Optimal Property Rights in Financial Contracting

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In this paper we propose a theory of optimal property rights in a financial contracting setting. Following recent contributions in the property law literature, we emphasize the distinction between contractual rights, that are only enforceable against the parties themselves, and property rights, that are also enforeceable against third parties outside the contract. Our analysis starts with the following question: which contractual agreements should the law allow parties to enforce as property rights? Our proposed answer to this question is shaped by the overall objective of minimizing due diligence (reading) costs and investment distortions that follow from the inability of third-party lenders to costlessly observe pre-existing rights in a borrower's property. Borrowers cannot reduce these costs without the law's help, due to an inability to commit to protecting third-parties from redistribution. We find that the law should take a more restrictive approach to enforcing rights against third-parties when these rights are i) more costly for third-parties to discover, ii) more likely to redistribute value from third-parties, and iii) less likely to increase efficiency. We find that these qualitative principles are often reflected in observed legal rules, including the enforceability of negative covenants; fraudulent conveyance; corporate veil-piercing; and limits on assignability.

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Abstract

In this paper we propose a theory of optimal property rights in a financial contracting setting. Following recent contributions in the property law literature, we emphasize the distinction between contractual rights, that are only enforceable against the parties themselves, and property rights, that are also enforeceable against third parties outside the contract. Our analysis starts with the following question: which contractual agreements should the law allow parties to enforce as property rights? Our proposed answer to this question is shaped by the overall objective of minimizing due diligence (reading) costs and investment distortions that follow from the inability of third-party lenders to costlessly observe pre-existing rights in a borrower's property. Borrowers cannot reduce these costs without the law's help, due to an inability to commit to protecting third-parties from redistribution. We find that the law should take a more restrictive approach to enforcing rights against third-parties when these rights are i) more costly for third-parties to discover, ii) more likely to redistribute value from third-parties, and iii) less likely to increase efficiency. We find that these qualitative principles are often reflected in observed legal rules, including the enforceability of negative covenants, fraudulent conveyance, corporate veil-piercing, and limits on assignability.

1 Introduction

What is a property right? What role should the law play in defining and enforcing these rights? Economists and legal scholars conceive of property rights in very different ways, and approach these questions differently as a result. The dominant view among economists, the property rights theory of Grossman and Hart (1986) and Hart and Moore (1990), defines property rights as residual rights of control. This theory argues that allocations of property rights can be valuable in alleviating holdup problems when contracts are incomplete.

The economist's view of property rights has important tacit implications for the role of the legal system. When all affected parties start around a common bargaining table under symmetric information, as the property rights theory assumes, there is essentially no role for the law beyond enforcing the contractual agreements reached by the parties.[1] Left to their own devices, the contracting parties can allocate all the relevant rights contractually in a way that maximizes their total surplus. The property rights theory, therefore, has little to offer in the way of a positive analysis of laws regarding property rights, nor does it offer normative prescriptions for the design of these laws, other than the recommendation that voluntary agreements should be enforced. [2]

This conception stands in sharp contrast to the concept of property and the role of property law in legal scholarship (Merrill and Smith 2000, 2001a, 2001b, Hansmann and Kraakman 2002). This literature focuses on the critical distinction between property rights and contractual rights, by defining property rights as rights *in rem* (rights to assets that are good against third-parties), and contractual rights as rights *in personam* (good only against the contracting parties themselves). In other words, property rights are unique because they

[1] This is not to say that economic contract theories more generally have not considered a more active role for the law. For example, intervention into private contracting has been justified on the basis of inefficiencies arising from asymmetric information (Aghion and Hermalin, 1990) or on the grounds that some affected parties are missing from the bargaining table (Aghion and Bolton, 1987). Note, however, that the existing economics literature on property rights does not take either of these approaches.

[2] The economists' viewpoint often presupposes that the law is necessary to defend an initial endowment, but this is not entirely obvious. Even if the law is completely silent on the initial allocation and all assets are in the public domain at the outset, efficiency is achievable if all parties are available to bargain over the uses of all assets going forward. This implies that the role of law in the domain of property rights (over and above enforcing contracts) is necessary only when third-parties outside the initial contracting coalition are affected.

bind not only the parties to a contract, but also third-parties who lie outside a contracting coalition. [3] As Hansmann and Kraakman (2002) explain the distinction:

> "*Property rights differ from contract rights in that a property right in an asset, unlike a contract right, can be enforced against subsequent transferees of other rights in the asset.*"

This definition of property rights highlights that the law plays an active role in defining property rights, and that property law plays an active role in increasing the efficiency of contractual agreements when third-parties outside a contracting coalition are involved. When rights to an asset are divided among multiple parties, and information about pre-existing rights are imperfect, third-parties may be unknowingly affected by the rights of other parties with whom they have not contracted. As a result, these scholars argue, property law is fundamentally different from contract law. Contract law typically provides flexibility to allow contracting parties to tailor rights and obligations as they choose. Property law, on the other hand, often limits the rights that can be created and enforced against third-parties. These general principle behind these limits is to reduce uncertainty and discovery costs for third parties as to which property rights they are at risk of violating. This may be achieved either through standardization (Merrill and Smith 2000), or through rules that govern the notice required to make property rights enforceable (Hansmann and Kraakman 2002).

The goal of this paper is to offer a first formal model which captures this legal definition of property rights, and builds on the main insights of this scholarship. A key innovation of our model relative to the economics literature on common agency (Bernheim and Whinston, 1986, Segal, 1999) is to introduce reading costs for third-parties. In the presence of such costs, bilateral contracts between a principal and multiple agents may be revealed to be inconsistent, since the contracting parties may not be aware of these inconsistencies at the time of signing. The complete characterization of the common agency game, then, requires legal rules that resolve inconsistencies. Depending on how these rules for enforcing inconsistent bilateral contracts are specified, the equilibrium of outcome of the common agency

[3] Note, however, that there are alternative definitions of what constitutes a "property right" in legal scholarship. Some define a property right as a right that is enforced through a "property rule" such as specific performance, while a contractual right is a right that is enforced through monetary damages. (Calabresi and Melamed 1972; Ayres and Talley 1995; Kaplow and Shavell 1995) This definition gives rise to different legal design problems than the one we consider here.

game may be more or less efficient. By modeling these potential inconsistencies explicitly, our paper helps sharpen the main logic underlying recent legal scholarship on property, and at the same time reveals common forces that influence legal rules regarding property in a variety of settings involving financial contracting.

Our model starts with a firm run by an agent (A) that requires funding from two lenders ($P1$ and $P2$), who each provide valuable capital to an investment project. Each lender contracts with the firm at a different point in time. We assume that the lenders observe their own contracts with A at zero cost. $P2$, however, must incur a cost to observe and understand $P1$'s pre-existing contract with A. This assumption captures the notion that reading costs are likely to be more severe in a multilateral setting than in a bilateral setting.[4]

The financial contracting context is a particularly important environment in which to consider these issues, since insolvency can result in incomplete satisfaction of a lender's claim. A mere contractual right to sue a bankrupt debtor can be substantially less valuable than a property right (such as priority rights to seize and sell collateral) that also binds past and/or future creditors. When the law allows for the borrower to give an early lender ($P1$) property rights in the borrower's assets, it can alleviate credit constraints by protecting $P1$ against borrower moral hazard and the claims of a later lender ($P2$). On the other hand, $P2$ might act more conservatively in extending funds when he is uncertain about the pre-existing rights of $P1$. He might insist on being compensated for the investigation costs required to verify these pre-existing rights, and if he can not be sufficiently reassured, might forgo lending entirely.

