Who Monitors the Monitor? Bank Capital Structure and Borrower Monitoring

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Abstract

The role that banks play in screening and monitoring their borrowers is well understood. However, these bank activities are costly and unobservable, thus difficult to contract upon. This introduces the possibility of shirking and leads to the question – who monitors the monitor? Financial intermediation theories posit that bank capital structure plays such a role in incentivizing banks to monitor their borrowers. Both bank debt and bank equity have been proposed in various theories as providing the discipline to induce banks to monitor. However, empirical evidence on how bank capital structure influences borrower monitoring is scant. To circumvent identification concerns with regressing (unobservable) bank monitoring on (endogenous) bank capital structure, we use variation in country-level creditor rights to capture banks' need to monitor their borrowers. We develop a theoretical model in which greater ex-post protection offered to lenders (i.e., banks) during borrower bankruptcy/renegotiation reduces the bank's ex-ante incentives to monitor. This is because the greater salvage value of bank loans reduces the bank's expected loss from not monitoring. Our model also examines how banks alter their capital structures in response to changes in their country's creditor rights, and shows that the reduced demand for bank monitoring induced by stronger creditor rights induces the bank to shift its capital structure away from the source of financing that induces it to monitor. We find empirically that increases in creditor rights result in banks tilting their capital structures away from equity and towards deposits. We verify (theoretically and empirically) that these demand-based tilts in bank capital structure are not explained by supply-side effects (i.e., creditor rights make it cheaper to supply bank debt), and conclude that bank equity is a stronger source of discipline on banks than bank debt.

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1. Introduction

The role that banks play in screening and monitoring their borrowers is well understood. By exerting costly effort to maintain/increase the value of their relationship loans, banks create liquidity and facilitate economic growth (Levine, 1997).[1] However, banks are institutions themselves and are subject to the same incentive problems as firms. This leads to the question – who monitors the monitor? In other words, who ensures that banks not only make good loans but also perform the due diligence to enhance the repayment likelihood of these loans? This paper seeks to provide evidence on this question.

Financial intermediation theories suggest that bank capital structure generates the appropriate incentives for banks to perform their screening and monitoring roles. These theories can be broadly classified into two categories – those that emphasize the disciplining role of bank demandable debt (i.e., deposits), and those that focus on the disciplining role of bank equity.[2] Theories in which bank deposits discipline banks rely on the idea that demandable debt increases bank fragility by creating a mismatch between these short-maturity liabilities and bank assets that are generally long-term (Calomiris and Kahn, 1991; Diamond and Rajan, 2001). As a result, the threat of withdrawal by depositors can trigger a bank run and force

[1] Boot and Thakor (2000), Rajan (1992), and Sharpe (1990) develop theories of relationship lending.

[2] Theories that rationalize why financial intermediaries exist (e.g., Allen, 1990; Ramakrishnan and Thakor, 1984) do not focus on bank capital structure. One exception is Coval and Thakor (2005) in which a bank is rationalized as an institution that provides a "beliefs bridge" between pessimistic investors and optimistic entrepreneurs, and a sufficient amount of bank capital is needed for the bank to be viable.

costly fire-sales or liquidations. This threat of exit by creditors creates the necessary market discipline to induce proper bank behavior.[3, 4]

Theories in which bank equity generates the appropriate incentives include Holmstrom and Tirole (1997), Allen, Carletti and Marquez, 2011, and Mehran and Thakor (2011). These theories rely on a "skin-in-the-game" argument in that bank equity increases not only how much the bank benefits from monitoring, but also how much it loses from shirking. In addition to this direct effect, Mehran and Thakor (2011) document an indirect benefit where bank equity leads to a higher probability of survival in the future, which reinforces the ex-ante incentives to monitor.[5] Thus, bank fragility *weakens* monitoring incentives in Mehran and Thakor (2011) by lowering the likelihood that banks will be around in the future to reap the benefits of borrower monitoring, and higher equity contributes to strengthened monitoring incentives by reducing bank fragility.

In spite of the theoretical insights, there is not much empirical evidence on the effect of bank capital structure on borrower monitoring.[6] This paucity is understandable given the challenges in documenting such an effect. To appreciate this, note that one cannot conduct a test by simply regressing bank monitoring/screening on bank capital structure for (at least) two

[3] The threat of exit has been recently studied in the context of large shareholder monitoring of firms. See Admati and Pfleiderer (2009), Edmans (2009), and Edmans and Manso (2011) for theoretical analyses and Bharath, Jayaraman and Nagar (2013) for empirical evidence.

[4] While complete deposit insurance would blunt the monitoring role of deposits, most countries do not insure 100% of their deposits, and the theory would therefore apply to the uninsured portion of the bank's deposits. Further, even insured depositors may run on a bank if there is uncertainty about the timing of the settling of depositors' claims by the government after it takes over a failed bank. Finally, most banks have uninsured deposit-like liabilities such as commercial paper, interbank borrowing and subordinated debt, which potentially provide a similar monitoring role.

[5] The idea that a higher likelihood of survival in the future increases banks' ex-ante monitoring incentives can also be found in Besanko and Thakor (1993), and Boot and Greenbaum (1993).

[6] Berger and Bouwman (2009) provide U.S.-based cross-sectional evidence that bank equity is positively correlated with liquidity creation in large banks but negatively correlated in small banks. Purnanandam (2011), among others, provides evidence that higher equity capital leads to stronger screening incentives for banks involved in securitization.

reasons – (i) monitoring and screening are unobservable and (ii) bank capital structure is endogeneous. To cope with this identification challenge, we use a different approach. We use variation in country-level creditor rights (e.g., Acharya et al., 2011; Djankov et al., 2007) to capture variation in banks' incentives to monitor their borrowers. We rely on the idea that the greater the extent of protection offered by the legal regime to creditors (i.e., banks) during borrower bankruptcy or renegotiation, the lower are the lenders' incentives to monitor borrowers ex ante. This is because stronger creditor rights increase the salvage value of the bank's relationship loans and consequently reduce the bank's expected loss from not monitoring its borrowers.

Our identification strategy entails examining how banks modify their capital structure in response to changes in their country's creditor rights. By doing so, we can gauge the effect of the bank's capital structure on its monitoring of borrowers. To obtain the predictions related to these capital structure responses, we first develop a theoretical model in which either bank debt or bank equity can induce the bank to monitor its borrowers, and the bank chooses its (value-maximizing) optimal capital structure taking these incentives into account. We obtain four main results.

First, when it is bank equity that provides the bank with its monitoring incentives, there is an interior optimal capital structure for the bank that trades off the monitoring benefits of equity against the tax-shield benefits of debt. Second, with bank equity providing the bank with monitoring incentives, stronger creditor rights lead the bank to use less equity and more debt in its optimal capital structure, and the equilibrium level of monitoring declines. Third, when bank debt provides the bank with its monitoring incentives and there are bankruptcy costs, there is an interior optimal capital structure that trades off the tax shield and monitoring benefits of

debt against bankruptcy costs. Fourth, in this case, stronger creditor cause the bank to monitor less and also to tilt its capital structure away from debt and towards equity.

The theory does not take a stand on whether it is bank debt or bank equity that provides monitoring incentives, but it produces predictions that allow the data to answer the question. If it is bank debt that is providing monitoring incentives, then we should expect bank capital structure to become less levered in response to a strengthening of creditor rights in the country in which these banks are domiciled. However, if it is bank equity that is providing monitoring incentives, then the theory predicts that banks will tilt their capital structure towards bank debt and away from bank equity after a strengthening of creditor rights.

Since our theory makes predictions about how banks would alter their capital structure in response to changes in their countries' creditor rights, we use the passage of legal reforms across countries as our experimental setting. In other words, we use instances where countries either strengthen or weaken their creditor rights and examine how banks change their capital structures in response. This ensures a better match between the theory and the empirics than performing a cross-sectional comparison of bank capital structure across countries with different levels of creditor rights. Our identification strategy exploits the staggered passage of legal reforms across countries and compares *changes* in bank capital structure within reforming countries to those in non-reforming countries around the same time, to identify a (presumably causal) effect. This within-country design mitigates concerns about cross-country heterogeneity in other factors affecting bank capital structure, such as minimum capital requirements, as these factors are subsumed by our country-fixed effects (to the extent they are time-invariant) and by year effects (to the extent they vary intertemporally).

Using this staggered passage of legal reforms in 14 countries across Europe and Asia during the 1990s and early 2000s, we find strong evidence that banks tilt their capital structures

away from bank equity and toward bank deposits when their countries strengthen creditor rights; and do the opposite when their countries weaken creditor rights.[7] In terms of economic significance, legal reforms that strengthen (weaken) creditor rights result in lower (higher) bank equity of 15% (18%) relative to pre-passage levels. Based on our theory, we interpret these results as evidence that bank equity is the primary form of financing that incentivizes banks to monitor their borrowers.

Our identification strategy makes some pivotal assumptions that merit discussion. First, the effect of creditor rights on bank capital structure emanates from the asset side of the bank's balance sheet and specifically via borrower monitoring. Take, for example, one of our predictions that stronger creditor rights result in banks taking on less equity, if bank equity is the one that encourages borrower monitoring. One might argue that this result could be obtained merely by the fact that greater recovery rates brought about by the strengthened creditor rights reduce the need for bank equity as a cushion against losses. However, this argument is conceptually incorrect because bank equity is used as a cushion against *unexpected* losses and banks use loan interest rates to protect themselves against *expected* losses. Thus, decreases in expected loan losses brought about by stronger creditor rights should lead to lower loan rates (as documented by Qian and Strahan, 2007) rather than less bank equity.

Our primary challenge is to distinguish our borrower-monitoring channel, which relies on the "asset side" of the bank's balance sheet, from a competing explanation based on the "liability side" of the bank's balance sheet. In particular, our finding that banks take on less equity in response to stronger creditor rights could be explained without any reliance on borrower monitoring as follows – bank creditors are willing to lend to banks at a lower cost

[7] We acknowledge that this design ignores any heterogeneity across the individual reforms. However, to the extent such heterogeneity exists, we reason that it would bias against us finding an overall effect.

when the country strengthens creditor rights, making bank debt more attractive and causing banks to shift away from equity.

This explanation, based on the "liability side" channel, has two conceptual weaknesses. First, it is inconsistent with prior work that finds that increases in creditor rights *reduce* debt in industrial firms because firms become more wary of borrowing from creditors (Vig, 2013; Acharya et al., 2011).[8] Second, it does not accord well with the political economy of banking where explicit and implicit safety nets provide guarantees to bank creditors against default. We nevertheless explore this "liability side" channel by performing three tests. First, we control for money market funding and subordinated debt in all our specifications and find that the effect of creditor rights on bank equity is not subsumed by these "liability side" effects. Second, we find that increases in creditor rights result in banks taking on more *deposits* – which are not protected under bankruptcy law and should be unaffected by the "liability side" channel. Rather, these results are consistent with the "asset side" channel where bank equity and bank deposits are the alternative sources of monitoring-inducing financing.

Third, we test the main prediction of the "liability side" channel, which is that increases in creditor rights *lower* banks' cost of debt. We extend our theoretical model to incorporate asset-substitution moral hazard by the bank in response to the greater leverage brought about by the strengthening of creditor rights (in the case where bank equity incentivizes monitoring). We derive, within the context of our model, the combined effects of the higher bank leverage (predicted by theory) and the asset-substitution moral hazard associated with this higher leverage, particularly in light of the political economy of government safety nets. We reason that banks respond to the higher bank leverage induced by stronger creditor rights by

[8] Our theoretical model in which monitoring responsibility is assigned to creditors also makes a similar empirical prediction, albeit with a different mechanism (i.e., stronger creditor rights reduce the demand for debt-based monitoring).

increasing risk-taking to take advantage of the safety nets provided by the government. Our model predicts that banks' cost of debt could *increase* in response to this higher moral hazard. Consistent with this predicted possibility and in sharp contrast to the "liability side" channel, we find a *higher* cost of bank debt after increases in creditor rights; and the opposite effect after decreases in creditor rights. When we condition this result on the extent of government safety nets (based on the presence of an explicit deposit insurance scheme and whether countries' insurance premiums are risk-adjusted), we find that the higher cost of debt is concentrated in countries with high government safety nets. We also document an increase in bank risk-taking (as measured by the distance-to-default measure) after a strengthening of creditor rights and further that that this increase is concentrated in countries with high safety nets.[9] Consistent with our cost-of-debt results, we find no change in risk-taking in countries with low safety nets. We view these results as being inconsistent with the "liability side" channel and interpret our results on the effect of creditor rights on bank capital structure as emanating from the asset-side-based borrower monitoring channel.

