Floating charge	Registration

Notes: This table summarizes the security interests over movable property in sample countries. The information is from multiple sources, including the Secured Transactions Law Reform Project, Thomson Reuters Practical Law, and other academic publications.

Table A2: Overview of the Syndicated Loan Sample

Country	Reformed year	#Obs	%Obs
Austria	Unreformed	36	0.24
Croatia	2006	4	0.03
Denmark	Unreformed	171	1.16
Finland	Unreformed	50	0.34
France	2006	2,854	19.41
Germany	Unreformed	1,789	12.17
Greece	Unreformed	61	0.41
Hungary	1996	10	0.07
Iceland	Unreformed	17	0.12
Ireland	Unreformed	299	2.03
Italy	2016	927	6.30
Netherlands	Unreformed	1,066	7.25
Norway	Unreformed	522	3.55
Poland	1998	175	1.19
Portugal	Unreformed	140	0.95
Romania	2000	2	0.01
Russian	Unreformed	1,352	9.19
Slovakia	2003	8	0.05
Spain	Unreformed	1,879	12.78
Sweden	Unreformed	663	4.51
United Kingdom	Unreformed	2,680	18.23
Total		14,705	100.00

B Variable Definition

Table B1: Variable Definitions

Variable	Definition	Source
Dependent variables		
Sum of lead arranger share(%)	The sum of lead arranger share of a syndicate.	Own calculation
Lead arranger share(%)	The share of the loan a lead arranger contributes.	Own calculation
Explanatory variables		
Reform	A dummy variable that equals one if a firm in a country c (as recorded in Compustat) reformed the secured transaction law in year t, zero otherwise. The time window is [-10,10] around the reform year for reformed countries.	DealScan
Treated	A dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data (Compustat variables: ppenme and invt) between 1983 and 1994.	Compustat
Loan characteristics		
Loan type	I include two types of loans: term loans and revolvers.	DealScan
Loan purpose	Primary purpose of the deal.	DealScan
Loan maturity	Calculated as the natural logarithm of loan maturity in months.	DealScan
Loan amount	Natural logarithm of facility amount.	DealScan
Loan spread	Natural logarithm of AIDS.	DealScan
Firm characteristics		
Size	Natural logarithm of total assets.	Compustat
Debt ratio	Long-term debt/Total assets.	Compustat
Current ratio	Current assets/Total assets.	Compustat
Tangibility	Net fixed assets/Total assets.	Compustat
Employment	Natural logarithm of number of employees.	Compustat
Net sales	Net sale/Total assets.	Compustat
Capital expenditure	Capital expenditure/Total assets.	Compustat
Macro variables		
GDP per capita growth	Annual growth rate of GDP per capita for a country. GDP per capita is calculated as gross local product divided by midyear population.	World Bank
Export to GDP	The percentage of exports of goods and services to GDP.	World Bank
Import to GDP	The percentage of imports of goods and services to GDP.	World Bank
Inflation GDP deflator	Inflation measured by the annual growth rate of the GDP	World Bank
Ln(population)	Natural logarithm of the total population of a country.	World Bank
Population growth	Annual growth rate from year $t-1$ to t,	World Bank
Domestic credit to private sector	The percentage of amounts of credit provided to private sectors to GDP.	World Bank
Variables from Credit Registry		
Commit amount	The commitment amounts (million) of a loan issued by a bank to a firm.	AnaCredit

Outstanding amount	The outstanding amounts (million) in a quarter of a loan issued by a bank to a firm.	AnaCredit
Interest rate	Annualised interest rate of a loan.	AnaCredit
Maturity	The number of months between the loan settlement date and maturity date.	AnaCredit
Real estate	A dummy variable that equals one if a loan is secured by real estate, and zero otherwise.	AnaCredit
Collateral value	The latest collateral value (million) reported by a bank.	AnaCredit
PD	One-year-ahead probability of default as estimated by banks	AnaCredit
$\mathbb{1}$(Revaluation)	A dummy variable that equals one if the collateral of a loan is revalued in a quarter, and zero otherwise.	Own calculation
Revaluation duration	Natural logarithm of the number of months between latest valuation date and reference quarter.	Own calculation
PD change	A dummy variable that equals one if a bank modify the PD of a firm in a quarter, and zero otherwise.	Own calculation