Our model generates several findings. First, in a world where all contracts are costlessly observable, there are affirmative reasons for A to provide maximum protection of $P1's$ claim against subsequent opportunism, and for the law to enforce these protections. In particular,

[4]This may be true for several reasons. First, there is added risk that a third-party is never even aware of the existence of prior contracts whose terms will affect him. Second, the possibility that A will collude with later parties ($P2$) against earlier parties ($P1$) creates an inherent reason why the contract with $P1$ is likely to be complex, and hence, generate high reading costs for $P2$. In other words, $P1$ may *require* a complex contract to protect himself against $P2$. These forces are not present in the bilateral contracting context. For a model that does consider reading costs for the parties to a given contract, see Katz (1990). In the presence of reading costs for the contracting parties themselves (e.g. fine print in boilerplate contracts), legal intervention to minimize reading costs can also extend to contract law. See Section 5.1 for more discussion of this issue.

A would like to promise $P1$ both seniority over any $P2$, and an upper limit on the future claims of any $P2$ (a *negative pledge* covenant). Both rights are valuable because monitoring A's behavior is costly for $P1$, and A has an incentive to over-borrow from $P2$ to continue his project inefficiently at $P1$'s expense. To ensure that his claim is sufficiently likely to be repaid, $P1$ requires not only seniority, but also that A retain sufficient cash flow rights so that his incentives to make the project succeed are preserved (Holmstrom and Tirole, 1998). To constrain A effectively, however, we show that the loan contract between A and $P1$ must give $P1$ property rights in $A's$ assets that are good against $P2$, rather than a mere contractual right to sue A in the event that A violates his contractual agreement with $P1$.

Notwithstanding these efficiency benefits, the law places restrictions on the ability of contracting parties to create these kinds of property rights. Under U.S. law, a *security interest* is a means of giving seniority in the form of a property right in collateral that binds subsequent lenders. Enforcement of security interests against third-parties is not absolute, however. A lender must give notice to potential future lenders by posting notice of his security interest in a registry. Failure to do so limits the rights of a secured creditor under the law to a mere contractual claim against the borrower. In addition, some security interests can be invalidated by law when they are particularly harmful to other creditors, even if this notice requirement is met. The enforceability of negative covenants as property rights is thus limited more severely: they are generally enforced as mere contractual rights against the borrower rather than as property rights that also bind a later lender. Exceptions have been made when it can be shown that the later lender has actual knowledge of the negative covenant. But, importantly, the law does not place the burden on the later lender to acquire this knowledge.

Our model suggests a rationale for these types of legal restrictions on property rights when $P2$ must expend reading costs to observe and understand the pre-existing rights of $P1$. If $P1$ and A anticipate that $P2$ will not conduct any costly investigation to discover $P1$'s rights, this opens the door for $P1$ to write a *redistributive contract* with A that diverts as much value from $P2$ as the law will enforce. Anticipating this behavior, $P2$ will want to conduct a thorough investigation into $P1's$ contract, and will insist that A reimburse enough of $P2's$ reading costs that $P1$ and A will not be tempted to redistribute. In equilibrium, inefficient deadweight reading costs are inevitably incurred, and when these costs are sufficiently large, credit rationing to A may occur. Though these deadweight losses are in the end borne by A,

A cannot eliminate them because he cannot costlessly demonstrate to $P2$ that he has not written a redistributive contract with $P1$, without the commitment provided by the law. [5]

Though the model focuses on the enforceability of security interests and negative covenants in particular, it generates qualitative principles that can apply in more general settings involving property rights. We find that the law should take a more restrictive approach to enforcing a right (given by A to $P1$) against a third party ($P2$) when the right (i) is more costly for $P2$ to discover, (ii) is more *redistributive* from an uninformed third-party, and (iii) is less likely to increase the efficiency of contractual relationships. We analyze a series of examples in U.S. debtor-creditor law, and find that these principles are often reflected in legal rules. The principles echo central themes in Hansmann and Kraakman (2002), who argue that an optimally designed law balances the value of a right to its users against the verification costs borne by non-users. Our model adds to this intuition in finding that when redistributive rights are enforceable, these verification costs are most severe. Hence, an optimal law restricts the enforceability of particularly redistributive property rights.[6]

The rest of the paper will proceed as follows. Section 2 introduces the general model and Section 3 solves for optimal contracts when all information about pre-existing contracts is costlessly observable by third-parties. Section 4 solves the model in the presence of reading costs by third-parties, which leads to our key results regarding the optimal legal design of property rights and generates comparative statics that can be applied to existing features of the law. Sections 5 and 6 discuss real-world legal environments and how they relate to the principles in our model, and Section 7 concludes.

[5] This logic differs from Merrill and Smith (2000), who argue that legal restrictions on property rights are valuable because they limit externalities *across firms* (i.e. an A-$P1$-$P2$ coalition increases investigation costs for other A-$P1$-$P2$ coalitions by creating a novel property right). Merrill and Smith argue that there is no role for law to limit investigation costs within an A-$P1$-$P2$ coalition, because A ultimately internalizes these costs. Our model shows that this logic is, in general, not valid. A internalizes all reading costs in equilibrium, but he can not reduce them without the credible commitment provided by the law.

[6] Our analysis is also related to the large literature on optimal priority and the efficiency of secured credit. Bebchuk and Fried (1996, 1997) argue for mandatory limits on the priority of secured creditors in bankruptcy; unlike our model, their argument relies heavily on the existence of involuntary creditors or small creditors who find it costly to adjust interest rates. Schwartz (1991) argues that current law regarding creditor priorities should be replaced by a pure first-in-time rule, which is similar to the Coasean legal environment we consider here. Schwartz's model allows for costs of revealing information to creditors, but does not consider the role the law might play in reducing them.

2 Model

2.1 Technological Assumptions

We consider a simple model of a firm with a single project that requires two rounds of financing from two different lenders. At date 1, a wealthless agent (A) is endowed with a valuable idea, and must raise an amount of i_1 from a principal ($P1$) to start the project. To continue the project at date 2, the agent requires an additional input of i_2 from a second principal ($P2$).

If the project receives two rounds of financing a random cash flow is produced at date 3. If the project does not receive the required funding at date 2, it is liquidated for a known value $L > 0$. The final cash flow outcome depends on the realization of the state of nature at date 2, which becomes observable to all parties at date 2 before the continuation decision is made. We allow for two states of nature, $\hat{s} \in \{s_g, s_b\}$. The good state of nature (s_g) occurs with probability π and the bad state (s_b) occurs with probability $1 - \pi$.