We conclude by assessing whether the possible endogeneity of legal reform passage confounds our inferences. While all our specifications include country fixed effects that capture time-invariant differences across countries, it is possible (and quite likely) that countries initiate legal reforms in response to or in anticipation of time-varying factors such as economic growth. Although all our specifications include time-varying macroeconomic factors such as GDP growth and inflation, we further address the endogeneity concern by creating a control group of non-reforming countries using a propensity-score-based matching technique. This design benchmarks our treatment effects against a control group of countries with similar

[9] These risk-taking results further rebut the possibility that stronger creditor rights reduce the bank's cost of debt. This is because under the latter interpretation, banks would scale-back their risk-taking not increase it (Hellmann, Murdock and Stiglitz, 2000).

macroeconomic conditions but which did not pass legal reforms. Results from these tests suggest that our inferences are robust to benchmarking against countries most likely to pass legal reforms but which did not.

While the above matching technique controls for *observable* factors that might be correlated with countries' decisions to pass legal reforms, it leaves open the concern that the passage of legal reforms might be correlated with *unobservable* differences across countries. To fully address time-varying, country-specific factors (both observable and unobservable) that might be correlated with legal reform passage, one needs to include country-specific year indicators, i.e., country-times-year indicators. However, to identify the effect of legal reforms in such a specification, we need within-country-year variation in the effect of legal reforms. In other words, we need legal reforms to affect some banks within each country and in each year differentially from others. We exploit differences in banks' business models to capture such within-country-year variation. In particular, we expect the effect of creditor rights to be more pronounced for banks that are primarily lending-based (i.e., relationship banks) as opposed to those that are fee-based (i.e., transaction banks).[10] Consistent with our expectation, we find that the effect of legal reforms (with country-specific-year fixed effects) is more pronounced in lending-based banks.[11] We therefore conclude that our inferences are unlikely to be affected by the endogeneity of legal reform passage.

The intended contribution of our paper is fourfold. First, ours is one of the first empirical tests of the relative importance of bank equity and bank debt in providing monitoring

[10] Boot and Thakor (2000) develop a theory in which banks choose between relationship lending and transaction lending.

[11] It could be that countries initiate legal reforms to bring about differential effects across lending and non-lending banks. However, the political economy of banking tends to be dictated by concerns such as too-big-to-fail that are related to bank size, not lending focus. We find no difference in lending focus between large and small banks.

incentives to banks. In contrast to the heavy emphasis in the literature on the monitoring role of bank debt, we find that bank equity appears to play a more important role in encouraging banks to monitor borrowers (consistent with Holmstrom and Tirole, 1997; Allen et al. 2011; and Mehran and Thakor, 2011). Our finding is relevant to the current regulatory debate on bank capital requirements. The conventional wisdom is that while bank equity increases stability, it has to be traded off against the higher monitoring or disciplining benefits offered by bank debt. Our evidence that bank equity offers stronger monitoring incentives suggests that the observed high levels of bank leverage are probably due to reasons other than to induce greater creditor discipline, such as the effects of government safety nets (e.g., Acharya and Thakor, 2012; and Farhi and Tirole, 2012)[12], taxes,[13] and possible behavioral biases that generate a desire for higher return on equity.

Second, to the best of our knowledge, ours is the first paper to develop a theory in which either bank debt or bank equity can provide the bank with monitoring incentives, and the bank capital structure ramifications of creditor rights are analyzed within this framework to generate testable predictions.

Third, we provide new evidence that government safety nets play a key role in how creditor rights, in conjunction with their effect on bank capital structure, influence bank risk-taking. Our finding that a strengthening of creditor rights increases bank risk-taking and banks' cost of debt in countries with government guarantees indicates that strong creditor rights are not necessarily a universally "desirable" institutional feature, and that governments should consider the unintended consequences of strengthening these rights in the presence of

[12] Acharya, Mehran, Schuermann and Thakor (2012) discuss data on the intertemporal behavior of bank capital ratios, consistent with deposit insurance inducing a strong downward shift in capital ratios.
[13] Schepens (2014) documents how a change in the Belgian tax code to reduce the tax disadvantage of equity relative to debt led Belgian banks to increase their capital ratios.

government guarantees to banks.[14] Fourth, our paper highlights the uniqueness of banks by documenting how the effects of creditor rights on bank capital structure, cost of debt and risk-taking differ from those on firms. While prior empirical studies have primarily focused on the effect of creditor rights on bank loan yields (e.g., Qian and Strahan, 2007) or bank risk-taking (e.g., Houston et al., 2010), we examine the effect of creditor rights within a borrower monitoring framework.

The rest of the paper is organized as follows. Section 2 discusses the related literature. Section 3 develops the theory and derives the main predictions. Section 4 presents the empirical research design. Results of the empirical analysis are presented in Section 5. Section 6 concludes.

2. Theoretical literature on bank capital structure and borrower monitoring

Bank capital structure plays an important role in theoretical discussions of bank monitoring of its borrowers. Given that borrower monitoring is costly and unobservable, theories of bank capital structure focus on how features of the capital structure encourage banks to monitor their borrowers. Theories examining the role of bank capital structure on bank monitoring can be classified into two groups – those that emphasize the disciplining role of bank deposits, and those that focus on the disciplining role of bank equity. Before discussing the details of these models, it is important to clarify what is meant by monitoring. While the details vary from model to model, bank monitoring is construed as efforts taken by banks to maintain/increase the value of their relationship loans. Thus, greater monitoring means not only that banks increase the likelihood of making good loans, but also that they perform the due

[14] Similarly, Acharya et al. (2011) show that strong creditor rights discourage innovation in firms.

diligence that enhances the repayment likelihood of these loans. We now discuss the theoretical models in greater detail.

2.1.1. Bank deposits and monitoring

Calomiris and Kahn (1991) provide one of the earliest theoretical analyses of the monitoring role of demandable debt. They argue that the monitoring role of debt provides an economic rationale for two common institutional features of banks – the heavy reliance on debt and the presence of the "sequential service constraint", where payments are made to demanders on a first-come-first-served basis. The banker in their model has better information about the bank's investment opportunities than depositors, but can also abscond with the proceeds. Depositors can prevent absconding by acquiring (costly) private information about asset returns and demanding liquidation if the information acquired is adverse. The sequential service constraint makes depositors' demand for liquidation credible in equilibrium, because those earlier in the queue are paid in full (including the costs of information acquisition) while those later in the queue suffer losses. Thus, demandable deposit claims lead to greater monitoring as they mitigate the banker's ability to abscond with the assets. Diamond and Rajan (2001) use similar reasoning to argue that the threat of a run by depositors can induce the bank to use its skills to collect repayment from borrowers (broadly interpreted as monitoring skills), which makes the loans liquid.

2.1.2. Bank equity and monitoring

The earliest contemporary analysis of how bank equity affects its borrowers appears in Holmstrom and Tirole (1997). In that model, higher bank equity leads to stronger bank monitoring incentives and this, in turn, improves the borrower's capital-market access as well

because of an improvement in its credit worthiness. In a dynamic model of bank capital structure, Mehran and Thakor (2011) predict that greater bank equity leads to higher bank monitoring. In their model, the bank's choice of capital structure determines the amount of monitoring that it undertakes and also whether the regulator shuts down the bank at an interim stage (prior to loan maturity). The dynamic nature of the model permits an analysis of not only the direct benefit of bank equity (i.e., it allows the bank to retain a greater share of the monitoring rewards), but also of the indirect benefit (i.e., greater bank equity leads to a higher probability of survival in the future) that reinforces the ex-ante incentives to monitor.[15]

Using a one-period model, Allen, Carletti and Marquez (2011) also argue that more equity can improve bank monitoring incentives. Banks in their model can improve monitoring incentives by either taking on more equity or by increasing the loan rate. While equity encourages monitoring by forcing the bank to internalize a greater proportion of the costs of default, a higher loan rate does so by increasing the rewards to monitoring. The effectiveness of these alternatives depends on the degree of loan market competition and banks use equity (loan rate) to generate monitoring incentives when the loan market is more (less) competitive.

3. Theoretical model

The purpose of this section is to develop a simple theoretical model in which stronger creditor rights lead to weaker monitoring incentives for the bank, and this has capital structure ramifications for the bank. Monitoring is privately-costly for the bank, and the marginal benefit of monitoring for the bank comes via an enhancement in the borrower's repayment probability. The bank's own capital structure affects the *net* amount the bank's shareholders collect when

[15] The idea that a higher likelihood of survival in the future increases banks' ex-ante monitoring incentives can also be found in Besanko and Thakor (1993), and Boot and Greenbaum (1993).

the borrower repays, and hence influences the bank's monitoring incentives. Creditor rights determine the bank's expected payoff if the borrower defaults. Hence, the strength of creditor rights impacts the bank's monitoring intensity as well, and this effect is mediated by the bank's capital structure.[16]

In what follows, we develop two models, one in which it is bank equity that provides the monitoring incentive, and the other in which bank debt provides this incentive. The models are highly stylized, and not meant to be literal representations of how banks monitor their borrowers. Rather, they are meant to be broad enough to be consistent with many different ways in which banks could regulate the behavior of their borrowers.

3.1. Model 1: Bank Equity Provides Monitoring Incentives

Consider a three-date model. At $t = 0$, the bank can make a \$1 loan to finance a borrower's project; for simplicity, the bank has no legacy debt. The borrower's project will pay off X with probability (w.p.) $p \in [0,1]$ and 0 w.p. $1-p$. This project payoff will occur at t=2.[17] Thus, if all that the bank has access to is the borrower's project, then p is the loan repayment probability. We assume that the maximum pledgeable income the borrower has is $Y \in (0, X)$, and $Yp > 1$ (so the loan can be feasibly financed if the bank has access to nothing beyond the project cash flow). Further, p is affected by the bank's monitoring of the borrower, i.e., p is a function:

$$p : [0, \bar{m}] \to [0,1] \tag{1}$$

[16] While the model focuses on ex-post monitoring after the loan is made, the intuition for screening is the same. By reducing the bank's losses during borrower bankruptcy, creditor rights reduce the marginal benefits of screening of its potential borrowers by the banks.

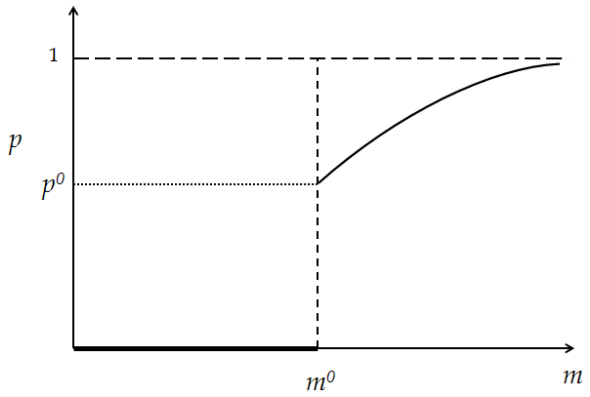
[17] See Appendix 1 for a time line with sequence of events.

that maps the amount of borrower monitoring, $m \in [0, \bar{m}]$, done by the bank into a probability that the borrower will repay the loan. This is a reduced-form specification that can reflect many possibilities. For example, it is consistent with a setting in which the borrower may invest in an excessively risky, inefficient project, and the more the bank invests in monitoring the higher is the probability with which this can be prevented. The bank's monitoring occurs at *t*=1.

Assume that $p' \geq 0,\ p'' \leq 0$. The cost of monitoring for the bank's shareholders is $K(m)$, with $K' > 0,\ K'' > 0$, and the Inada conditions, $\lim_{m \to 0} K' = 0$, and $\lim_{m \to \bar{m}} K' = \infty$. The bank's choice of *m* is observable only to its shareholders and not to its creditors. The riskless rate is zero, there is universal risk neutrality and all financial claims are competitively priced. That is, the bank's creditors earn an expected return of 0. All decisions are made by the bank in the best interests of its shareholders. The shareholders can choose how much of their own money (equity) to finance with and how much debt to use to finance the loan, and then they choose how much to monitor the borrower.