C Additional Results

Table C1: Legal Reform and Bank Monitoring: Facility Level Loan Types

	Sum lead arranger share		
	(1)	(2)	(3)
Reform × Treated	-0.300***	-0.494***	-0.566***
	(0.023)	(0.025)	(0.053)
Term loans	-0.004	-0.008	-0.001
	(0.013)	(0.017)	(0.022)
Reform × Term loans	0.001	0.004	-0.002
	(0.014)	(0.011)	(0.013)
Treated × Term loans	0.036*	0.028	0.023
	(0.018)	(0.019)	(0.022)
Reform × Treated × Term loans	-0.024	0.069***	0.076***
	(0.021)	(0.020)	(0.020)
ln(Facility maturity)		-0.009	-0.008
		(0.026)	(0.026)
ln(Facility amount)		0.006	0.005
		(0.006)	(0.008)
ln(AIDS)		0.013	0.000
		(0.024)	(0.029)
Firm size			0.032
			(0.045)
Debt ratio			0.374
			(0.477)
PPE			-0.037
			(0.167)
Current ratio			0.184
			(0.274)
Loan purpose FE	✓	✓	✓
Country-Time FE	✓	✓	✓
Firm FE	✓	✓	✓
N	1,732	1,161	1,149
Adjusted R^2	0.756	0.832	0.834

Notes: This table presents the estimation results of the specification:

$$Y_{f,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f \times H_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,i,t},$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. The sample only include secured loans and firms that only have secured loans in the sample period. The dependent variable is the sum of lead arranger share of a syndicate. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. H_f is a dummy variable that equals one if a loan is a term loan, zero otherwise. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C2: Legal Reform and Bank Monitoring: Facility Level Loan Purpose

	Sum lead arranger share		
	(1)	(2)	(3)
Reform × Treated	-0.323***	-0.461***	-0.536***
	(0.002)	(0.011)	(0.056)
Real purpose	-0.014	-0.135***	-0.141***
	(0.026)	(0.039)	(0.046)
Reform × Real purpose	-0.033	-0.073	-0.087
	(0.022)	(0.048)	(0.066)
Treated × Real purpose	-0.090***	0.029	0.047
	(0.028)	(0.093)	(0.082)
Reform × Treated× Real purpose	-0.036	-0.058	-0.060
	(0.026)	(0.101)	(0.100)
ln(Facility maturity)		-0.058*	-0.057*
		(0.030)	(0.027)
ln(Facility amount)		0.016	0.014
		(0.013)	(0.013)
ln(AIDS)		0.048*	0.035
		(0.024)	(0.034)
Firm size			0.046
			(0.044)
Debt ratio			0.449
			(0.478)
PPE			0.029
			(0.207)
Current ratio			0.150
			(0.298)
Loan type FE	✓	✓	✓
Country-Time FE	✓	✓	✓
Firm FE	✓	✓	✓
N	1,732	1,161	1,149
Adjusted R^2	0.729	0.796	0.801

Notes: This table presents the estimation results of the specification:

$$\mathrm{Y}_{f,i,t} = \beta \mathrm{Reform}_{c,t} \times \mathrm{Treated}_f \times \mathrm{H}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \mathrm{FE} + \varepsilon_{f,i,t},$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. The sample only include secured loans and firms that only have secured loans in the sample period. The dependent variable is the sum of lead arranger share of a syndicate. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. H_f is a dummy variable that equals one if a loan is for real purpose, zero otherwise. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C3: Legal Reform and Bank Monitoring: Facility Level Firm Heterogeneity