Under continuation in the bad state of nature, the project yields a cash return of X at date 3 with probability p, and a liquidation value γL with probability $(1 - p)$, where $\gamma < 1$. In the good state of nature, the cash-flow outcome of the project depends on the agent's effort choice $e \in \{0, 1\}$ at date 2. If the agent chooses high effort, $e = 1$, then the project yields a final cash flow X with certainty. If the agent chooses low effort, $e = 0$, the project yields X with probability p and γL with probability $(1 - p)$, as in the bad state of nature. The agent's private cost of choosing high effort is $c > 0$, and the cost of low effort is normalized to zero. We assume the agent will choose to continue the project at date 2 if he is indifferent.

2.2 Payoff and contracting assumptions

We consider a dynamic common agency game with a similar structure as in Bizer and DeMarzo (1992) and Kahn and Mookherjee (1998). To fund the project initially, agent A and principal $P1$ begin the game by writing a bilateral long-term debt contract C_1 at date 1. To fund continuation at date 2, A and $P2$ may follow by writing another bilateral debt contract. To focus on the interface between principal $P1$'s and $P2$'s claims, we shall restrict attention to situations where $P2$ can contribute no more than the maximum required investment outlay i_2 and $P1$ can not contribute the entire maximum amount $i_1 + i_2$ at date

1. [7] We assume that both principals operate in competitive lending markets, and that all parties are risk-neutral.

As in Bizer and DeMarzo (1992), we do not allow contract terms to be contingent on the state of nature s_l, $l = g, b$. We also rule out the possibility that $P1$ is available to monitor the firm, or to renegotiate his contract with A at date 2 after the realization of the state of nature s_l. Thus, $P1$ is a passive lender who can only lend at date 1 and collect at the final date. This assumption is somewhat restrictive, and is made to demonstrate in the simplest possible fashion the potential conflicts between $P1$ and $P2$ when they lend at different points in time. [8]

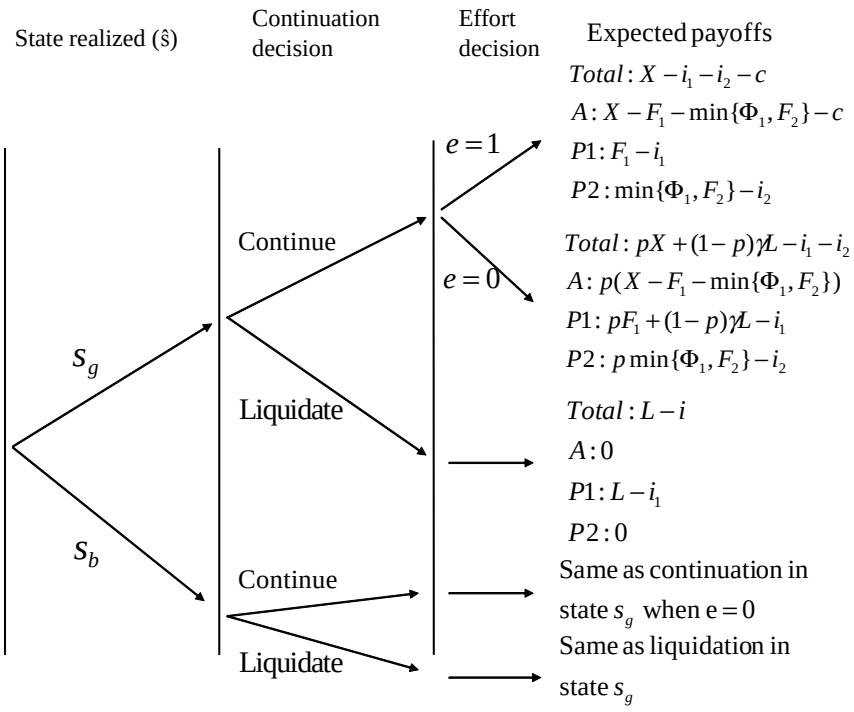
Each bilateral contract can specify the amount the principal agrees to lend i_j, a repayment F_j at date 3, and a priority ordering specifying which lender is senior $\Psi_j \in \{P1, P2\}$. Unlike previous dynamic common agency games, we also allow the contract between $P1$ and A to include a *negative pledge covenant* specifying a maximum amount Φ_1 of date 3 cash flows A may promise to pay $P2$ at date 3. This clause effectively allows $P1$ and A to de-couple the firm's liabilities F_1 from the financial constraint imposed on A at date 2. In sum, C_1 has four elements $(i_1, F_1, \Psi_1, \Phi_1)$ and C_2 has three elements (i_2, F_2, Ψ_2).

At this stage, it is crucial to note that a full specification of the contracting problem requires a set of assumptions about the background legal environment. Specifically, how will courts determine payouts when C_1 and C_2 are mutually inconsistent? Our contracting environment allows for two inconsistencies: A might make each lender senior to the other ($\Psi_1 = P1$ and $\Psi_2 = P2$), and A might violate a negative pledge by promising $P2$ a larger repayment than the contract with $P1$ permits ($F_2 > \Phi_1$).

As our benchmark, we will assume that these inconsistencies are resolved in the way that is often (implicitly) assumed in the economics literature: by giving maximum force to the earliest contract written in time. Thus, if A promises seniority to both lenders, $P1$ will be

[7] There may be several reasons why each principal can only invest a limited amount. For one, the lenders may be wealth-constrained. A lender might also prefer to have a limited exposure to a given firm for risk-diversification reasons. Also, $P1$ may be reluctant to invest more than i_1 for fear that A simply wastes the surplus funds.

[8] The assumption that $P1$ is not available at all at date 2 becomes relevant because $P1$ could potentially accelerate his loan in response to an attempt by $P2$ to collude with A that would hurt $P1$. These issues clearly occur in reality, but they require that $P1$ monitor A continuously, which comes at a cost. A surprise acceleration of a loan might also be costly to $P2$.



senior to $P2$. If A sets $F_2 > \Phi_1$, then the contract will be enforced as if $F_2 = \Phi_1$. We will refer to this background legal environment as the *Coasean legal environment*. This is a natural benchmark, because it maximizes A's contracting possibilities. It allows A to provide maximum commitment to protect $P1$ from the claims of $P2$ (by including strong protections in C_1), or vice versa (by not including them), if she so chooses. As we will show, however, this legal environment can be strictly suboptimal when reading costs are present, and it does not match real-world legal environments.

Figure 1 illustrates the timeline of the model and the total expected payoffs. For sake of illustration, we also give the players' respective expected payoffs in the Coasean legal environment when P1 is senior to P2.[9]

2.3 Parameter assumptions and efficient allocations

The following parameter value assumptions are crucial to our analysis and will be made throughout:

[9] The payoffs assume that the firm is solvent when it succeeds ($X - F_1 - F_2 \geq 0$) and that P1 is not fully repaid in the event of liquidation or failure ($F_1 \geq L$). These conditions will hold in equilibrium, so we omit the general description of the payoffs for the sake of exposition.

A1) $X - c - i_2 > L > pX + (1-p)\gamma L - i_2$

A1 implies that the efficient state-contingent action plan is to continue with high effort in state s_g, and liquidate in state s_b.