Suppose that the borrower also has other assets that are worth $V \in (0, Y)$ at $t = 2$. The bank could use these assets as collateral in case the project cash flow is insufficient to repay the loan and the borrower defaults. However, how much of *V* the bank can actually seize depends on the creditor rights in the economy. Let $q \in [0,1]$ be the fraction of *V* that the bank can recover in case of borrower default. For simplicity, we assume that the bank has sufficient market power to set the loan repayment equal to the pledgeable income *Y*, and that *m* does not affect *Y*. In what follows, we will see that default by the borrower causes default by the bank on its deposits. Let *B* be the bankruptcy cost the bank faces when it experiences default. For now we will suppress *B* by setting it at zero, but we will see later what role it plays.

Suppose that the monitoring function looks like in the figure below:



So, $p = p^0 \ \forall\ m < m^0$ and there is a jump in p at $m = m^0$, with $p' > 0$, $p'' < 0 \ \forall\ m > m^0$. Let p^0 be the value of p at the higher of the two values at m^0, i.e., $p(m^0) = p^0$. The motivation for such a monitoring function is that it takes a minimum level of monitoring before it becomes effective at all, and after that there are diminishing returns to scale in monitoring. Assume the project is socially efficient at $p = p^0$, i.e., $p^0 X > 1$, and further that $p^0 Y > 1$. Suppose the corporate income tax rate is $T \in (0,1)$ and all debt payments are tax-deductible.

Bank's Choice of Monitoring for a Given Capital Structure:

A bank that uses D_0 in debt and E_0 in equity at *t*=0 such that $D_0 + E_0 = 1$, will choose its monitoring m to maximize the net wealth of its shareholders:

$$\underset{m}{Max}\left\{p(m)\left[Y - F_0\right]\left[1-T\right] + \left[1-p(m)\right]\left\{Max\left[qV - F_0, 0\right]\right\}\left[1-T\right] - K(m) - E_0\right\} \qquad (2)$$

subject to

$$D_0 + E_0 = 1 \qquad (3)$$

$$p(m^*)F_0 + \left[1-p(m^*)\right]\left\{\min\left[qV, F_0\right]\right\} = D_0 \qquad (4)$$

where F_0 is the face value of the debt (bank's repayment obligation on its debt).

Note that the shareholders are choosing *m* to maximize the NPV of the bank to them, for a given capital structure choice (i.e., given D_0 and E_0). D_0 is provided by the bank's creditors and E_0 by its shareholders. This is (2). The constraint (3) just says that the bank raises exactly \$1 to finance the loan. Constraint (4) says that, even though the bank's creditors cannot observe *m*, they price the debt (determine D_0 for any given F_0) based on rational expectations about the shareholders' optimal choice of *m*, denoted as *m**.

We now have the following result (all proofs are in Appendix 2):

Proposition 1: *For any given capital structure, the bank has a unique optimum with respect to its choice of monitoring, m*. With* $qV \geq F_0$ *, we have* $dm^*/dq < 0$.

This proposition indicates that an increase in creditor rights, *q*, reduces bank monitoring, consistent with our earlier discussion. The easiest way to see the intuition is to examine (2). With $qV \geq F_0$, the marginal benefit of monitoring to the bank's shareholders is:

$$p'\left[Y - qV\right]\left[1-T\right] \tag{5}$$

which is strictly decreasing in *q*. The marginal cost of monitoring is K', which is unaffected by *q*.[18] Thus, shareholders choose lower monitoring when facing a higher *q*.

This proposition takes the bank's capital structure as given. We examine the optimal choice of capital structure now.

[18] The result $dm^*/dq < 0$ also holds when $qV < F_0$, but the argument is a bit more complicated because it relies on the impact of *q* on the endogenously chosen F_0.

Bank's Optimal Capital Structure and Monitoring:

Since the bank's creditors price the debt competitively to earn a zero expected return, the bank shareholders' initial capital structure choice will maximize the total value of the bank. That is, F_0 will be chosen to maximize:

$$p(m)Y\left[1-T\right]+p(m)F_0T+\left[1-p(m)\right]qV-K(m) \tag{6}$$

taking into account the impact of F_0 on *m**. The objective function in (6) assumes that the bank's debt is risky ($qV < F_0$), which we will verify occurs in equilibrium. This leads to one of our main results.

Proposition 2: *The bank's optimal capital structure involves choosing debt with face value,* F_0^**, such that debt is risky (i.e.,* $qV < F_0^*$*) and* $dF_0^*/dq > 0$*. Moreover, the optimal level of monitoring, m*, satisfies* $dm^*/dF_0 < 0$*, and* $dm^*/dq < 0$ *when the bank's capital structure is chosen optimally.*

This proposition shows that in equilibrium the bank will choose leverage that is high enough to make its debt risky.[19] More importantly, the bank's leverage is increasing in q (the strength of creditor rights), and the amount of monitoring done by the bank is decreasing in q.

The intuition is that leverage is attractive for the bank due to its debt tax shield. So the bank would like to be all-debt financed. However, the bank's optimal monitoring is decreasing in its leverage because a higher amount of debt reduces the marginal benefit of monitoring to

[19] The intuition for why debt must be risky in equilibrium is as follows. Suppose, counterfactually, that debt is riskless in equilibrium. In this case, F_0 no longer factors into the bank's optimal choice of *m**. To see this, note that (2) now becomes $p(m)\left[Y-F_0\right]\left[1-T\right]+\left[1-p(m)\right]\left[qV-F_0\right]\left[1-T\right]-K(m)-E_0$ which simplifies to $p(m)\left[Y-qV\right]\left[1-T\right]+qV+F_0T-K(m)-1$. Clearly, this expression can be increased monotonically without affecting *m**, the bank's monitoring. In other words, the bank can increase the tax shield by taking on more debt, without incurring a loss of monitoring benefits. Thus, with riskless debt, no level of F_0 is high enough and F_0 will be increased until debt is risky and (2) becomes $p(m)\left[Y-F_0\right]\left[1-T\right]-K(m)-E_0$. Now an increase in F_0 decreases *m**, so there is a tradeoff between monitoring and the debt tax shield in the choice of F_0.

the bank's shareholders. To see this, note from (2) that for $qV < F_0$ (risky debt), the marginal benefit of monitoring to the bank's shareholders is:

$$p'(m)\left[Y - F_0\right]\left[1 - T\right] \tag{7}$$

which is strictly decreasing in F_0. So, to increase its monitoring level, the bank sacrifices some debt tax shield and reduces D_0 below 1. As q increases, the value of monitoring, in terms of its impact on total bank value, declines, so the bank prefers a lower level of monitoring. This means the monitoring-tax shield tradeoff shifts in favor of the benefit of the tax shield and the bank employs more leverage in its capital structure.

3.2. Model 2: Bank Debt Provides Monitoring Incentives

In this case the bank's shareholders choose the bank's capital structure, but m is chosen by the bank's creditors. Again, this should not be interpreted literally as the creditors supplanting the bank's manager and choosing how much to monitor the borrower. Rather, it is meant to reflect a situation in which the bank's creditors are active in the bank's corporate governance and therefore influence the bank manager's decision of how much to invest in controlling borrower risk via monitoring. While one often thinks of debt discipline as coming from either the fact that debt is a "hard" claim on the firm and thus disciplines management by reducing discretionary cash flow (e.g. Hart and Moore, 1995), or from the threat of liquidation if management makes bad project choices (e.g. Calomiris and Kahn, 1991), the role of creditors in having a " voice" in the governance of the bank by watching over key decisions and using a variety of mechanisms (e.g. tightening covenants, increasing the price of credit, shortening the maturity of credit, or reducing the availability of credit) to rein in risk taking when they detect it is potentially just as important. For a given F_0 and q, the creditors choose m to maximize,

$$p(m)F_0 + \left[1 - p(m)\right]qV - K(m) \tag{8}$$

This maximization produces an optimal monitoring choice $m^0(F_0, q)$ as a function of F_0 and q. The bank's shareholders choose F_0, given a q, to maximize the total value of the bank given in (6). Once F_0 and D_0 are set, the bank's creditors choose m^0, and this choice is privately observed only by the creditors.[20] This now gives us our final result.

Proposition 3: *For any given F_0 and q, the bank's optimal monitoring, m^0, is such that $dm^0/dF_0 > 0$. The bank has an optimal capital structure that involves raising all of its financing from debt. Moreover, $dm^0(F_0^0, q)/dq < 0$.*

This proposition shows that with debt providing monitoring incentives, we also have the equilibrium provision of monitoring declining in the strength of creditor rights, q. The intuition can again be seen from (8). As q increases, the marginal benefit of monitoring to the bank's creditors

$$p'(m)\left[F_0 - qV\right] \tag{9}$$

declines.

In light of our earlier discussion, it should not be surprising that an all-debt capital structure is optimal for the bank. When debt is providing the monitoring incentives and also giving the bank a tax-shield benefit, the bank prefers to be all-debt financed. Any equity that it keeps will be merely to satisfy regulatory capital requirements. In practice, banks do face bankruptcy costs, just like other firms. We verify below that the introduction of a bankruptcy cost can generate an interior optimum for the bank's capital structure.

[20] Our model does not incorporate the threat of liquidation as a source of debt discipline (as in Calomiris and Kahn, 1991), for example) because doing so would make the model asymmetric across debt and equity in terms of the manner in which they provide discipline through monitoring, making a comparison of the efficacy of monitoring by debt relative to equity difficult. Thus, we standardize "monitoring" across these two financing sources.

Corollary 1: *Suppose there is a bankruptcy cost, $B(F_0)$, for the bank that is increasing and convex in the amount of indebtedness, and is incurred by the bank in the event of default, i.e., $B' > 0, B'' > 0$. Then there will be an interior optimal capital structure with debt, and the optimal debt level F_0^O, is decreasing in q, i.e., $dF_0^0 / dq < 0$.*

As we would expect, the presence of bankruptcy costs yields an interior optimal capital structure in which the monitoring and tax shield benefits of debt are traded off against the cost of bankruptcy. Moreover, a strengthening of creditor rights reduces the bank's expected loss in the event of the borrower's bankruptcy and hence reduces its demand for monitoring. This leads to a reduction in debt in the bank's capital structure since it is debt that is providing the monitoring benefits.[21]

3.3. Additional Issues

In this subsection, we take up two additional issues: (i) what will be the effect of creditor rights on bank capital structure with no monitoring, and (ii) what is the effect of an increase in *q* (stronger creditor rights) on the deposit interest rate?

In our model, because bank debt has a tax-shield advantage, bank equity will never be used if there is no monitoring, unless there is a bankruptcy cost, in which case it serves only to reduce expected bankruptcy costs. Therefore, as pointed out earlier, stronger creditor rights, which arguably lead to higher expected bankruptcy costs, tend to reduce debt in bank capital

[21] It is pertinent to note that bankruptcy costs in the model are independent of creditor rights, but one can imagine that stronger creditor rights would mean less room for shareholders to negotiate with creditors and avoid bankruptcy as creditors will be less willing to make any concessions to avoid bankruptcy. This is because creditors stand to collect more by forcing bankruptcy, and this makes bankruptcy more likely for financially-distressed firms, thereby increasing expected bankruptcy costs for all banks. Thus, our results will be made stronger by having bankruptcy costs depend on creditor rights.

structure. To the extent that we find evidence of an opposite effect, it further indicates a relevance for the equity monitoring channel.

As for the second question, note first that an increase in q induces the bank to choose a higher F_0 and a lower m^*. Now imagine that the bank can choose between the loan we have modeled (call it G) and a riskier loan (call it R) with a success (repayment) probability of $p(m)-\hat{p}$, where $\hat{p} \in (0, \overline{p}]$ is a positive constant, and a pledgeable income of $\hat{Y} > Y$. Assume that $p(m) > p(\tilde{m}) - \hat{p} \ \forall \ m, \tilde{m} > m^0$. This means that loan G has a higher success (repayment) probability than loan R, regardless of m. Let $\hat{m}$ be the optimal monitoring level chosen by the bank when it chooses the riskier loan R. Assume that the bank's choice of loan is unobservable to its financiers.