	Sum lead arranger share		
	(1)	(2)	(3)
Reform × Treated	-0.710***	-1.325***	-0.777***
	(0.169)	(0.171)	(0.144)
CHE	-0.001		
	(0.015)		
Reform × CHE	0.083***		
	(0.026)		
Treated × CHE	0.037		
	(0.049)		
Reform × Treated×CHE	-0.136**		
	(0.061)		
Inventory		0.096***	
		(0.031)	
Reform × Inventory		0.187***	
		(0.040)	
Treated × Inventory		-0.284**	
		(0.109)	
Reform × Treated×Inventory		-0.276***	
		(0.072)	
Current assets			0.162
			(0.159)
Reform × Current assets			0.220**
			(0.086)
Treated × Current assets			-0.216
			(0.258)
Reform × Treated×Current assets			-0.377**
			(0.145)
ln(Facility maturity)	-0.000	-0.009	-0.000
	(0.027)	(0.031)	(0.027)
ln(Facility amount)	-0.003	-0.004	-0.002
	(0.008)	(0.007)	(0.008)
ln(AIDS)	0.015	0.007	0.009
	(0.024)	(0.017)	(0.021)
Loan type FE	✓	✓	✓
Loan purpose FE	✓	✓	✓
Firm FE	✓	✓	✓
Country-Time FE	✓	✓	✓
N	1,023	971	1,027
Adjusted R^2	0.839	0.850	0.841

Notes: This table presents the estimation results of the specification:

$$Y_{f,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f \times H_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,i,t},$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. The sample only include secured loans and firms that only have secured loans in the sample period. The dependent variable is the sum of lead arranger share of a syndicate. *Treated*$_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. *Reform*$_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. H_f is a variable capturing ex-ante firm characteristics. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C4: Legal Reforms and Syndicate Structure

	Syndicate concentration					
	(1)	(2)	(3)	(4)	(5)	(6)
Reform × Treated	-0.095	-0.195***	-0.097**	-0.299***	-0.117***	-0.337***
	(0.056)	(0.010)	(0.043)	(0.021)	(0.037)	(0.039)
ln(Facility maturity)			0.016	0.017	0.020	0.017
			(0.030)	(0.029)	(0.031)	(0.029)
ln(Facility amount)			-0.019	-0.001	-0.012	-0.001
			(0.012)	(0.005)	(0.010)	(0.006)
ln(AIDS)			0.013	-0.017	0.013	-0.026
			(0.023)	(0.024)	(0.020)	(0.026)
Firm size					-0.010	0.034
					(0.014)	(0.027)
Debt ratio					0.120	0.212
					(0.075)	(0.398)
PPE					0.066	-0.009
					(0.069)	(0.154)
Current ratio					0.346***	0.030
					(0.083)	(0.359)
Loan type FE	✓	✓	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓	✓	✓
Sector FE	✓		✓		✓	
Firm FE		✓		✓		✓
Country-Time FE	✓	✓	✓	✓	✓	✓
N	1,860	1,732	1,253	1,161	1,241	1,149
Adjusted R^2	0.493	0.770	0.568	0.841	0.587	0.842

Notes: This table presents the estimation results of the specification:

$$\mathrm{Y}_{f,i,t} = \beta \mathrm{Reform}_{c,t} \times \mathrm{Treated}_f + \boldsymbol{\mu}_{\prime} \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \mathrm{FE} + \varepsilon_{f,i,t},$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the ratio of the number of lead arranger scaled by the number of lenders of a syndicate. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C5: Legal Reform and Bank Monitoring - Country of Syndication

	Lead arranger share			
	(1)	(2)	(3)	(4)
Reform × Treated	-0.589***	-0.572***	-0.551***	-0.547***
	(0.073)	(0.048)	(0.072)	(0.047)
ln(Facility maturity)	-0.010*	-0.008*	-0.008*	-0.006*
	(0.005)	(0.004)	(0.004)	(0.004)
ln(Facility amount)	0.000	-0.003	-0.004	-0.006
	(0.008)	(0.010)	(0.008)	(0.010)
ln(AIDS)	0.018	0.025**	0.019	0.026**
	(0.010)	(0.010)	(0.012)	(0.012)
Firm size	-0.025	-0.054	-0.027	-0.029
	(0.056)	(0.039)	(0.048)	(0.030)
Debt ratio	0.978*	0.734*	0.567	0.312
	(0.546)	(0.411)	(0.461)	(0.251)
PPE	0.495**	0.366***	0.407	0.281***
	(0.213)	(0.056)	(0.251)	(0.077)
Current ratio	1.148	0.958**	0.987	0.963**
	(0.733)	(0.356)	(0.692)	(0.335)
Loan type FE	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓
Lender FE	✓		✓	
Lender-Time FE		✓		✓
N	3,426	3,212	3,796	3,570
Adjusted R^2	0.898	0.913	0.907	0.922