To encourage A to choose high effort, A requires a sufficient stake w_g in the output when the project succeeds. An optimal contract will pay the agent w_g when the cash flow is X and 0 if output is 0. Thus, in order to elicit effort from A, the following incentive compatibility constraint must be satisfied:

$$w_g - c \geq p w_g$$

which reduces to

$$w_g \geq \frac{c}{1-p}.$$

Therefore, the maximum net pledgeable cash flow to all lenders is $X - \frac{c}{1-p}$. Since $P2$ will not participate unless he receives an expected payment equal to his monetary contribution, $P2$ must be promised a repayment of i_2 in the good state. Therefore, the maximum net pledgeable cash flow to $P1$ is

$$\bar{F}_1 \equiv X - \frac{c}{1-p} - i_2. \tag{1}$$

For ease of exposition we will use the notation $\bar{F}_1$ to denote the highest possible promised repayment to $P1$ that retains enough "room" in the good state (pledgeable cash flow) to allow for continuation financing by $P2$, and elicit high effort from A.

Assumption **A2** says that under the efficient state-contingent action plan, the firm generates enough pledgeable cash flow to repay $P1$'s loan, but liquidation in both states does not:

A2) $\pi \bar{F}_1 + (1-\pi)L \geq i_1 > L$

A2 implies that $\bar{F}_1 > L$, so that continuation with effort produces more pledgeable cash flow to $P1$ than liquidation in the good state.

The next assumption, **A3,** creates an important tension in our contracting problem:

A3) $X - \bar{F}_1 \geq \frac{i_2}{p}$.

This assumption implies that giving $P1$ a simple senior debt contract cannot simultaneously allow for continuation with effort in the good state and prevent continuation in the bad state. Any promised repayment to $P1$ above $\bar{F}_1$ will forestall continuation with effort in the good state, but a repayment of $\bar{F}_1$ or lower leaves "room" for a claim sufficient to

repay $P2$ in the bad state[10]. As we will show in the next section, this contracting problem can be fixed by including a negative pledge covenant in $P1's$ loan contract that limits the future cash flow that A can pledge to $P2$.

This leads to the fundamental tension in our contracting problem: the negative pledge in our model is a valuable tool that increases the efficiency of the contracting relationship between A, $P1$, and $P2$. In a world with no contract reading costs, it is efficient to enforce this term against $P2$. But when reading costs are present, the enforceability of negative pledge clauses opens the door for A and $P1$ to divert value from $P2$ by including a redistributive clause in $P1$'s contract, hoping that $P2$ will not see it. This provides a role for the law to intervene, by refusing to enforce some terms against third-parties.

3 Optimal Contracting With No Reading Costs

Implementation: state-contingent contracts

If the contracting parties can write (bilateral) state-contingent contracts, then the efficient action plan can be implemented as a subgame perfect equilibrium (SPE) of the following contracting game:

At date 1, the agent makes a take-it-or-leave-it offer of a state-contingent debt contract to $P1$, with a loan i_1 from $P1$ and in exchange the following promises to $P1$:

1. in state s_b at date 2, $P1$ has the right to liquidate the project and keep the entire liquidation proceeds;

2. in state s_g at date 3, A repays $P1$ a face value of debt

$$F_1 = \frac{i_1 - (1-\pi)L}{\pi};$$

3. $P1$ is senior to $P2$ ($\Psi_1 = P1$).

Given that this contract covers $P1$'s investment i_1 in expected terms, $P1$'s (weak) best response is to accept this contract.

[10] The managerial effort, and the agency rents required to elicit this effort, are necessary to create this tension in the model. In a model without effort, it would always be possible to choose an F_1 that both prevents inefficient continuation and allows room for efficient continuation financing by $P2$.

At date 2 in state s_g, A's (weak) best response to this contract is to offer $P2$ the contract $C_2 = (i_2, i_2, P1)$: A borrows i_2 dollars from $P2$ in exchange for a debt claim with face value $F_2 = i_2$. As $P1$ has been promised seniority and the legal environment is Coasean, $P2$ must be junior, so the choice of Ψ_2 is irrelevant. This contract covers $P2$'s investment i_2, so that $P2$'s (weak) best response is to accept this contract.

Finally, to see that A's contract offer at date 1 is a best response to the respective equilibrium moves of $P1$ at date 1, and A and $P2$ at date 2, observe that under this contract A gets the first-best expected payoff $\pi(X-c-i_2)+(1-\pi)L-i_1$ which is equal to total social welfare under the first-best action plan. This is the highest expected payoff A could achieve in any equilibrium, since any deviation from the first-best action plan at date 2, induced by another contract offer, would be anticipated by $P1$ and priced into the loan contract through a higher F_1. In other words, A's private objective is perfectly aligned with social welfare and therefore A's choice of contract implements the first-best social outcome.

Incomplete contracts: the insufficiency of seniority

While a first-best outcome is straightforward to implement under complete contracting, it is less obvious under incomplete contracting (when courts cannot observe the state of the world). At first glance, one might expect that seniority alone would be sufficient to generate the socially efficient outcome even with non-contingent debt contracts.

Indeed, if $P1$ has a senior debt claim one might expect that this would generate the right social incentives for $P2$ to refuse to lend in the bad state even if $\Phi_1 = \infty$, since $P2$ bears more of the cost of failure than $P1$. [11] Given assumption **A3**, however, it is still in the joint interest of $P2$ and A to continue the firm inefficiently at the expense of $P1$.[12] Indeed, $P2$ is then willing to lend i_2 and take a junior debt claim with face value $F_2 = \frac{i_2}{p}$, A then receives an expected payoff from continuation of

$$p(X - F_1 - F_2) \geq p(X - \bar{F}_1 - \frac{i_2}{p}) \geq 0,$$

which is (weakly) greater than what A receives in liquidation.[13]The value of $P1$'s debt claim is *diluted* by the inefficient continuation. Instead of L, $P1$ receives an expected payoff of

[11]Since $P1$'s loan is senior, he will recover the entire cash flow in the low state if the project fails, γL while $P2$ will receive nothing. Thus, the consequences of failure are more severe for $P2$ than for $P1$.

[12]The idea that junior debt can be used to dilute senior claims in the presence of moral hazard was originally formalized in Bizer and DeMarzo (1992).

[13]It may be possible to correct this inefficiency by giving A a payment in the event of liquidation, of say

only

$$pF_1 + (1-p)\gamma L \leq p\bar{F}_1 + (1-p)\gamma L \leq p(X - \frac{i_2}{p}) + (1-p)\gamma L < L$$

The second inequality follows from assumption **A3** and the third inequality follows from assumption **A1.** Thus, under the parameter assumptions in the model, seniority alone is not sufficient to protect $P1$ from dilution. Although social welfare is wasted by the inefficient continuation, the value transferred from $P1$ to the $P2/A$ coalition outweighs this loss when **A3** holds. Thus, the incentives of $P2$ and A are not aligned with social welfare when a simple senior debt contract is written without a negative pledge. Since A bears this efficiency loss in equilibrium, A would prefer to give $P1$ stronger rights than seniority alone in order to achieve efficiency and maximize his private payoff.