Now, suppose that at some $q=q_1$,

$$p(m^*)[Y - F_0][1-T] - K(m^*) > [p(\hat{m}) - \hat{p}][\hat{Y} - F_0][1-T] - K(\hat{m}) \tag{10}$$

Let LHS be the left-hand side of (10) and RHS be the right-hand side of (10). Then,

$$\partial LHS / \partial F_0 = -p(m^*)[1-T] \tag{11}$$

$$\partial RHS / \partial F_0 = -[p(\hat{m}) - \hat{p}][1-T] \tag{12}$$

Given our assumption,

$$\left|\partial LHS / \partial F_0\right| > \left|\partial RHS / \partial F_0\right| \tag{13}$$

Thus, the RHS of (10) falls more slowly than the LHS as F_0 increases. This means that even though (10) might hold at some level of $q=q_1$, the inequality could be reversed at some $q_2>q_1$. The bank's creditors will recognize this and further push up F_0 as q increases. If we interpret F_0/D_0 as (one plus) the deposit interest rate, then funding cost increases with q because a high enough q causes the bank to shift to loan R.

An increase in q has two opposite effects. On the one hand, it increases the payoff to the bank's creditors when the loan defaults. This reduces the bank's cost of funding. On the other hand, an increase in q leads to a higher F_0 and a lower m. This may induce the bank to choose the riskier loan R, leading to a higher interest rate for the bank on its own financing. We will examine which effect dominates when we conduct our empirical analysis.

4. Research design and data

4.1. Primary specification

The main prediction from our theoretical model is that an increase in creditor rights reduces the bank's incentive to monitor its borrowers, and that the bank shifts its capital structure away from equity and towards debt (if bank equity is providing the monitoring incentives) or away from debt and towards equity (if bank debt is providing monitoring incentives).

Rather than using cross-country variation in creditor rights first introduced by Laporta et al. (1998), we follow Djankov, McLiesh and Shleifer (2007) and Acharya, Amihud and Litov (2011) and use instances of legal reforms where countries either strengthened or weakened their creditor rights as identifying variation in creditor rights.[22] The advantage of using legal reforms is that rather than comparing bank capital structure across ordinal rankings of creditor rights (ranging from 0 to 4), we compare *changes* in bank capital structure within countries that *changed* creditor rights as compared to countries that did not change these rights.

[22] In addition to Acharya et al. (2011), other studies using the creditor rights index in a banking context are Houston, Lin, Lin and Ma (2010), Qian and Strahan (2007), Esty and Megginson (2003). For example, Qian and Strahan (2007) find that strong creditor rights lead to higher loan availability and lower interest rates. The impact of their findings on bank equity is not obvious, as more lending might increase the need for banks to hold equity, while lower interest rates would decrease this need.

Following Bertrand and Mullainathan (1999, 2003), we use a difference-in-differences (DiD) design where we compare changes in bank capital structure before versus after the event in reforming countries (treatment group) and benchmark these changes against those in non-reforming countries (control group). We define *Post* as an indicator variable that takes the value of 1 for the years after passage of the legal reform in the reforming countries. This captures the first level of differencing (pre versus post passage). To compare this change with that in non-reforming countries (the second level of differencing), we define *Inc* and *Dec* as two indicator variables that take the value of 1 for countries passing legal reforms that improved or retarded creditor rights respectively. The DiD effect is captured by the interaction terms *Inc*Post* and *Dec*Post*. All three indicators are set to 0 for banks in non-reforming countries. Following Acharya et al. (2011) we include year and country fixed effects and cluster our robust standard errors by country (Bertrand, Duflo and Mullainathan, 2004).[23] The empirical specification is as follows:

$$Equity = \alpha_c + \gamma_t + \beta_1 Inc * Post + \beta_2 Dec * Post + \delta X + \varepsilon \quad (14)$$

where, *Equity* is bank equity; α_c and γ_t represent country and year fixed effects respectively and *X* is a vector of bank-level and country-level controls. The country fixed effects not only absorb all time-invariant variation across countries (such as minimum capital requirements, the strength of the banking sector, differences in investor protection), but also whether countries passed legal reforms during our sample period. As a result, these fixed effects subsume the coefficients on *Inc* and *Dec*. Similarly, the year effects not only absorb the coefficient on *Post* but also control for intertemporal variation in minimum capital requirements that apply to our sample countries

[23] Our results are robust to clustering the standard errors by bank.

If bank equity encourages borrower monitoring, then our model predicts $\beta_1 < 0$ and $\beta_2 > 0$. On the other hand, if bank debt provides monitoring incentives, then our model predicts $\beta_1 > 0$ and $\beta_2 < 0$.

4.2. Variable definitions

Our dependent variable is book equity scaled by book assets (*Equity*) and follows the definition in prior studies (e.g., Mehran and Thakor, 2011; Gropp and Heider, 2010). We also examine bank deposits (*Deposits*) defined as the ratio of total deposits to total bank assets.

Our control variables fall into three categories – bank-level factors, controls for economic development across countries, and variation in financial market development across countries. We include the log of total bank assets to control for bank size (*Log assets*), growth defined as the annual change in total revenues (*Revenue change*), bank profitability defined as return on equity (*ROE*) and the proportion of loan loss provisions to net income to capture health of the loan portfolio (*LLP*). Prior studies (e.g., Flannery and Rangan, 2008) find that larger banks finance a smaller fraction of their assets with equity, so we expect a negative coefficient on *Log assets*. If dividends tend to be sticky, then more profitable banks will accumulate equity faster, which leads to the prediction of a positive coefficient on *ROE* (e.g., Flannery and Rangan, 2008; Nier and Baumann, 2006; Berger, Herring and Szego, 1995). A similar argument extends to revenue growth, so the coefficient on *Revenue change* is expected to be positive. While a higher loan loss provision reduces equity, the two could also be positively associated if riskier banks make greater provisions and also hold more equity (e.g., Nier and Baumann, 2006; Ayuso, Perez and Saurina, 2004). We therefore do not make a directional prediction on *LLP*.

We follow Laeven and Levine (2007, 2009) and control for lending market concentration (*Loan market conc*) using a loan-based Herfindahl index computed at the country-year level. In addition to capturing the essence of Allen et al.'s (2011) model where bank equity and loan market concentration act as substitutes, *Loan market conc* also proxies for bankruptcy costs as greater concentration denotes more rents lost in bankruptcy (the charter value hypothesis, Hellmann, Murdock and Stiglitz, 2000). Turning to the other country-level controls, we include both the level of GDP (*Log GDP*) as well as annual growth in GDP (*GDP growth*) to capture differences in economic development across countries. We also control for the annual inflation rate (*Inflation*). Further, we control for differences in financial market development across countries by including the log of the ratio of equity market cap of listed companies to GDP (*Log equity market cap*), the log of stock market turnover of listed firms to GDP (*Log turnover*) and the log of international trade (*Log trade*) defined as the sum of exports and imports divided by GDP. As these variables are defined at an annual frequency for each country, they are identified even in the presence of country and year fixed effects. Making ex-ante predictions on the signs of the country-level controls is difficult. Our intent here is to ensure that we are appropriately capturing additional time-varying macroeconomic factors that might be correlated with countries' decisions to pass legal reforms.

4.3. Sample

Our data are from several sources. Dates of passage of legal reforms are obtained from Appendix A of Djankov, McLiesh and Shleifer (2007, pg. 326). Bank capital structure and other accounting data are from Bankscope, a commercial database provided by Bureau van Dijk on major international banks. Macroeconomic variables that capture differences in economic and financial development are from the World Development Indicators (WDI) database of the

World Bank. We follow Laeven and Levine (2007) and delete banks with total asset of less than US$ 100 million, and also banks classified as "Islamic banks" since, as noted by Laeven and Levine (2007), the accounting information of these banks does not match the rest of the sample.

Our treatment group comprises 14 legal reform events (Bulgaria in 2000, Finland in 1993, Indonesia in 1998, Israel in 1995, Japan in 2002, Kazakhstan in 2001, Lithuania in 1998, Romania in 2003, Russia in 2004, Spain in 2004, Sweden in 1995, Thailand in 1999, Ukraine in 1999 and Uruguay in 2001) and consists of 11,623 bank-year observations over the period from 1990 to 2009.[24] Djankov et al. (2007) list 32 instances of legal reforms over the period 1978 – 2004. Out of these, we exclude 8 instances (Austria in 1982, Denmark in 1984, United Kingdom in 1985, Ireland in 1990, Canada in 1992, India in 1993, Russia in 1994, and Romania in 1994) where the year of passage does not allow enough observations in the pre-period. Further, we exclude 5 instances (Armenia, Azerbaijan, Mongolia, Niger and Malawi) that are not on Bankscope.

Of the remaining 19 instances, Japan weakened creditor rights in 2000 but strengthened them shortly thereafter in 2002. To cleanly identify the more recent event, we drop observations for Japanese banks prior to 2000. Similarly, since Kazakhstan strengthened creditor rights in 1997 and 1998 only to weaken them subsequently in 2001, we retain observations from 1997 onwards to identify the latter. [25] Further, we combine the two closely occurring instances of creditor rights increases for Lithuania (in 1995 and 1998) into the latter. Finally, while Russia weakened creditor rights in 1998 and strengthened them in 2004, we use the latter as most observations for Russian banks fall in the post 1998 period.

We form two sets of control groups – (i) a matched sample where we select non-reforming countries that are similar to the reforming countries using a propensity-score based

[24] We end the sample at 2009 as it corresponds to five years after the most recent legal reforms in 2004.
[25] Our results are robust to identifying the former event in each case.

matching technique, and (ii) all countries that did not pass legal reforms. We use the propensity-score based matching technique based on macroeconomic characteristics, and estimate a cross-sectional probit model using data from the year prior to passage of legal reforms.[26] The countries that comprise this matched control group are – Austria, Belgium, China, Germany, Ireland, Morocco, Nigeria, Oman, Pakistan, Poland, Portugal, Slovenia, Switzerland and Venezuela, and the final sample consists of 28,954 bank-year observations. Appendix 3 tabulates the results of the propensity-score based matching model. The second control group of all non-reforming countries consists of 62,479 bank-year observations and includes 61 countries around the world.

Table 1 presents the list of reforming countries along with the year of passage of legal reforms. As can be seen, the event years are fairly scattered over the sample period, which further aids in identification. *Table 1* also tabulates countries that comprise the two control groups.

5. Results

5.1. Summary statistics

Table 2 presents summary statistics of the entire sample. The average bank funds around 8.4% of its assets using equity, and around 74.8% using deposits. The sample exhibits wide cross-sectional variation in bank size with the average bank having assets of US$1.6 billion ($e^{7.4}$). The smallest bank in the sample has assets of US$116 million while the largest bank has US$ 366 billion. Revenue change in the average bank is almost stagnant with a small decline of 0.2%. This bank has a return on equity of 8.6%, loan loss provisions that amount to 18.36% of net income. The average bank pays an annual interest cost of 3.9% of total liabilities and finances

[26] Our results are robust to using three years or five years before the passage date.

around 4.5% of its asset base using money-market funding and 7.5% using subordinated debt and bonds. With respect to bank risk-taking, the mean *Zscore* of 3.704 indicates that bank profits have to fall by 40 standard deviations before they can wipe out both capital and profits.

Turning to the country-level variables, the banking industry is fairly competitive with the mean value of loan market concentration at 849.038. The highest value is 7,335 which is well below the maximum possible value of 10,000. The economy-wide indicators depict modest growth with the annual growth in GDP amounting to 2.1% and an annual inflation rate of 3.4%. Finally, the average equity market cap, turnover and international trade are 59%, 80% and 53% of GDP respectively. Overall, our sample depicts rich heterogeneity with respect to bank-level characteristics such as capital, size and profitability as well as macro-level factors such as economic and financial development.

5.2. Multivariate evidence

Table 3 presents the main results of eq. (14). We start with bank equity (*Equity*) as the dependent variable and present three specifications. First, we restrict the sample to the reforming countries. The staggered nature of the legal reform passage allows us to identify an effect of legal reforms within this sample. The second specification presents results using the propensity-score based control group while the third specification uses all non-reformers as the control group.

Our results are consistent across all three specifications and indicate that the coefficient on *Inc*Post* is negative and significant while that on *Dec*Post* is positive and significant. In terms of economic significance, given the pre-passage mean *Equity* of 7.78%, the coefficient of -1.204 on *Inc*Post* in Model (3) signifies a 15% decrease in equity while that on *Dec*Post* indicates an 18% increase. Results based on the matched-sample design are slightly stronger and indicate a

22% decrease and a 24% increase in bank equity after a strengthening and weakening of creditor rights respectively. These results indicate that increases (decreases) in creditor rights lead to banks shifting their capital structure away from (towards) equity. Given our theoretical model, we interpret these results as evidence that bank equity is the primary form of monitoring-inducing financing, and that banks substitute away from equity when strong creditor rights reduce their need to monitor their borrowers.