Notes: This table presents the estimation results of the specification:

$$Y_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t},$$

where f, b,i, c, and t denote firm, bank, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the lead arranger share. *Treated*$_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. In Columns (1)-(2) The sample only includes observations that the borrower country is the same as the country of syndication. In Columns (1) and (2), *Reform*$_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. In Columns (3) and (4), *Reform*$_{c,t}$ is a dummy variable that equals one if the "Country of syndication" c reformed the secured transaction law in year t, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table C6: Legal Reform and Bank Monitoring - Location

	Lead arranger share			
	(1)	(2)	(3)	(4)
Reform × Treated	-0.392***	-0.529***	-0.532***	-0.523***
	(0.059)	(0.046)	(0.044)	(0.043)
ln(Facility maturity)	-0.006**	-0.003	-0.008	-0.007
	(0.003)	(0.002)	(0.006)	(0.004)
ln(Facility amount)	-0.005	-0.003	-0.007	-0.004
	(0.007)	(0.005)	(0.011)	(0.011)
ln(AIDS)	0.001	0.018*	0.019	0.026
	(0.009)	(0.009)	(0.017)	(0.017)
Firm size	-0.008	-0.020	-0.006	-0.009
	(0.038)	(0.043)	(0.049)	(0.046)
Debt ratio	0.116	0.371***	0.252	0.445
	(0.221)	(0.122)	(0.239)	(0.285)
PPE	0.377	0.433***	0.320*	0.248
	(0.312)	(0.117)	(0.178)	(0.166)
Current ratio	0.192	0.474***	0.208	0.492
	(0.420)	(0.144)	(0.784)	(0.637)
Loan type FE	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓
Lender FE	✓		✓	
Lender-Time FE		✓		✓
N	3,941	3,748	3,503	3,287
Adjusted R^2	0.872	0.915	0.880	0.903

Notes: This table presents the estimation results of the specification:

$$Y_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t},$$

where f, b,i, c, and t denote firm, bank, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the lead arranger share. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. Columns (1)-(2) only include loans where lender operating country is the same as their parents. Columns (3)-(4) only include loans where firms country recorded in Compustat is the same as the one in DealScan. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

D Robustness Checks

Table D1: Legal Reform and Bank Monitoring - Facility Level Robustness

	Sum lead arranger share					
	(1)	(2)	(3)	(4)	(5)	(6)
	France			Firm level treat		
Reform × Treated	-0.327*	-0.443***	-0.587***	-0.232***	-0.374***	-0.378***
	(0.187)	(0.147)	(0.119)	(0.052)	(0.030)	(0.054)
ln(Facility maturity)		-0.114**	-0.099**		-0.008	-0.006
		(0.045)	(0.042)		(0.025)	(0.028)
ln(Facility amount)		0.003	0.003		0.008	0.008
		(0.009)	(0.009)		(0.007)	(0.008)
ln(AIDS)		-0.028	-0.029		-0.007	-0.013
		(0.036)	(0.032)		(0.022)	(0.023)
Firm size			-0.265*			-0.014
			(0.131)			(0.016)
Debt ratio			1.507**			0.067
			(0.612)			(0.307)
PPE			0.302			-0.088
			(0.221)			(0.141)
Current ratio			-0.935			0.224
			(0.994)			(0.255)
Loan type FE	✓	✓	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓	✓	✓
N	666	510	507	1,409	938	935
Adjusted R^2	0.816	0.873	0.900	0.753	0.823	0.821

Notes: This table presents the estimation results of the specification:

$$Y_{f,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,i,t},$$

where f, i, c, and t denote firm, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the lead arranger share. *Treated*$_f$ in Columns (1)-(3) is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. *Treated*$_f$ in Columns (2)-(6) is a dummy variable that equals one if the fixed assets ratio (fixed assets/total assets) of firm in 2005 is higher than the median value, zero otherwise. *Reform*$_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D3: Legal Reform and Bank Monitoring - Loan Level Robustness