The value of the negative pledge

In the good state $P2$ is willing to lend i_2 in exchange for debt with face value $F_2 = i_2$, since the project will succeed with certainty.[14] In the bad state, however, the project fails with probability $1-p$ if it is continued. As noted above, $P2$ will then require a face value of debt higher than i_2 (F_2 must be at least $\frac{i_2}{p}$) in order to be compensated for this added

ϕL, sufficient to offset the positive gain A would get under continuation. Deviations from absolute priority in bankruptcy could, thus, be rationalized in our model as a way of forestalling inefficient continuation.

In a somewhat richer model, however, one might be concerned that by structuring the agent's incentives in this way one might undermine her incentives to perform at date 1. For example, if efficiency requires that A raise the probability of reaching the good state from λ to $\pi > \lambda$ at date 1, by taking action $a = 1$ with private effort-cost ψ, rather than the free action $a = 0$, then rewarding the agent in the event of liquidation might be counterproductive.

Indeed, the agent's incentive constraint at date 1 :

$$\pi(X - F_1 - F_2) - \psi \geq \lambda(X - F_1 - F_2)$$

without any payment in liquidation might be satisfied, while the constraint with a payment ϕL in liquidation :

$$\pi(X - F_1 - F_2) + (1-\pi)\phi L - \psi \geq \lambda(X - F_1 - F_2) + (1-\lambda)\phi L$$

might not.

[14]By definition of $\bar{F}_1$, as long as $P1$ is promised no more than this amount, $P2$ can be promised i_2 if the good state occurs, and A will prefer high effort. Therefore, the probability of success will be 1 and $P2$ will be repaid with certainty.

default risk. Thus, a negative pledge clause can elicit the state of the world from A and $P2$ by denying this credit spread to $P2$:

Proposition 1 *Under assumptions **A1** to **A3**, the following sequence of contracts are a SPE and implement the first-best allocation*:

$C_1 = (i_1, \frac{i_1-(1-\pi)L}{\pi}, P1, i_2)$. *In state* s_g, $C_2 = (i_2, i_2, P1)$ *and in state* $s_b, C_2 = \emptyset$

A receives i_1 *at date 1, and promises* $P1$ *a repayment*

$$F_1 = \frac{i_1 - (1-\pi)L}{\pi},$$

at date 3. $P1$ *is guaranteed seniority, and* $P2$ *can be promised no more than* $\Phi_1 = i_2$.

The best response for $P2$ *and* A *at date* 2 *is to sign a new loan contract only in state* s_g, *specifying a loan of* i_2 *in return for a (riskless, junior) claim of* i_2 *at date* 3. *In state* s_b, $P2$ *does not lend.*

Proof. See the appendix ■

In order to implement the first-best, $P1$ requires not only priority over $P2$, but also that A make a credible commitment not to borrow more than i_2. Since $P2$ understands that A can legally transfer no more than i_2, he is not willing to lend in the bad state, and the first-best can be achieved. [15] We will refer to the optimal contract between $P1$ and A in Proposition 1 as the *efficient contract*, and denote this contract C_1^{fb}.

The proposition demonstrates that Coasean legal environment is ideal in a world with no reading costs, because it provides an environment in which optimal contracting can implement the first-best outcome. In the next section, we introduce contract reading costs and show that this result breaks down. A legal environment that allows for the creation of strong protections on behalf of some parties can create costs for others. The reading costs third parties face are a form of negative externality that contracting parties impose on others. What is more, we will show that the contracting parties are not well placed to internalize these externalities.

[15] The fact that the negative pledge clause allows the first-best allocation to be implemented is specific to our assumptions. For example, if i_2 were random and non-contractible, then the first-best is not achievable in general, even with a negative pledge.

4 Equilibrium Contracting With Reading Costs

4.1 The contracting game with reading costs

We begin by describing how the contracting game between A, $P1$, and $P2$ is modified to account for imperfect observability by third-parties. A natural starting point is to assume that $P2$ is unable to observe the true contract C_1 between $P1$ and A without incurring reading costs. Thus, when negotiations between A and $P2$ begin, $P2$ can only form a prior belief over the contract $P1$ and A have signed at date 1.

As in standard signaling games, $P2$ can rationally revise his beliefs about C_1 when he sees A's contract offer C_2, which is costlessly observable by $P2$. The contract offer $C_2 = (i_2, F_2, \Psi_2, \rho)$ is now composed of an additional element, a promise to compensate $P2$ for the cost he incurs when reading contract C_1. The intensity of $P2's$ investigation is captured by the (continuous) reading cost parameter $\rho \in [0, \infty)$. While there may be other ways of modeling the sharing of reading costs, our choice corresponds closely to the way due diligence is conducted and financed in practice. [16] Indeed, it is common practice for potential lenders to require that borrowers reimburse their investigation costs even if the loan is not ultimately made (Cohen, 1996). [17]

It is also possible for $P2$ to revise his beliefs again when he completes his investigation, which reveals a binary signal $\sigma \in \{0, 1\}$ about the presence (1) or absence (0) of unexpected content in C_1. We assume that the contracting game is the same as the game with no reading costs, *modulo* the addition of reading costs:

1. Agent A begins by making a loan contract offer $C_2 = (i_2, F_2, \Psi_2, \rho)$ to $P2$.

2. $P2$ proceeds with the reading of C_1 as specified in A's contract offer [18].

[16] An alternative formulation of the problem would involve the lender choosing her reading costs privately after being paid a lump sum by A. In this setup, a mixed strategy equilibrium can be supported, in which the lender reads probabilistically and A and $P1$ write redistributive contracts probabilistically.

[17] In practice, the due diligence costs of a new lender are financed out of the firm's retained earnings. As we have assumed that the firm has no positive earnings until date 3 we assume that $P1$ lends $i_2 + \rho$ and that the expected due diligence expenditures are earmarked in a special account set up to fund such expenditures.

[18] We assume that when indifferent $P2$ always conducts the due diligence. Thus, $P2$ always conducts a level of due diligence that A fully reimburses.

3. Nature decides whether $P2$'s investigation is *effective*, which occurs with probability $P(\rho) = \frac{\rho}{\rho+\kappa}$, or *ineffective*, which occurs with the complementary probability $(1 - \frac{\rho}{\rho+\kappa})$. If the investigation is effective, $P2$ will observe the signal 0 if the true C_1 is the same as his belief about C_1, and 1 if the contract is different from his belief. If the investigation is ineffective, $P2$ will observe the signal 0, irrespective of the contract $P1$ and A have written.

4. Finally, after completing the investigation, $P2$ decides whether or not to lend given his updated beliefs about C_1.

This setup is intended to capture the possibility that $P1$ and A may put terms into their contract that have the effect of redistributing date 3 cash-flows to them rather than to $P2$. The second lender's uncertainty can then come from two possible sources. First, he may be unsure that he observes the entirety of the pre-existing loan contracts that A has written. For example, he may be wary that A did not disclose a hidden obligation, such as a loan guarantee to a parent company, that would reduce the assets available to $P2$ in the event of default. Second, even if $P2$ is confident that he possesses all relevant pre-existing contracts, some of the covenants in these contracts may be overlooked, or have implications for $P2$'s rights that are misleading. The parameter $\kappa > 0$ then represents the difficulty of discovering the meaning or implications of a clause: as κ approaches zero, even low levels of reading will discover hidden terms with probability approaching one; as κ grows toward infinity, a given reading cost expenditure discovers hidden terms with probability approaching zero.