Since deposits are the channel through which debt-based monitoring is hypothesized to work, we perform a sharper test of the theory by examining the effect of creditor rights on bank deposits (*Deposits*). We are careful to control for other sources of financing in this specification, viz., the extent of money-market funding (*MM funding*) and the amount of subordinated debt (*Subordinated debt*) defined as subordinated debt, hybrid capital, convertible bonds, mortgage bonds, and other bonds scaled by total assets. Consistent with our equity-based monitoring results, we find in Models (4) to (6) of Table 3 that the coefficient on *Inc*Post* is positive and significant and that on *Dec*Post* is negative and significant. This means that stronger creditor rights result in banks shifting away from equity and more importantly, towards deposits. These results further validate our inferences as the theory pitches bank equity and bank deposits as the competing sources of financing that incentivize borrower monitoring.

5.3. Parallel trends and other validation tests

Table 4 presents results of additional validation tests of our main inferences. First, we examine the effects of creditor rights increases and decreases individually rather than in a single specification. Doing so has the advantage of allowing the control variables to differ between the two events. Model (1) of Table 4 indicates that the coefficient on *Inc*Post* remains negative and significant around creditor rights increases, while Model (4) shows that the coefficient on

*Dec*Post* remains positive and significant around creditor rights decreases. Second, we include bank fixed effects rather than country fixed effects as a sensitivity tests. Our results are again robust. Models (2) and (5) indicate that the coefficient on *Inc*Post* and *Dec*Post* remain negative and significant and positive and significant respectively.

An important assumption in DiD designs is that the treatment and the control groups behave in a similar fashion prior to the treatment (i.e., the parallel trends assumption). This assumption could be violated if there are differential time-trends in bank equity between the treatment and control groups that started prior to legal reform passage, or if legal reforms were the result rather than the driver of lower bank equity. To address these concerns, we follow Bertrand and Mullainathan (2003) and examine whether anticipatory effects preceded legal reform passage. We create two indicator variables *Post (-2)* and *Post (-1)* to denote the two years preceding the year of passage of legal reforms and interact these with *Inc* and *Dec*. If the parallel trends assumption is satisfied, then the coefficients on *Inc*Post (-2)*, *Inc*Post (-1)*, *Dec*Post (-2)* and *Dec*Post (-1)* should all be insignificant.

This is exactly what we find. The coefficients on *Inc*Post (-2)* and *Inc*Post (-1)* in Model (3) of *Table 4* are all insignificant, indicating no difference in bank equity between the treatment and the (propensity-score-based) control group in the period preceding the event. Similarly, the coefficients on *Dec*Post (-2)* and *Dec*Post (-1)* are also insignificant in Model (6) of *Table 4*. These results indicate no differential trend in bank equity between reforming countries and non-reforming countries in the years leading up to legal reform passage. This facilitates our analysis of the effect of legal reform passage on bank equity and helps to disentangle the treatment effect from a possible time-trend or reverse causality effect.

5.4. Ruling out the liability-side channel: creditor rights and the cost of bank debt

Can our results be explained by the liability-side of the bank's balance sheet? In other words, do banks take on less equity when creditor rights get stronger merely because the legal environment now offers greater protection to the bank's creditors?

We do not find this alternative explanation appealing on conceptual grounds for two reasons. First, it is inconsistent with prior evidence. For example, Vig (2013) and Acharya et al. (2011) find that stronger creditor rights result in industrial firms taking on less debt (i.e., more equity) whereas we find the opposite effects for banks. We argue that this difference arises because creditor rights affect banks in a fundamentally different way (i.e., via the asset-side) as compared to industrial firms. Second, banks' cost of debt is less likely to be impacted by changes in creditor rights as bank funding is generally insulated from market shocks by explicit (and implicit) safety nets that provide guarantees to bank debt holders against possible distress.

Further, our primary results on bank deposits also help rule out this interpretation because bank deposits are unlikely to be covered under bankruptcy law, and are not protected by creditor rights. We nevertheless explore this interpretation further by examining how creditor rights affect the cost of bank debt. If stronger creditor rights encourage bank creditors to lend more freely to the bank, then we expect to see a lower interest cost on the bank's funding. On the other hand, our theoretical model (in Section 3.3) predicts that banks' cost of debt could possibly rise in response to the strengthening of creditor rights due to the higher asset-substitution moral hazard brought about by the higher leverage.

To test these opposing predictions, we regress the bank's *Cost of debt* (defined as the ratio of annual interest expense to total liabilities) on *Inc*Post*, *Dec*Post* and controls.[27] We also

[27] To ensure that our inferences are not confounded by the recent financial crisis, we restrict the sample period in these tests until 2005.

examine how the presence of government safety nets influences this overall effect. We do so in two ways – first we decompose legal reformers into high and low safety net groups (*Inc_HighSafety* and *Inc_LowSafety*; *Dec_HighSafety* and *Dec_LowSafety*) and estimate the primary specification using these indicators. Second, we split the entire sample into high and low safety net groups and examine the effect of legal reform passage within each sub-sample. The advantage of the latter design is that it allows the non-reforming group and also the control variables to vary between the high and low safety-net groups. We categorize countries into high and low safety-net groups based on data from Demirguc-Kunt and Huizinga (2004) on the presence of an explicit deposit insurance scheme and whether countries' insurance premiums are risk-adjusted. High-safety-net countries are those with an explicit deposit insurance scheme and where the premiums are not risk-adjusted, while all other countries are classified as low-safety-net.

Table 5 presents these results. In sharp contrast to conventional wisdom, but consistent with our theoretical model, we find that a strengthening of creditor rights *increases* the bank's cost of debt; while a weakening does the opposite. Our theory suggests that this may be because the higher leverage by banks in response to a higher q is inducing banks to make riskier loans. Further, results from Models (2) to (4) indicate that the increase in cost of debt after a strengthening of creditor rights is concentrated in countries with high government guarantees in place. In particular, the coefficient on *Inc_HighSafety*Post* is positive and significant, while that on *Inc_LowIncent*Post* is insignificant. Further, these coefficients are significantly different from one another (p-value of 0.052). These inferences are robust to the split-sample design – the coefficient on *Inc*Post* and *Dec*Post* are significant only in the *HighSafety* sub-sample but not in the *LowSafety* sub-sample. Overall, these results indicate that stronger creditor rights lead to increases in banks' cost of debt, especially in countries with high safety nets. More importantly,

they provide assurance that our results are not driven by the liability-side effect of creditor rights on the bank's balance sheet.

5.5. Is the higher cost of bank debt due to greater bank risk-taking?

We probe the above results further to see if they might indeed be consistent with a risk-taking story, as suggested by our theoretical model in Section 3.3. That is, the increase in bank leverage induced by the strengthening of creditor rights increases the bank's risk appetite, especially when government safety nets encourage such risk-taking behavior. This interpretation predicts an increase (decrease) in bank risk taking after a strengthening (weakening) of creditor rights, especially in countries with high safety nets.

To test this prediction, we examine the effect of legal reform passage on bank risk taking and condition this effect on high versus low safety-nets. We measure bank *Risk taking* using the distance-to-default measure, which is the inverse measure of the likelihood of insolvency and where lower values indicate greater bank risk (Roy, 1952; Boyd and Runkle, 1993; Laeven and Levine, 2009). *Risk taking* is defined as (the log of) return on assets plus the capital asset ratio divided by the standard deviation of asset returns. *Table 6* presents these results. Model (1) presents the single specification results, while Models (2) and (3) present those based on the split-sample. Consistent with our predictions, a strengthening (weakening) of creditor rights increases (decreases) bank risk-taking but only in countries with high-safety-nets. In particular, the coefficient on *Inc_HighSafety*Post* is negative and significant while that on *Inc_LowSafety*Post* is insignificant. Further, these coefficients are significantly different from each other (*p*. value = 0.009). Similarly, *Dec_HighSafety*Post* comes in positive and significant while *Dec_LowSafety*Post* is insignificant, with these coefficients again being significant different. Overall, these results indicate that the increase in bank leverage brought about by

stronger creditor rights increases banks' risk appetite, especially when the political economy provides banks with government guarantees via strong safety-nets.

5.6. Endogeneity of legal reform passage

In this section, we examine the concern that the passage of legal reforms is itself endogenous and could potentially confound our inferences. For example, countries' passage of legal reforms might be correlated with macroeconomic conditions, which brings back the identification problem. While we use a propensity-score based matched sample, this only controls for observable differences between treatment and control countries. To satisfactorily address concerns about *unobservable* differences between reforming and non-reforming countries, one needs to include country-times-year fixed effects (i.e., separate year indicators for each country). These would absorb *all* time-varying, country-specific factors and would adequately control for both unobservable and observable macroeconomic factors correlated with legal reform passage. However, the drawback is that these country-times-year fixed effects would also absorb the coefficients of interest, i.e., *Inc*Post* and *Dec*Post*. Identifying an (arguably causal) effect of legal reforms under this design requires within-country-year variation in the effect of creditor rights.

To do so, we use differences in banks' business models. In particular, we predict that the effect of creditor rights will be stronger for banks that are in the business of making loans (i.e., relationship banks) rather than those that are in the trading business (i.e., transaction banks). To capture lending-based versus fee-based banks, we define *Lend* as the proportion of interest revenue to total revenue (i.e., interest revenue plus trading income plus fees and commissions)

and interact it with *Inc*Post*.[28] The coefficient on *Inc*Post*Lend* captures the incremental effect of creditor right increases on lending-based banks as compared to fee-based banks. In addition to country-times-year fixed effects (that subsume the coefficient on *Inc*Post*), we also include bank fixed effects to capture all time-invariant differences across banks within each country, and additionally interact *Lend* with *Increase* and with *Post* (see Gormley and Matsa, 2014 for a discussion of two-dimensional, high-frequency fixed effects).

Table 7 presents these results. The first set of specifications presents results for bank *Cost of debt* while the next set pertains to *Risk taking*. Consistent with our previous tests, we conduct separate analyses for the high and low safety-nets groups. Consistent with our expectation, the effect of creditor rights increases is stronger for lending-based banks as compared to fee-based banks. In particular, the coefficient on *Inc*Post*Lend* is positive and significant in the cost of debt specification and negative and significant in the risk-taking specification, but only for countries with high-safety-nets. Consistent with our previous results, there is no elevated risk taking or cost-of-debt in lending-based banks that are domiciled in countries with low-safety-nets.

One concern is that countries might be initiating legal reforms to achieve desired outcomes in lending banks. In that case, the endogeneity problem persists. We find this possible interpretation unlikely for two reasons. First, one would have to argue that such preemptive passage of reforms is more likely to occur in countries with government safety nets – which seems quite ad hoc. Second, the political economy of banking tends to be driven by other factors related to bank size (such as too-big-to-fail) rather than to lending focus. To ensure that bank size is not correlated with lending focus, we compare the ratio of interest revenue to total

[28] We are able to perform this test only for creditor rights increases because including country-times-year fixed effects does not leave enough degrees of freedom, given that only 1 country (Ukraine with 233 observations) decreased creditor rights in the high safety nets group. This issue did not arise in the prior tests where we included country *and* year fixed effects (rather than country-*times*-year effects).

revenue across the smallest and largest deciles of bank size in our sample. We find no evidence of any systematic differences in lending focus across these deciles. The proportion of interest revenue to total revenue is around 77% for the smallest banks and 76% for the largest ones. Overall, these results provide assurance that our inferences are not confounded by the endogeneity of legal reform passage.

5.7. Using loan portfolio risk to measure risk-taking

We have thus far relied on the distance-to-default measure to capture bank risk taking. While this is a comprehensive measure of risk taking, it requires five years of historical data, which could pose a survivorship bias problem. To mitigate this concern, we follow Berger, Klapper and Ariss (2008) and use the ratio of non-performing loans to total loans (*Non Performing Loans*) as an alternative measure of bank risk taking. While this measure is available at an annual frequency, it captures only loan portfolio risk and not overall bank risk. Further, these data are not reported for all banks, which limits the generalizability of our results.

With the above caveats in mind, we present results in the last set of specifications in *Table 7*. We are careful to expand our sample to also include banks with less than five years' data. Consistent with our earlier results, we find that the coefficient on *Inc*Post*Lend* is positive and significant in countries with high safety nets, but insignificant in countries with low safety nets. Further, these coefficients are statistically different from each other. These results indicate that stronger creditor rights increase loan portfolio risk, but only when government guarantees are in place. More importantly, these results provide assurance that our results do not hinge on how we measure bank risk taking.