	Lead arranger share			
	(1)	(2)	(3)	(4)
	No UK		Longer window	
Reform × Treated	-0.423***	-0.475***	-0.358***	-0.473***
	(0.076)	(0.060)	(0.061)	(0.048)
ln(Facility maturity)	-0.010**	-0.006	-0.008**	-0.005
	(0.004)	(0.003)	(0.004)	(0.003)
ln(Facility amount)	-0.003	-0.004	-0.009	-0.011*
	(0.006)	(0.005)	(0.007)	(0.006)
ln(AIDS)	0.003	0.018***	0.006	0.024**
	(0.008)	(0.005)	(0.009)	(0.009)
Firm size	0.005	0.017	0.002	0.023
	(0.060)	(0.045)	(0.036)	(0.026)
Debt ratio	0.452	0.622**	0.055	0.305**
	(0.429)	(0.264)	(0.198)	(0.128)
PPE	0.652**	0.388***	0.336	0.338***
	(0.232)	(0.096)	(0.297)	(0.095)
Current ratio	0.970*	1.123***	0.131	0.435**
	(0.513)	(0.218)	(0.393)	(0.200)
Loan type FE	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓
Lender FE	✓		✓	
Lender-Time FE		✓		✓
N	3,591	3,382	4,602	4,362
Adjusted R^2	0.877	0.911	0.875	0.911

Notes: This table presents the estimation results of the specification:

$$Y_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}_{\prime} \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t},$$

where f, b, i, c, and t denote firm, bank, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the lead arranger share. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window in is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D3: Legal Reform and Bank Monitoring: Alternative Standard Error Computation

	Lead arranger share					
	(1)	(2)	(3)	(4)	(5)	(6)
	Bootstrap SE		Country and Sector		Country-Sector	
Reform × Treated	-0.008***	-0.005***	-0.357***	-0.468***	-0.357***	-0.468***
	(0.002)	(0.001)	(0.079)	(0.054)	(0.115)	(0.087)
ln(Facility maturity)			-0.008**	-0.005	-0.008***	-0.005**
			(0.004)	(0.004)	(0.003)	(0.002)
ln(Facility amount)			-0.008	-0.008	-0.008	-0.008
			(0.009)	(0.008)	(0.009)	(0.008)
ln(AIDS)			0.006	0.023**	0.006	0.023**
			(0.012)	(0.010)	(0.011)	(0.011)
Firm size			-0.001	0.009	-0.001	0.009
			(0.035)	(0.024)	(0.044)	(0.048)
Debt ratio			0.051	0.289*	0.051	0.289*
			(0.206)	(0.147)	(0.163)	(0.147)
PPE			0.341	0.360***	0.341*	0.360**
			(0.298)	(0.102)	(0.184)	(0.139)
Current ratio			0.118	0.359	0.118	0.359
			(0.387)	(0.278)	(0.384)	(0.331)
Loan type FE	✓	✓	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓	✓	✓
Lender FE	✓		✓		✓	
Lender-Time FE		✓		✓	✓	
N	4,496	4,263	4,496	4,263	4,496	4,263
Adjusted R^2			0.874	0.910	0.874	0.911

Notes: This table presents the estimation results of the specification:

$$\text{Y}_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t},$$

where f, b, i, c, and t denote firm, bank, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the lead arranger share. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window in is [-10,10] around the reform year for reformed countries. Robust standard errors clustered (iii) bootstraped are in parentheses in Columns (1)-(2) (ii) at the double clustered at country and sector level are in parentheses in Columns (3)-(4) (iii) at the country-sector level are in parentheses in Columns (5)-(6). *** p<0.01, ** p<0.05, * p<0.1.