As $P2$ may not always discover a hidden term, he understands that when $P1$'s contract appears normal to him, he still "may have missed something" (i.e. if $P1$ and A attempted to cheat him, $P2$ might receive the 0 signal even though the true C_1 is different from the contract he expects). Lender $P2$ is aware, however, that if $P1$ and A willingly reimburse a sufficient level of reading expenditures, then $P1$ and A no longer have an incentive to include a redistributive clause in C_1, since discovery of the clause by $P2$ would preclude further lending and result in an inefficient liquidation. Thus, investigation gives $P2$ confidence to lend, even if the investigation itself does not reveal the content of $P1$'s contract with certainty.

4.2 Equilibrium Contracting

We begin our analysis by pointing out that the game with reading costs does not admit a Bayes-Nash equilibrium, which implements the first-best outcome without any reading costs incurred by $P2$. To see this point, suppose that $P2$ simply follows the same lending policy as before without reading the details of the contract between $P1$ and A, hoping that $P1$ and A have written the efficient contract. Could the efficient contract between $P1$ and A still be an equilibrium move when reading costs are positive? If so, then the presence of reading costs for third parties would not be a serious concern for welfare, as agents would simply continue to draft contracts as if they were in a transactions-cost free world.

As the next lemma establishes, when $P1$ and A expect $P2$ to lend without any investigation, then their best response is to write a contract that involves maximal redistribution from $P2$ to themselves (call this contract C_1^x). Let V_x denote the joint continuation payoff to $P1$ and A in the event that they write this maximally redistributive contract and $P2$ lends. [19] Then we have the following lemma:

Lemma 2 *Suppose that $P2$ never conducts any investigation and always accepts the contract $C_2 = (i_2, i_2, P1, 0)$ in state s_g. Then the best response for $P1$ and A is to write a maximally redistributive contract $C_1^x = (i_1, \frac{i_1-(1-\pi)L}{\pi}, P1, 0)$:*

A receives i_1 at date 1, and promises $P1$ a repayment

$$F_1 = \frac{i_1 - (1-\pi)L}{\pi},$$

at date 3. $P1$ is senior to $P2$, and $P2$ has no right to any repayment at date 3 ($\Phi_1 = 0$), and no reimbursement of reading costs ($\rho = 0$). In the Coasean legal environment, $P1$ and A would receive the maximum possible joint continuation payoff $V_x = X - c$.

This lemma implies that in a Coasean legal environment with third-party reading costs, it will be impossible to avoid these costs completely, because no reading would invite opportunism by $P1$ and A.

Next, we proceed to characterize what we will term the *least-cost separating equilibrium* of the contracting game. This will be the equilibrium with the lowest feasible (deadweight)

[19] In principle, the law could even allow for negative Φ_1, implying that $P1$ could seize $P2$'s property (over and above i_2) if $P2$ makes a loan. In a world with no reading costs, there would be no loss in enforcing these extremely redistributive contracts, because $P2$ would never sign them.

reading costs that supports lending in equilibrium by $P1$ and by $P2$ in state s_g. As is well known, the set of possible Bayes-Nash equilibrium outcomes in a signaling game is typically large, and our game is no exception. This multiplicity is driven by the general form the conditional belief function can take, and the weak restrictions imposed by the equilibrium consistency-of-beliefs requirement in a Bayes-Nash equilibrium. In our game, as in other signaling games, a particular belief function appears to be particularly intuitive.

We assume that the belief function is such that $P2$ will attach positive probability weight to at most two contracts: the efficient contract C_1^{fb}, and the maximally redistributive contract C_1^x. Let $\nu(C_1) \in [0,1]$ denote $P2$'s initial belief that C_1^{fb} was written. As $P2$ expects the efficient contract C_1^{fb} before the investigation (this will be the unique contract written by $P1$ and A in equilibrium), we have $\nu(C_1) = 1$. Moreover, as in standard signaling games, $P2$ can rationally revise his beliefs about C_1 to $\nu_2(C_1 \mid C_2, \sigma)$ when he sees A's contract offer C_2 and the signal σ that results from his investigation.

We assume that this belief function takes the general form that any contract offer $C_2 = (i_2, F_2, \Psi_2, \rho)$ – where ρ is below a cutoff value ρ^*– is interpreted by $P2$ as signaling the redistributive contract C_1^x. In that case, $P2$'s updated beliefs are $\nu_2(C_1 \mid C_2, \sigma) = 0$, and $P2$'s best response is to reject the contract. On the other hand, all contract offers $C_2 = (i_2, F_2, \Psi_2, \rho)$ with $\rho \geq \rho^*$ provide sufficient reassurance to $P2$ that he is willing to lend as long as the investigation reveals nothing unusual ($\sigma = 0$). If this occurs, then $\nu_2(C_1 \mid C_2, 0) = 1$. $P2$ will then find it individually rational to invest in state s_g, as long as $F_2 \geq i_2$.

We now characterize the cutoff ρ^* that implements the least-cost separating equilibrium. Consider some $\rho \geq \rho^*$, such that $P2$ will lend after observing $\sigma = 0$. Then, $P1$ and A will find one of two possible strategies optimal given $P2$'s beliefs. The first strategy is to write the contract C_1^{fb}, which is optimal for $P1$ and A given a fully-informed $P2$. If $P1$ and A were to agree on this contract, followed by the same contract offer $C_2 = (i_2, i_2, P1, \rho)$, their date 1 expected joint continuation payoff (net of reading costs) in state s_g would be $X - i_2 - c$.

The second strategy is to write the *maximally redistributive contract* ($C_1 = C_1^x$), hoping that $P2$ will not discover it. This contract would return the highest possible joint payoff $V_x = X - c$ to the parties if the investigation is ineffective, but will result in liquidation if $P2$'s investigation is effective. The expected joint continuation payoff of $P1$ and A in the

good state from writing C_1^x is

$$\left(\frac{\rho}{\rho+\kappa}\right)L + \left(1-\frac{\rho}{\rho+\kappa}\right)V_x$$

With these expressions in hand, the following inequality tells us the level of reading costs that $P1$ and A will prefer to write into the efficient contract, given $P2$'s beliefs:

$$X - i_2 - c \geq \left(\frac{\rho}{\rho+\kappa}\right)L + \left(1-\frac{\rho}{\rho+\kappa}\right)V_x \tag{2}$$

Since equilibrium requires that $P2$'s beliefs must be consistent with the behavior of $P1$ and A along the equilibrium path, the lowest feasible cut-off ρ^* is given by the solution ρ for which (2) holds as an equality:

$$\rho^* = \frac{\kappa\{V_x - (X - i_2 - c)\}}{X - i_2 - c - L} \tag{3}$$

In the Coasean legal environment (in which the law allows fully-flexible design of property rights), this expression reduces to:

$$\rho^* = \frac{\kappa i_2}{X - i_2 - c - L} \tag{4}$$

In the least-cost separating equilibrium, $P1$ and A must set aside ρ^* to compensate $P2$ for his reading costs: if they offer less, $P2$ will rationally believe that the contract is redistributive and refuse to lend.