6. Conclusion

Financial intermediation theories posit that bank capital structure plays a key role in encouraging borrower monitoring by the bank. Rather than testing this theory by regressing bank monitoring on bank capital structure – an approach fraught with endogeneity and lack-of-observability problems – we use variation in country-level creditor rights to capture the bank's need to monitor its borrowers. We present a theoretical model in which stronger ex-post rights offered to creditors (i.e., banks) during renegotiation/default reduces their ex-ante incentives to monitor. We then use this model to show that if equity (debt) provides the bank with monitoring incentives, then a strengthening of creditor rights will induce the bank to tilt its capital structure in favor of more debt (equity). Thus, we examine how banks modify their capital structures in response to changes in country-level creditor rights offered by the legal regime, and the theory generates predictions about these capital structure responses that enable us to run an empirical horse race between the monitoring-inducing roles of bank equity and bank debt.

We find strong evidence that an improvement in creditor rights (which reduces the need for banks to monitor their borrowers) results in banks shifting their capital structures away from equity and towards deposits. Given our theory, we interpret these results as evidence that bank equity, rather than bank deposits, is the primary source of financing that incentivizes borrower monitoring by the bank, and that banks' marginal demand for this financing falls as they experience a lesser need to monitor their borrowers.

We perform several sensitivity tests to rule out supply-side effects (i.e., bank creditors are more willing to lend to the bank when creditor rights become stronger). We extend our theoretical model to examine the effect of creditor rights changes on the liability side of banks' balance sheets. Consistent with our theoretical prediction, we find that stronger creditor rights

in fact *increase* banks' cost of debt, especially when the political economy offers strong government guarantees to banks. These results are not only inconsistent with supply-side effects, but also indicate that stronger creditor rights need not always be "better" and that the legal regime interacts with the political economy of banks in rather intricate ways. We show that this concoction, can at times, result in seemingly "good" outcomes such as a strengthening of creditor rights bringing about unintended consequences in the form of greater bank risk taking and higher cost of bank debt. Given the pivotal role of banks in the economy, we hope that our study spurs further research on a host of related issues such as the effect of these interactions on bank liquidity creation and economic growth. We hope, in future research, to explore the economic reasons – apart from the distorting effects of government safety nets – for the apparent reluctance of banks to hold equity, and capital-structure spillover effects across banks when multiple banks monitor the same group of borrowers.

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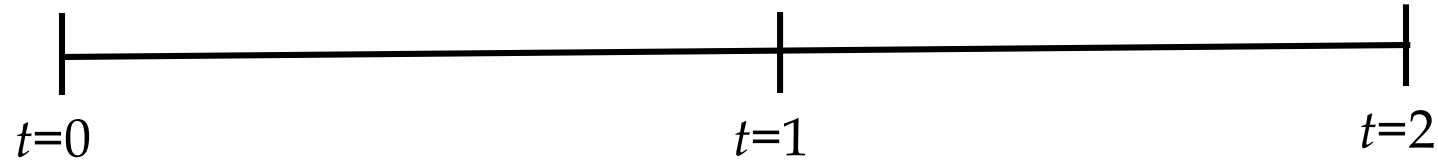
Appendix 1: Model timeline with sequence of events



- Bank makes $1 loan to finance the borrower's project.
- Bank chooses capital structure to finance loan.
- Borrower's maximum pledgeable income is $Y \in (0, X)$ with $Yp > 1$.
- Bank has enough market power to set repayment = Y.
- Riskless rate=0
- Risk neutrality

- Bank conducts monitoring.
- Bank's monitoring m affects: $p(m)$, $p' \geq 0, p'' < 0$.
- Cost of monitoring for bank shareholders is $K(m),\ K' > 0,\ K'' > 0$.
- m privately observed by bank's shareholders

- Borrower's project pays off X w.p. $p \in (0,1)$ and 0 w.p. $1-p$.
- Borrower's maximum pledgeable income $= Y \in (0, X)$.
- Borrower has non-project assets worth $V \in (0, Y)$.
- If q="creditor rights", then bank recovers qV in case borrower defaults

Appendix 2: Proofs

Proof of Proposition 1: Suppose first that $qV \geq F_0$. Then from (2) we see that the bank maximizes

$$p[Y - F_0][1-T] + [1-p][qV - F_0][1-T] - K \tag{A-1}$$

with its choice of *m*. The first-order condition is:

$$p'[Y - F_0][1-T] - p'[qV - F_0][1-T] - K' = 0$$

or

$$p'[Y - qV][1-T] - K' = 0 \tag{A-2}$$

The second-order condition for a unique optimum is:

$$p''[Y - qV][1-T] - K'' < 0 \tag{A-3}$$

which holds since $Y > qV$, $p'' < 0$ and $K'' > 0$. Now totally differentiating (A-2) yields:

$$\{p''[Y - qV][1-T] - K''\}\left(\frac{dm^*}{dq}\right) - p'V[1-T] = 0$$

which means

$$\frac{dm^*}{dq} = \frac{p'V[1-T]}{p''[Y - qV][1-T] - K''} \tag{A-4}$$

$$< \quad 0 \quad \text{since } p' > 0 \text{ and the denominator is (A-3).}$$

Now consider $qV < F_0$. The bank chooses *m* to maximize (from (2)):

$$p[Y - F_0][1-T] - K \tag{A-5}$$

The first-order condition is:

$$p'[Y - F_0][1-T] - K' = 0 \tag{A-6}$$

and the second–order condition is :

$$p''[Y - F_0][1-T] - K'' < 0 \tag{A-7}$$

which is obviously satisfied. Thus, there exists a unique optimal value of *m*, say *m**. □

Proof of Proposition 2: The bank chooses F_0 to maximize (6). The first-order condition is given by:

$$\left[\frac{dm^*}{dF_0}\right]\left\{p'\left[Y\left[1-T\right]+F_0T-qV\right]-K'\right\}+pT=0 \tag{A-8}$$

Now, in the case of risky debt, totally differentiating (A-6), we see that

$$\left\{p''\left[Y-F_0\right]\left[1-T\right]-K''\right\}\left(\frac{dm^*}{dF_0}\right)-p'\left[1-T\right]=0$$

or

$$\frac{dm^*}{dF_0}= \qquad \frac{p'\left[1-T\right]}{p''\left[Y-F_0\right]\left[1-T\right]-K''} \tag{A-9}$$

which means

$$\frac{dm^*}{dF_0} \;<\; 0 \tag{A-10}$$

Now, if the bank's optimal capital structure involved riskless debt, then from (A-2) it is apparent that $dm^*/dF_0=0$. Going back to (A-8) and plugging in $dm^*/dF_0=0$, we would have

$$pT>0\ ,$$

which clearly violates (A-8). Hence, if debt is riskless, the bank will wish to increase F_0 until (A-8) is satisfied, which requires $dm^*/dF_0<0$ (consistent with risky debt), since

$$\begin{aligned}
&p'\left[Y\left[1-T\right]+F_0T-qV\right]-K' \\
&=p'\left\{\left[Y-F_0\right]\left[1-T\right]+F_0\left[1-T\right]+F_0T-qV\right\}-K' \\
&=p'\left[Y-F_0\right]\left[1-T\right]-K'+p'\left[F_0-qV\right] \\
&=p'\left[F_0-qV\right] \quad \text{after substituting from (A-6)} \\
&>0 \quad \text{since } p'>0 \text{ and } F_0>qV.
\end{aligned}$$

Thus, we have proved that the F_0^* satisfying (A-8) involves risky debt.

The result that $dF_0^*/dq>0$ follows immediately from inspecting (A-8). An increase in q reduces the positive quantity inside the braces in (A-8) which multiplies dm^*/dF_0. Since $dm^*/dF_0<0$, this means that at the previously optimal F_0 that corresponded to a lower value

of q, the quantity in (A-8) becomes positive, implying that the F_0^* corresponding to the higher value of q must be higher. That is, choose $q_1 < q_2$. Then if $F_0^*(q_1)$ is optimal for q_1, we have

$$\left[\frac{dm^*}{dF_0}\right]\left\{p'\left[Y\left[1-T\right]+F_0^*(q_1)T-q_1V\right]-K'\right\}+pT=0 \tag{A-11}$$

implying that

$$\left[\frac{dm^*}{dF_0}\right]\left\{p'\left[Y\left[1-T\right]+F_0^*(q_1)T-q_2V\right]-K'\right\}+pT>0 \tag{A-12}$$

which means

$$F_0^*(q_2) > F_0^*(q_1)$$

since this will be needed to return (A-12) to an equality. Thus, $dF_0^*/dq > 0$.

Finally, we will prove that $dm^*/dq < 0$, taking into account the optimal F_0^* . Let q_1 and q_2 with $0 < q_1 < q_2 < 1$ be two possible values of q. Define $F_0^*(q_1)$ and $F_0^*(q_2)$ as the corresponding optimal face values of debt. We have shown that $F_0^*(q_2) > F_0^*(q_1)$. Go back to the first-order condition (A-6) for q_1:

$$p'(m_1^*)\left[Y-F_0^*(q_1)\right]\left[1-T\right]-K'(m_1^*)=0 \tag{A-13}$$

where m_i^*, i=1,2, represents the optimal monitoring level corresponding to q_i. So, given $F_0^*(q_2)$ $> F_0^*(q_1)$, we know that

$$p'(m_1^*)\left[Y-F_0^*(q_2)\right]\left[1-T\right]-K'(m_1^*)<0$$

which implies that m_2^* satisfying

$$p'(m_2^*)\left[Y-F_0^*(q_2)\right]\left[1-T\right]-K'(m_2^*)=0$$

must satisfy $m_2^* > m_1^*$, given the concavity of the $p\left[Y-F_0\right]\left[1-T\right]-K$ function in m. □

Proof of Proposition 3: Since m is chosen to maximize (8), we can write the first-order condition as:

$$p'(m^0)\left[F_0-qV\right]-K'(m^0)=0 \tag{A-14}$$

The second-order condition is:

$$p''(m^0)\left[F_0-qV\right]-K''(m^0)<0 \tag{A-15}$$

which is clearly satisfied. Now totally differentiating (A-14) yields:

$$p''\left[F_0 - qV\right]\left(\frac{dm^0}{dF_0}\right) - K''\left(\frac{dm^0}{dF_0}\right) + p' = 0 \tag{A-16}$$

which means

$$\frac{dm^0}{dF_0} = \frac{-p'}{\left\{p''\left[F_0 - qV\right] - K''\right\}}$$

$$> 0 \tag{A-17}$$

The bank chooses F_0 to maximize (6). The first-order condition is,

$$\left\{p'\left[Y\left[1-T\right] + F_0T - qV\right] - K'\right\}\left\{\frac{dm^0}{dF_0}\right\} + p(m)T = 0 \tag{A-18}$$

Now note that

$$Y\left[1-T\right] + F_0T > F_0$$

since

$$Y\left[1-T\right] > F_0\left[1-T\right]$$

Thus,

$$p'\left[Y\left[1-T\right] + F_0T - qV\right] - K'$$
$$> p'\left[F_0 - qV\right] - K'$$
$$= 0 \qquad \text{(by (A-14))}$$

Returning to (A-18), this means that

$$\left[p'\left[Y\left[1-T\right] + F_0T - qV\right] - K'\right]\left\{\frac{dm^0}{dF_0}\right\} + p(m)T > 0 \tag{A-19}$$

Since $\frac{dm^0}{dF_0} > 0$ and $p(m)T > 0$. This implies that there is no interior optimum and the bank chooses the maximum F_0 that is consistent with $D_0 = 1$.

Now the bank's debt (with $D_0 = 1$) is priced as follows:

$$p(m^0)F_0 + \left[1 - p(m^0)\right]qV - K(m^0) = D_0 = 1 \tag{A-20}$$

Holding fixed m^0, it is clear that F_0 is decreasing in q, i.e., $dF_0/dq < 0$.