Table D4: Legal Reform and Bank Monitoring: Banks Only

	Lead arranger share			
	(1)	(2)	(3)	(4)
	No institutional tranches		Banks only	
Reform × Treated	-0.248***	-0.357***	-0.456***	-0.500***
	(0.074)	(0.065)	(0.038)	(0.016)
ln(Facility maturity)	-0.011**	-0.008**	-0.010**	-0.006*
	(0.004)	(0.003)	(0.004)	(0.003)
ln(Facility amount)	-0.003	-0.006	-0.006	-0.006
	(0.006)	(0.004)	(0.007)	(0.005)
ln(AIDS)	0.001	0.021***	0.003	0.021**
	(0.007)	(0.006)	(0.008)	(0.008)
Firm size	0.020	0.037	0.031	0.019
	(0.044)	(0.029)	(0.036)	(0.029)
Debt ratio	-0.181	0.095	-0.129	0.142
	(0.210)	(0.187)	(0.219)	(0.207)
PPE	0.298	0.312***	0.335	0.342***
	(0.236)	(0.042)	(0.274)	(0.059)
Current ratio	0.125	0.364	0.287	0.396
	(0.400)	(0.258)	(0.407)	(0.300)
Loan type FE	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓
Lender FE	✓		✓	
Lender-Time FE		✓		✓
N	3,278	3,031	3,899	3,686
Adjusted R^2	0.874	0.908	0.876	0.908

Notes: This table presents the estimation results of the specification:

$$Y_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t},$$

where f, b, i, c, and t denote firm, bank, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the lead arranger share. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window in is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table D7: Legal Reform and Bank Monitoring: Weighted Least Square Estimation

	Lead arranger share			
	(1)	(2)	(3)	(4)
	Weighted by all countries		Weighted by reformed countries	
Reform × Treated	-0.370***	-0.500***	-0.649***	-0.766***
	(0.067)	(0.027)	(0.102)	(0.102)
ln(Facility maturity)	-0.009**	-0.005	-0.011*	-0.007*
	(0.004)	(0.004)	(0.006)	(0.004)
ln(Facility amount)	-0.011	-0.013	-0.026	-0.032
	(0.010)	(0.008)	(0.020)	(0.025)
ln(AIDS)	0.011	0.032**	0.030	0.029
	(0.011)	(0.012)	(0.024)	(0.021)
Firm size	-0.018	0.019	-0.009	-0.205
	(0.036)	(0.033)	(0.118)	(0.142)
Debt ratio	0.096	0.316***	1.768*	2.666*
	(0.176)	(0.101)	(0.916)	(1.458)
PPE	0.326	0.382***	1.078***	-1.629
	(0.313)	(0.088)	(0.159)	(1.048)
Current ratio	-0.026	0.318**	1.912	2.587
	(0.347)	(0.121)	(1.768)	(2.479)
Loan type FE	✓	✓	✓	✓
Loan purpose FE	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓
Country-Time FE	✓	✓	✓	✓
Lender FE	✓		✓	
Lender-Time FE		✓		✓
N	4,496	4,263	974	891
Adjusted R^2	0.880	0.923	0.939	0.970

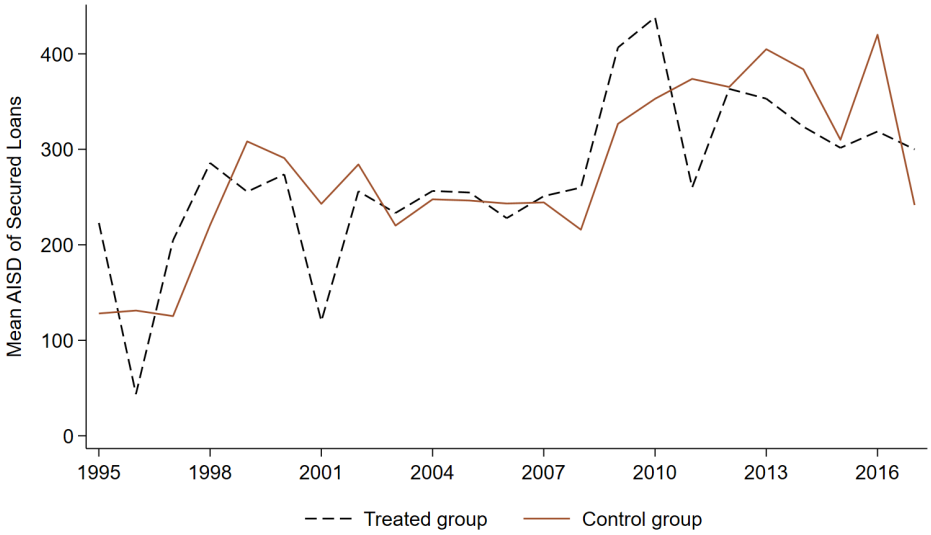
Notes: This table presents the estimation results of the specification:

$$Y_{f,b,i,t} = \beta \text{Reform}_{c,t} \times \text{Treated}_f + \boldsymbol{\mu}' \mathbf{X}_{f,t} + \boldsymbol{\gamma}' \mathbf{Z}_{i,t} + \text{FE} + \varepsilon_{f,b,i,t},$$

where f, b, i, c, and t denote firm, bank, facility, borrower country, and year, respectively. The sample only include secured loans. The dependent variable is the lead arranger share. $Treated_f$ is a dummy variable that equals one if a firm is in a sector with a sector movable assets index higher than the median value, zero otherwise. I calculate the sector movable assets index using US nonfinancial firm data between 1983 and 1994. $Reform_{c,t}$ is a dummy variable that equals one if a firm in a country (as recorded in Compustat) reformed the secured transaction law in a year, zero otherwise. The time window in is [-10,10] around the reform year for reformed countries. Robust standard errors clustered at the country level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

E Figures

Figure E3: Borrower Quality of Treated and Control Group



Notes: This figure illustrates the borrower quality for treated and control groups using the loan spread (All In Spread Drawn) of secured loans as a proxy. I average the loan spread for all facilities borrowed from the treated and control sectors, respectively, and plot two lines.

F Proofs

Proof of Proposition 1

Proof. Using Bayes' rule, we can calculate that

$$\begin{aligned}\Pr\{\tilde{\omega}=H|\tilde{s}=H\} &= \frac{\Pr\{\tilde{s}=H|\tilde{\omega}=H\}\Pr\{\tilde{\omega}=H\}}{\Pr\{\tilde{s}=H|\tilde{\omega}=H\}\Pr\{\tilde{\omega}=H\}+\Pr\{\tilde{s}=H|\tilde{\omega}=L\}\Pr\{\tilde{\omega}=L\}}\\ &= \frac{\rho p}{\rho p+(1-\rho)(1-p)}.\end{aligned}$$

Therefore, we have

$$\Pi_1^{rol}(\tilde{s}=H)=\frac{\rho p}{\rho p+(1-\rho)(1-p)}R_B+\frac{(1-\rho)(1-p)}{\rho p+(1-\rho)(1-p)}m(1-2\phi)\bar{v}_0.$$

Notice that $\Pr\{\tilde{s}=H\}=\rho p+(1-\rho)(1-p)$. Therefore, the bank's ex ante expected revenue can be expressed as

$$\Pi_0=\rho p R_B+(1-\rho)(1-p)m(1-2\phi)\bar{v}_0+[1-\rho p-(1-\rho)(1-p)]m(1-\phi)\bar{v}_0,$$

which yields Eq(5) by direct calculation. It is obvious that $\frac{\partial^2\Pi_0}{\partial m\partial\rho}=\bar{v}_0(\phi-p)$. □

Proof of Proposition 2

Proof. Denote $p_{HH}=\Pr\{\tilde{\omega}=H|\tilde{s}=H\}$. Then the variance of $\tilde{\Pi}_2$ conditional on $\tilde{s}=H$ can be expressed as

$$\begin{aligned}Var[\tilde{\Pi}_2|\tilde{s}=H] &= E[\tilde{\Pi}_2^2|\tilde{s}=H]-(E[\tilde{\Pi}_2|\tilde{s}=H])^2\\ &= R_B^2p_{HH}+[v_c(2)]^2(1-p_{HH})-[R_Bp_{HH}+v_c(2)(1-p_{HH})]^2\\ &= (1-p_{HH})p_{HH}[R_B^2+[v_c(2)]^2-2R_Bv_c(2)]\\ &= (1-p_{HH})p_{HH}[R_B-m(1-2\phi)\bar{v}_0]^2.\end{aligned}$$

By the assumption $R_B>v_c(1)$, we know that $R_B>v_c(2)$. Therefore, $[R_B-m(1-2\phi)\bar{v}_0]^2$ is decreasing in m, which yields $\frac{\partial Var[\tilde{\Pi}_2|\tilde{s}=H]}{\partial m}<0$. □