The final step in implementing this equilibrium is to verify that $P1$ and A prefer to implement an equilibrium that involves $P1$ lending at date 1, and continuing with effort in the good state by borrowing from $P2$. This will occur only if reading costs are not too high:

$$\pi(\bar{F}_1 - \rho^*) + (1-\pi)L \geq i_1$$

Under this assumption the project can feasibly repay $P1$ inclusive of $P2$'s reading costs, which are paid only in the good state.

We summarize this subsection by describing fully the least-cost separating equilibrium in the following proposition:

Proposition 3 *Suppose that (A1-A3) hold. If* $\pi(\bar{F}_1 - \rho^*) + (1-\pi)L \geq i_1$, *the* least cost separating Bayes-Nash equilibrium *of the lending game with reading costs is such that at date* 1, $P1$ *and* A *agree on contract* $C_1^{fb} = (i_1 + \rho^*, \frac{i_1+\rho^*-(1-\pi)(L+\rho^*)}{\pi}, P1, i_2)$ *and,*

1. $P1$ *lends* $i_1 + \rho^*$ *to* A. *In turn,* A *invests* i_1 *in the project and holds* ρ^* *until date* 2 *to reimburse* $P2$*'s reading costs,*

2. A *promises a repayment to* $P1$ *of* $F_1 = \frac{i_1+\rho^*-(1-\pi)(L+\rho^*)}{\pi}$, $P1$ *is senior, and* $P2$ *can collect no more than* $\Phi_1 = i_2$ *at date 3;*

   At date 2, *in the good state:*

3. A *offers contract* $C_2 = (i_2, i_2, P1, \rho^*)$ *to* $P2$,

4. $P2$ *reads* C_1, *observes the signal* $\sigma = 0$,*and accepts* C_2.

5. A *chooses high effort* ($e = 1$) *and the project yields* X *at date* 3.

   At date 2 *in the bad state:*

6. $P2$ *refuses to lend and the project is liquidated, paying* $L + \rho^*$ *to* $P1$.

If $\pi(\bar{F}_1 - \rho^*) + (1-\pi)L \geq i_1$ *does not hold, then there is no equilibrium with lending by* $P1$.

Proof. See the appendix. ■

If $\pi(\bar{F}_1 - \rho^*) + (1-\pi)L \geq i_1$, reading costs are not severe enough to cause lending to break down. Thus, the only inefficiency caused by the presence of reading costs for $P2$ are the deadweight reading costs ρ^*. As reading costs get larger relative to the pledgeable wealth of the project, credit-rationing can result. Firms that would otherwise receive funding under costless observability can not obtain an initial loan from $P1$.

To see this, consider the extreme case in which $\kappa = \infty$, so that reading is completely ineffective. In the Coasean legal environment, $P1$ and A can always write a contract that results in $P2$ receiving nothing at date 3. Since all inconsistencies are resolved in favor of $P1$'s contract, there is nothing A can write into $P2's$ contract that can provide any assurance to $P2$ in lieu of reading $P1's$ contract. If $P2$ believes that the efficient contract was written and lends anyway, Lemma 2 shows that $P1$ and A will prefer to write a redistributive contract. Thus, $P2$'s belief can not be sustained in equilibrium. If $P2$ never lends, then the project

always liquidates at date 1. Given our assumption that $L < i_1$, lending can never be sustained at date 1.

Whether the deadweight costs are the reading costs actually expended, or the indirect costs of underinvestment in valuable projects, it is clear that these losses will be higher when ρ^* is higher. A casual examination of (3), then, gives the following comparative statics:

Corollary 4 *Relative to the Coasean environment with no reading costs, the social welfare loss with positive reading costs is greater when:*

1. *Reading is less effective, for a given cost (higher κ);*
2. *The net gains from redistribution to $P1$ and A ($V_x - (X - i_2 - c)$) are larger;*
3. *The expected net present value of $P2$'s loan ($X - i_2 - c - L$) is smaller.*

Proof. These follow immediately from the definition of ρ^*. ■

These comparative statics are intuitive. The less effective is a given amount of reading in finding a hidden term, the more cost must be expended to eliminate the redistribution threat. When the net gains from redistribution ($V_x - (X - E(i_2) - c)$) are large relative to the cost of being caught ($X - i_2 - c - L$), $P2$ must be able to catch a redistributive covenant with greater probability for $P1$ and A to prefer to write an efficient contract rather than a maximally redistributive one.

5 Non-Coasean Legal Environments

5.1 Implementation in practice: property and contract rights

Our formal analysis so far has been based on economists' standard assumption that a Coasean legal environment prevails, in which A is free to convey any property rights in her assets to $P1$ (in particular, ownership of the firm's final cash flow). As we have highlighted, in a world with no reading costs the first-best outcome can be implemented only if A can give $P1$ these property rights, as opposed to mere contractual rights that bind only A. The difference between contractual and property rights is key when C_1 and C_2 are mutually inconsistent.

To understand this distinction, consider a legal environment that limits the ability to convey property rights. Suppose, for example, that if an inconsistency arises between C_1

and C_2, $P1$ has only the right to sue A for damages when he discovers the inconsistency (at date 3).[20] This claim for damages arises at the same time as $P2's$ contractual claims on the firm, and $A's$ assets may not be sufficient to pay everyone. Suppose that the first lender to demand his money at date 3 has priority over the other lender, and the order of arrival is random. (Under U.S. law, this is the legal rule that resolves competing contractual rights unless the borrower enters bankruptcy.)

To see why such a legal environment can fail to sustain the first-best, suppose that $F_2 > \Phi_1$, implying that A and $P2$ have violated a negative pledge clause in $P1's$ contract. This breach gives $P1$ a contractual right to sue A for damages at date 3, but no rights to recover anything from $P2$. [21]Given that $P1$'s protection does not bind $P2$, the best response of A and $P2$ in the bad state is to give $P2$ a (junior) claim on the project sufficient to satisfy $P2$'s participation constraint ($F_2 = \frac{i_2}{p}$). $P1$ will have the right to sue A for damages at date 3, but the property available to satisfy this judgment would be only the property A has left to give away. If $P2$ believes he is sufficiently likely to be able to satisfy his claim to A's assets before $P1$, then $P2$ will not be dissuaded from lending at date 2. Anticipating this outcome, $P2$ may be willing to lend in the bad state, and the inefficient continuation will not be prevented. [22][23]

A similar argument can be made if the clause in $P1$'s contract promising seniority is enforced only through a contractual right to damages against A. Since this contractual term does not bind $P2$, $P1$ has no guarantee that $P2$ will respect it. Instead, $P2$ has the incentive to race to satisfy his claim before $P1$ does. Consider the extreme case where $P2$ anticipates being able to satisfy his claim from A's assets before $P1$ with probability one. This extreme case is equivalent to seniority for $P2$ over $P1$, because $P1$ has no legal right to recover from $P2$ any money collected from A. Again, if $P1$ cannot be promised seniority, $P2$ may be

[20]These damages could be specified in $P1$'s contract; no matter how high the amount, they will not prevent the opportunism problem we describe here.