Next, observe that given any F_0, it is clear from (A-14) that

$$\frac{dm^0}{dq} = \frac{p'V}{p''\left[F_0 - qV\right] - K''}$$

$$< 0 \qquad \text{(A-21)}$$

Finally, we consider how m^0 responds to q, taking into account the optimal choice of F_0. Consider two values of q, say q_1 and q_2, with $0 < q_1 < q_2 < 1$. Then, using (14), and denoting $m_0(q_i)$ as the optimal monitoring choice corresponding to $q_i, i = 1, 2$, and $F_0^0(q_i)$ as the optimal debt face value corresponding to q_i, we have:

$$p'(m_0(q_1))\left[F_0^0(q_1, m^0(q_1)) - q_1 V\right] - K'(m^0(q_1)) = 0 \qquad \text{(A-22)}$$

which means

$$p'(m_0(q_1))\left[F_0^0(q_2, m^0(q_1)) - q_2 V\right] - K'(m^0(q_1)) < 0 \qquad \text{(A-23)}$$

since $F_0^0(q_2, m^0(q_1)) < F_0^0(q_1, m^0(q_1))$ and $q_2 V > q_1 V$. Given the concavity of the bank's creditors' objective function in *m*, it follows that:

$$m^0(q_2) > m^0(q_1)$$

Thus, we have proved that $dm^0(F^0, q)/dq < 0$ □

Proof of Corollary 1: With a bankruptcy cost, the objective function to maximize in the choice of F_0 becomes:

$$pY[1-T] + pF_0 T + [1-p][qV - B] - K \qquad \text{(A-24)}$$

The first-order condition for the optimal F_0 is:

$$\{p'A - K'\}\{dm^0/dF_0\} - [1-p]B' + pT = 0 \qquad \text{(A-25)}$$

where

$$A \equiv Y[1-T] + F_0 T - qV + B \qquad \text{(A-26)}$$

The second-order condition (SOC) is:

$$\{p''A - K''\}\{dm^0/dF_0\}^2 + 2[p'T + p'B'][dm^0/dF_0] - [1-p]B'' < 0 \qquad \text{(A-27)}$$

Now from (A-17) we know that

$$dm^0 \Big/ dF_0 = \frac{-p'}{\{p''[F_0 - qV] - K''\}}$$

and since $\lim_{m\to\infty} K' = \infty$, we know that K'' becomes arbitrarily large as *m* becomes large, implying that

$$\lim_{m\to\infty}\{dm^0/dF_0\} = 0 \qquad \text{(A-28)}$$

Since $B' > 0$ and $B'' > 0$, it is clear from (A-27) that $\exists\, F_0 < 1$ э (A-27) will be satisfied.

Now totally differentiating the first-order condition (A-25) yields:

$$[SOC]\{dF_0/dq\} - p'V\{dm^0/dF_0\} = 0 \qquad \text{(A-29)}$$

which gives:

$$dF_0/dq = \frac{p'V\{dm^0/dF_0\}}{SOC} \qquad \text{(A-30)}$$

$$< 0 \quad \text{since } dm^0/dF_0 > 0 \text{ and } SOC < 0 \qquad \square$$

Appendix 3: Propensity-score based matching model

The dependent variable in the probit model is an indicator variable *Reform* that denotes countries that passed legal reforms during the sample period. *Pvt credit* denotes the ratio of private credit to GDP. *Log equity market cap* indicates the log of equity market cap to GDP. *Log trade* denotes the log of international trade. *Log GDP* denotes the log of GDP, while *GDP growth* denotes the annual growth in GDP. *Inflation* indicates annual inflation. The probit regression contains robust standard errors. *P*-values are based on two-tailed tests.

	Probability of passing legal reforms Pr (*Reform* = 1)	
	Coeff.	*p*-val.
Intercept	-2.735	<0.001
Pvt credit	0.880	0.048
Log equity market cap	-1.655	0.016
Log trade	0.073	0.894
Log GDP	0.026	0.667
GDP growth	0.032	0.461
Inflation	0.019	0.079
Pseudo R^2	0.061	
Obs.	510	

Table 1: List of reforming and non-reforming countries

This panel provides the list of sample countries. The treatment group entitled "Reforming countries" denotes countries that passed legal reforms during the sample period. The year of passage is indicated in the column titled "Year". *Inc* and *Dec* denote reforms that increased and decreased creditor rights respectively. "Non-reforming countries" denotes countries that did not pass legal reforms during the sample period and represents two sets of control groups - "Matched" denotes non-reforming countries that have been matched to the reforming countries using a propensity-score based matching technique; and "All" which denotes the universe of non-reforming countries.

Reforming countries				**Non-reforming countries**					
Country	**Obs.**	**Year**	***Inc/Dec***	**Matched**		**All**			
				Country	**Obs.**	**Country**	**Obs.**	**Country**	**Obs.**
Bulgaria	175	2000	*Inc*	Austria	2,157	Argentina	764	Latvia	203
Finland	212	1993	*Dec*	Belgium	879	Australia	780	Lebanon	342
Indonesia	556	1998	*Dec*	China	505	Austria	2,322	Malaysia	987
Israel	241	1995	*Dec*	Germany	18,934	Bangladesh	239	Mexico	452
Japan	4,403	2002	*Inc*	Ireland	226	Belgium	937	Morocco	185
Kazakhstan	109	2001	*Dec*	Morocco	178	Bolivia	105	Netherlands	536
Lithuania	125	1998	*Inc*	Nigeria	397	Brazil	1,364	New Zealand	175
Romania	159	2003	*Inc*	Oman	115	Canada	661	Nigeria	407
Russia	1,309	2004	*Inc*	Pakistan	284	Chile	455	Norway	1,130
Spain	2,833	2004	*Inc*	Poland	450	China	515	Oman	124
Sweden	765	1995	*Dec*	Portugal	599	Colombia	364	Pakistan	308
Thailand	445	1999	*Dec*	Slovenia	233	Costa Rica	167	Panama	414
Ukraine	233	1999	*Dec*	Switzerland	3,709	Croatia	296	Paraguay	34
Uruguay	58	2001	*Inc*	Venezuela	288	Czech Republic	244	Peru	293
						Denmark	1,299	Philippines	523
Total	**11,623**			**Total**	**28,954**	Ecuador	145	Poland	484
						Egypt	342	Portugal	637
						El Salvador	123	Saudi Arabia	150
						France	5,573	Singapore	209
						Germany	20,254	Slovakia	198
						Ghana	148	Slovenia	250
						Greece	362	South Africa	381
						Hong Kong	622	Sri Lanka	190
						Hungary	249	Switzerland	3,784
						Ireland	243	Tunisia	249
						Italy	6,803	Turkey	419
						Jamaica	152	UAE	149
						Jordan	186	UK	2,388
						Kenya	198	Venezuela	304
						Korea	413	Vietnam	137
						Kuwait	112		
								Total	**62,479**

Table 2: Descriptive statistics

The sample comprises of 74,102 bank-year observations for 12,032 unique banks during the period 1990 to 2009. *Equity* denotes bank equity scaled by total assets. *Deposits* represents deposits scaled by total assets. *MM funding* denotes money market funding and is defined as the sum of commercial paper, certificates of deposit, securities loaned and other negotiable instruments divided by total assets. *Subordinated debt* indicates the ratio of subordinated debt, hybrid capital, convertible bonds, mortgage bonds, and other bonds divided by total assets. *Log assets* denotes bank size defined as the log of total assets. *Revenue change* indicates the annual percentage change in revenues. *ROE* denotes bank profitability defined as net income divided by average equity. *LLP* is the ratio of the bank's loan loss provision to net interest income. *Cost of debt* denotes the cost of bank debt and is defined as the ratio of interest expense to total liabilities. *Risk taking* denotes bank risk-taking measured using the distance-to-default measure. It is computed as (the log of) capital plus ROA scaled by the standard deviation of ROA, based on five annual observations. *Loan market conc* denotes loan market concentration and is computed using a loan-based Herfindahl measure at the country-year level. *Log GDP* denotes the log of GDP, while *GDP growth* denotes the annual growth in GDP. *Inflation* denotes annual inflation. These variables are defined annually and obtained from the World Development Indicators (WDI) database of the World Bank. *Log equity market cap* and *Log turnover* indicate the log of the ratio of equity market cap to GDP and turnover of listed stocks to GDP of the country respectively. *Trade* indicates international trade and is computed as the ratio of imports plus exports to GDP. These variables are obtained from WDI and are averaged over the entire sample period. All explanatory variables have been lagged by a year.

	Obs.	**Mean**	**Median**	**S.D.**	**Min.**	**Max.**
Bank-level variables:						
Equity (%)	74,102	8.433	6.745	5.583	1.502	44.424
Deposits (%)	74,102	74.837	81.705	19.217	2.333	95.646
MM funding (%)	74,102	4.467	0.000	10.246	0.000	62.050
Subordinated debt (%)	74,102	7.472	2.671	11.974	0.000	70.598
Log assets	74,102	7.402	7.075	1.782	4.760	12.811
Revenue change (%)	74,102	-0.200	-2.117	22.491	-67.384	129.182
ROE (%)	74,102	8.614	7.120	11.147	-46.390	49.910
LLP (%)	74,102	18.365	13.365	25.358	-39.060	172.770
Cost of debt (%)	74,102	3.920	3.312	2.817	0.064	21.494
Risk taking	74,102	3.704	3.723	1.137	0.595	6.525
Country-level variables:						
Loan market conc	74,102	849.038	487.301	1,108.471	179.730	7,335.594
Log GDP	74,102	6.376	7.002	1.436	2.411	8.545
GDP growth (%)	74,102	2.068	1.831	2.231	-6.182	9.317
Inflation (%)	74,102	3.380	1.874	5.265	-1.773	33.954
Log equity market cap	74,102	0.465	0.410	0.282	0.047	1.411
Log turnover	74,102	0.595	0.584	0.285	0.019	1.185
Log trade	74,102	0.429	0.391	0.169	0.152	1.153

Table 3: Effect of legal reforms on bank equity and bank deposits

The dependent variable in Models (1), (2) and (3) is bank equity (*Equity*) while it is bank deposits (*Deposits*) in Models (4), (5) and (6). Models (1) and (4) restrict the sample to reforming countries. Models (2) and (5) compare reformers with a matched sample while Models (3) and (6) compare reformers with all non-reforming countries. *Inc* (*Dec*) is an indicator representing countries that passed legal reforms that increased (decreased) creditor rights. *Post* is an indicator that denotes the post passage period. *MM funding* denotes money market funding while *Subordinated debt* indicates subordinated debt, hybrid capital, convertible bonds, mortgage bonds, and other bonds. *Log assets* denotes bank size. *Revenue change* indicates the annual percentage change in revenues. *ROE* denotes bank profitability. *LLP* is loan loss provision. *Loan market conc* denotes loan market concentration. *Log GDP* denotes the log of GDP, while *GDP growth* denotes the annual growth in GDP. *Inflation* denotes annual inflation. *Log equity market cap* and *Log turnover* indicate the log of equity market cap and turnover of listed stocks respectively. *Log trade* indicates the log of international trade. All explanatory variables are lagged by a year. All regressions include year and country fixed effects and robust standard errors clustered by country (reported under the coefficients in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

	Equity			*Deposits*		
	Only Reformers	Reformers vs. Matched	Reformers vs. All	Only Reformers	Reformers vs. Matched	Reformers vs. All
	(1)	(2)	(3)	(4)	(5)	(6)
*Inc*Post*	-1.679***	-1.732***	-1.204**	2.764***	2.486***	1.576**
	(.596)	(.561)	(.579)	(.584)	(.344)	(.663)
*Dec*Post*	1.220**	1.914**	1.870***	-1.670*	-2.034*	-2.017**
	(.592)	(.791)	(.390)	(.898)	(1.211)	(.850)
MM funding				-1.118***	-1.078***	-1.002***
				(.033)	(.053)	(.046)
Subordinated debt				-.996***	-.945***	-.969***
				(.029)	(.054)	(.030)
Log assets	-.734***	-.719***	-.966***	.623*	.461***	.553***
	(.283)	(.129)	(.129)	(.319)	(.157)	(.127)
Revenue change	.010**	.011***	.009***	.009	.016**	.011***
	(.005)	(.003)	(.001)	(.006)	(.007)	(.004)
ROE	-.0008	.017	.005	.007	-.064*	-.033
	(.020)	(.016)	(.009)	(.035)	(.037)	(.022)
LLP	-.002	.004	.001	.005	-.027**	-.013
	(.007)	(.004)	(.004)	(.010)	(.011)	(.009)
Loan market conc	9.87e-06	-.00009	-.00008	-.0004***	-.0002	-.0002
	(.0001)	(.0001)	(.00007)	(.0001)	(.0001)	(.0001)
Log GDP	-3.880*	3.838	2.559	8.111**	-.258	1.153
	(2.228)	(2.801)	(1.983)	(3.381)	(2.869)	(4.075)
GDP growth	.013	-.073	-.075**	.057	.064	-.075
	(.037)	(.045)	(.036)	(.068)	(.066)	(.070)
Inflation	.141***	.052**	.015	-.012	-.069	-.066**
	(.020)	(.025)	(.017)	(.032)	(.044)	(.029)
Log equity market cap	-1.558*	-1.323**	.456	-1.660	1.351*	.185
	(.878)	(.527)	(1.045)	(1.494)	(.760)	(1.327)
Log turnover	-.383	1.012	.237	1.231	-.555	1.218
	(.632)	(.692)	(.524)	(1.241)	(1.151)	(.960)
Log trade	-5.854*	.856	2.420	13.525**	4.089	.799
	(3.321)	(2.937)	(2.455)	(5.754)	(4.464)	(4.665)
Year effects	Y	Y	Y	Y	Y	Y
Country effects	Y	Y	Y	Y	Y	Y
Obs.	11623	40577	74102	11623	40577	74102
Adj. R^2	.395	.332	.327	.905	.836	.824

Table 4: Parallel trends and other validation tests

The dependent variable in all the models is bank equity (*Equity*). Models (1), (2) and (3) present results for legal reforms that increased creditor rights (*Increases*) while Models (4), (5) and (6) present those for decreases in creditor rights (*Decreases*) . The control group in all the specifications is the propensity-score based matched sample. *Inc* (*Dec*) is an indicator variable representing countries that pass legal reforms that increase (decrease) creditor rights. *Post* is an indicator that denotes the post passage period. *Post(-2)* and *Post(-1)* denote the two years prior to and the year immediately preceding the year of legal reform passage. All other variables are as defined in Table 3. All regressions include year fixed effects and robust standard errors clustered by country (reported under the coefficients in parentheses). In addition, Models (1) and (3) include country fixed effects, while Models (2), (3), (5) and (6) include bank fixed effects. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

	Increases			*Decreases*		
	(1)	(2)	(3)	(4)	(5)	(6)
*Inc*Post(-2)*			-.122			
			(.319)			
*Inc*Post(-1)*			-.439			
			(.373)			
*Inc*Post*	-.987***	-1.278***	-1.537***			
	(.207)	(.259)	(.315)			
*Dec*Post(-2)*						-.071
						(.641)
*Dec*Post(-1)*						-.062
						(1.670)
*Dec*Post*				3.161***	1.812**	1.766**
				(1.035)	(.706)	(.883)
Log assets	-.540***	-1.476***	-1.498***	-1.265***	-2.313***	-2.314***
	(.076)	(.334)	(.329)	(.159)	(.734)	(.738)
Revenue change	.013***	.006***	.006***	.005	.009	.009
	(.003)	(.001)	(.002)	(.005)	(.006)	(.006)
ROE	.009	.006**	.006**	.034	-.003	-.003
	(.017)	(.003)	(.003)	(.027)	(.016)	(.016)
LLP	.002	-.002	-.002	.009	-.001	-.001
	(.006)	(.002)	(.002)	(.006)	(.004)	(.004)
Loan market conc	.00006	2.79e-07	-4.68e-06	-.0002	-.0002	-.0002
	(.0001)	(.00005)	(.00005)	(.0002)	(.0002)	(.0002)
Log GDP	-3.576**	-.952	-.705	11.710***	10.013***	10.013***
	(1.789)	(1.531)	(1.487)	(4.380)	(3.727)	(3.730)
GDP growth	-.055*	.018	.024	-.105	-.062	-.062
	(.030)	(.026)	(.027)	(.071)	(.056)	(.057)
Inflation	.080***	.076***	.076***	-.041	-.030	-.030
	(.020)	(.019)	(.019)	(.038)	(.034)	(.034)
Log equity market cap	-1.122***	-1.723***	-1.662***	-1.277**	.834	.832
	(.387)	(.584)	(.606)	(.574)	(.697)	(.717)
Log turnover	-.249	-.193	-.259	.931	-1.001*	-.995*
	(.203)	(.169)	(.164)	(1.176)	(.591)	(.594)
Log trade	1.644	-3.065***	-3.682***	-14.961***	-11.380***	-11.364***
	(1.892)	(1.184)	(1.405)	(5.355)	(2.731)	(2.691)
Year effects	Y	Y	Y	Y	Y	Y
Country effects	Y	N	N	Y	N	N
Bank effects	N	Y	Y	N	Y	Y
Obs.	32056	32056	32056	8521	8521	8521
Adj. R^2	.355	.846	.846	.18	.815	.815

Table 5: Legal reforms, cost of bank debt and government safety nets

The dependent variable is the cost of bank debt (*Cost of debt*). *Inc_HighSafety* (*Inc_LowSafety*) denotes countries that increased creditor rights and have high (low) risk-shifting incentives due to government safety nets, defined based on Demirguc-Kunt and Huizinga (2004). Analogous definitions extend to *Dec_HighSafety* and *Dec_LowSafety*. All regressions include year and country fixed effects and robust standard errors clustered by country (reported under the coefficients in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

	Entire sample		Sub-samples	
			HighSafety	*LowSafety*
	(1)	(2)	(3)	(4)
*Inc*Post*	.694***		.844***	-.292
	(.234)		(.112)	(.556)
*Dec*Post*	-1.358**		-4.448***	-.173
	(.574)		(1.067)	(.520)
*Inc_HighIncent*Post*		.851***		
		(.108)		
*Dec_HighIncent*Post*		-5.003***		
		(.642)		
*Inc_LowIncent*Post*		-.382		
		(.665)		
*Dec_LowIncent*Post*		-1.298**		
		(.570)		
Log assets	.085**	.085**	.100***	-.030
	(.034)	(.034)	(.030)	(.099)
Revenue change	.008***	.008***	.010***	.004
	(.002)	(.002)	(.002)	(.004)
ROE	-.015***	-.015***	-.015***	-.018**
	(.004)	(.004)	(.006)	(.007)
LLP	.0002	.0003	-.00005	.0003
	(.001)	(.001)	(.001)	(.003)
Loan market conc	-.00009	-.0001*	-.00005	-.00006
	(.00006)	(.00006)	(.00006)	(.00008)
Log GDP	-4.389**	-3.839**	-7.592***	2.464
	(1.709)	(1.822)	(2.640)	(1.799)
GDP growth	-.119**	-.117**	-.039	-.210***
	(.051)	(.051)	(.061)	(.052)
Inflation	.080***	.078***	.063***	.050*
	(.019)	(.020)	(.023)	(.028)
Log equity market cap	-.392	-.273	-.791	.725
	(.526)	(.527)	(.817)	(.645)
Log turnover	-.700	-.765*	-.709**	-2.278***
	(.431)	(.418)	(.345)	(.844)
Log trade	4.111	3.971	-.155	-.344
	(2.965)	(3.024)	(3.696)	(2.897)
p. val. of differences:				
(1)			0.039	
(2)			0.001	
(3)=(5)		0.052		
(4)=(6)		0.001		
Year effects	Y	Y	Y	Y
Country effects	Y	Y	Y	Y
Obs.	29755	29755	26211	3544
Adj. R^2	.675	.676	.714	.562

Table 6: Is the higher cost of bank debt due to bank risk-taking?

The dependent variable is bank risk-taking (*Risk taking*). *Inc_HighSafety* (*Inc_LowSafety*) denotes countries that increased creditor rights and have high (low) risk-shifting incentives. Analogous definitions extend to *Dec_HighSafety* and *Dec_LowSafety*. All regressions include year and country fixed effects and robust standard errors clustered by country (reported under the coefficients in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

	Entire sample	Sub-samples	
		HighSafety	*LowSafety*
	(1)	(2)	(3)
*Inc*Post*		-.225**	.270
		(.097)	(.170)
*Dec*Post*		.811**	-.574
		(.324)	(.393)
*Inc_HighIncent*Post*	-.231***		
	(.081)		
*Dec_HighIncent*Post*	.829***		
	(.217)		
*Inc_LowIncent*Post*	.162		
	(.140)		
*Dec_LowIncent*Post*	-.305		
	(.254)		
Log assets	-.015	-.014	-.014
	(.021)	(.024)	(.027)
Revenue change	-.00008	-.0006	.001
	(.0007)	(.0009)	(.0006)
ROE	-.0009	-.001	-.001
	(.008)	(.011)	(.003)
LLP	-.006***	-.006***	-.003**
	(.002)	(.002)	(.001)
Loan market conc	3.31e-06	-.00003*	.00003
	(.00002)	(.00002)	(.00004)
Log GDP	1.775***	1.463**	1.195
	(.327)	(.591)	(.943)
GDP growth	.010	.005	.026
	(.010)	(.011)	(.020)
Inflation	-.004	-.003	-.003
	(.003)	(.004)	(.011)
Log equity market cap	-.246	-.316	.580*
	(.189)	(.239)	(.341)
Log turnover	.354***	.249***	.375
	(.107)	(.083)	(.323)
Log trade	-1.802***	-2.127	-1.160
	(.667)	(1.322)	(1.256)
p. val. of differences:			
(1)		0.009	
(2)		0.005	
(3)=(5)	0.013		
(4)=(6)	0.001		
Year effects	Y	Y	Y
Country effects	Y	Y	Y
Obs.	29755	26211	3544
Adj. R^2	.248	.187	.217

Table 7: Endogeneity of legal reform passage: Identification based on within-country-year variation

The dependent variable in the first two specifications is the cost of bank debt (*Cost of debt*) defined as interest expense divided by total liabilities; while that in the next two specifications is bank risk-taking (*Risk taking*) defined as (the log of) capital plus ROA scaled by standard deviation of five annual ROAs. The dependent variable in the last two specifications denotes loan portfolio risk (*Non Performing Loans*) defined as the percentage of non-performing-loans to total loans. *High Incent* (*Low Incent*) denotes countries that have high (low) risk-shifting incentives due to the presence of government safety nets. *Lend* is defined as the ratio of interest revenue to total revenue and captures lending-based versus fee-based banks. *Inc* denotes countries that increase creditor rights while the *Post* indicator indicates the post-passage period. All other variables are as defined in Table 3. All explanatory variables have been lagged by a year. All regressions include bank fixed effects, country-year fixed effects and robust standard errors clustered by country (reported under the coefficients in parentheses). ***, ** and * denote significance at the 1%, 5% and 10% levels respectively.

	Cost of debt		*Risk taking*		*Non Performing Loans*	
	High Incent	*Low Incent*	*High Incent*	*Low Incent*	*High Incent*	*Low Incent*
	(1)	(2)	(3)	(4)	(5)	(6)
Lend	.130	-.294	-.064	-.154	-.948	1.464
	(.308)	(.728)	(.069)	(.165)	(1.502)	(3.732)
*Inc*Lend*	.093	-.774	-.058	-.009	-3.754**	-1.206
	(.370)	(.958)	(.429)	(.154)	(1.681)	(4.523)
*Post*Lend*	.160	.505	.305***	.109	.755	-1.678
	(.212)	(.799)	(.094)	(.166)	(2.153)	(4.154)
*Inc*Post*Lend*	.931***	-.979	-1.088***	-.055	7.324***	-3.602
	(.215)	(.954)	(.173)	(.333)	(2.261)	(5.812)
Log assets	-.020	-.081	-.045	.046	-.378	-1.918
	(.128)	(.173)	(.044)	(.055)	(.434)	(1.570)
Revenue change	.009***	.006***	.0003*	.0001	.007	-.003
	(.001)	(.001)	(.0002)	(.0003)	(.005)	(.004)
ROE	-.007***	-.016***	.004**	.003	-.050***	-.040*
	(.002)	(.003)	(.002)	(.002)	(.017)	(.023)
LLP	.0009	-.0007	-.002***	-.002**	.016**	.032***
	(.0008)	(.001)	(.0003)	(.0008)	(.007)	(.010)
p. val. of diff.	0.048		0.006		0.086	
Bank effects	Y	Y	Y	Y	Y	Y
Cy-year effects	Y	Y	Y	Y	Y	Y
Year effects	N	N	N	N	N	N
Country effects	N	N	N	N	N	N
Obs.	41557	14162	41557	14162	10021	9295
Adj. R^2	.913	.905	.737	.749	.885	.868