[21]Note that another alternative is for $P1$ to contract for the right to impose a non-monetary penalty on A, such as jail, if an inconsistency arises. We do not consider such penalties in the model because they are generally unenforceable in the real world.

[22]Of course, $P1$ could take $A's$ remaining cash flow, making him indifferent between continuation and liquidation. Adding a private benefit to continuation for A (avoiding a reputational penalty for liquidating, for example) would make the property right strictly more valuable than the contractual right only.

[23]A similar point is made by Schwartz (1996), arguing for property-like protections for unsecured creditors with negative covenants because contractual remedies may be insufficient.

willing to lend in the bad state.

Optimal Property Rights with Omniscient Courts

As much as the Coasean legal environment is efficient in a world with no reading costs, we now show that with positive reading costs it is not a welfare-maximizing legal rule. To establish this claim we begin by characterizing the legal rule an *omniscient* social planner would choose. That is, a planner who can observe and condition legal rules on the same set of variables that the parties can contract upon. An optimal legal rule in the presence of reading costs would then limit the rights that A could grant to $P1$, so as to eliminate the risk of expropriation of $P2$. With this risk eliminated, $P2$ will be free to lend without reading.

Lemma 5 *If courts are omniscient, an optimal legal rule modifies the Coasean legal environment by adding the following limitations on the space of enforceable property rights:*

1. *A limit on seniority: A can promise $P1$ a repayment of no more than*

$$F_1 = \frac{i_1 - (1-\pi)L}{\pi}.$$

that binds $P2$.

2. *A limitation on negative covenants: No limit below $\Phi_1 = i_2$ will be effective against $P2$.*

In this modified legal environment, the first-best action plan can be implemented by the sequence of contracts in Proposition 1 with no reading costs expended by $P2$.

Proof. Omitted. ■

The lemma demonstrates, at least in principle, that legal rules limiting the set of enforceable property rights can increase social welfare. In the lemma, the law simply mandates that $P1$'s rights be no stronger than what is necessary to achieve the first-best outcome.

It is worth noting that the law may need to limit A's senior indebtedness to $P1$ (F_1) as well as the negative covenant (Φ_1) in order for $P2$ to lend without any investigation. If the law limited Φ_1 but did not limit F_1, then $P1$ and A may find it optimal to set $F_1 = X$ (thus giving $P1$ a senior claim on the entire date 3 cash flow). If $P2$ chose to lend in the good state without investigation, he would receive zero at date 3. [24] Though A will choose low

[24] A would receive nothing at date 3 as well, but A would require an up-front cash payment from $P1$ at date 1, so that $P1$'s participation constraint binds and A receives the expected rents.

effort in the good state under this contract, the value redistributed from $P2$ (his entire loan i_2) may outweigh the efficiency loss from continuation with low effort ($(1-p)(X-\gamma L)-c$). Under U.S. law, this type of redistributive contract by $P1$ and A could in fact be invalidated by $P2$ if a court considers it a *fraudulent conveyance*. We discuss the conditions under which this can occur in Section 6.

Of course, the obvious critique of the above intervention is that it would require an unrealistic level of knowledge by courts to implement successfully in practice. Given that firms vary along many dimensions that are unobservable, the optimal cap on F_1 and Φ_1 will be firm-specific and difficult to identify precisely on a case-by-case basis. As a result, legal rules that limit the space of enforceable property rights in practice will be subject to a trade-off: stricter restrictions may reduce reading and credit rationing costs, but due to their imperfect design, tighter restrictions will impose costs on parties who would write these contracts even in a world of perfect observability.

Optimal Property Rights under Imperfect Legal Enforcement

To see this trade-off consider the following imperfect legal rule. At date 2, A may promise $P2$ a payment up to i_2 that is senior to $P1$. Suppose then that the legal rule is to enforce this contract, notwithstanding the terms in the contract between A and $P1$. This rule is similar in spirit to existing legal rules that give later lenders priority over earlier lenders that can not be contracted away, such as the priority given to debtor-in-possession lenders in bankruptcy. [25]While this provides $P2$ with reassurance in the good state, suppose that this guaranteed seniority is enough to support lending in the bad state as well, i.e. that $i_2 \leq \gamma L$.

To compare welfare under this rule and the Coasean legal environment (which simply amounts to comparing A's expected payoff under the two rules), note that total expected welfare in the least-cost separating equilibrium in the Coasean legal environment (assuming that $P1$'s participation constraint is satisfied) is given by

$$\pi(X - c - \rho^* - i_2) + (1-\pi)L - i_1 \tag{5}$$

While investment efficiency is guaranteed in the Coasean legal environment (continuation with effort in the good state, and liquidation in the bad state), deadweight reading costs ρ^*

[25]See Bisin and Rampini (2006), who argue that a reorienting of creditor priorities in bankruptcy can be valuable for moral hazard reasons in a world where exclusivity is not enforceable. See Triantis (1993) for a discussion of debtor-in-possession financing in bankruptcy.

are incurred in equilibrium. Social welfare under the new legal environment, which in effect "rules in" the new loan is the following:

$$\pi(X-c)+(1-\pi)(pX+(1-p)\gamma L-i_1-i_2) \tag{6}$$

If $P2$ knows for sure that he will recover at least the value of his loan, he would be willing to lend at fair terms to A at date 2 without the need for any investigation. But as we have seen, the cost of providing $P2$ with a certain return is that $P2$ and A have the incentive to invest and continue in the bad state of the world. Comparing social welfare in (5) and (6), we observe that as long as

$$\pi\rho^* > (1-\pi)(L-pX-(1-p)\gamma L+i_2)$$

the "rule-in" legal environment will be welfare-improving relative to the Coasean environment.

The comparative statics underlying the above inequality are also instructive. When ρ^* increases (which will be higher when κ and/or V_x are higher all else equal) the more restrictive legal environment improves welfare relative to the Coasean environment. On the other hand, $[L-pX-(1-p)\gamma L+i_2]$ represents the forgone efficiency gains when the bad state occurs. As these efficiency gains rise, the Coasean environment is more likely to be preferred. Finally, the probability $(1-\pi)$ can be thought of as a measure of the likelihood that the potentially unenforceable right would be used in equilibrium. When the states of the world in which the right is valuable are sufficiently unlikely, the more restrictive environment is to be preferred.

It is worth emphasizing that this result is driven by the inability of $P1$ and A to commit to protecting $P2$ in a Coasean legal environment, where all contracts are strictly enforced as written and all property rights are transferable. If the inequality above holds, $P1$ and A would like to commit to offering $P2$ a senior claim, because of the reading cost savings, even though this would result in an inefficient continuation in the bad state. But although they prefer this outcome, they cannot achieve it in the Coasean environment because of reading costs. Any attempt to offer this "guaranteed seniority" to $P2$ would not be credible unless accompanied by an offer to reimburse ρ^* in reading costs. Lender $P2$ is aware that, due to the first-in-time rule in the Coasean world, $P1$'s contract could contain a term setting $\Phi_1 = 0$, which would essentially nullify $P2$'s contract. Thus, $P2$ will react with suspicion to any proposal that does not include reimbursement of reading costs, and refuse to participate.

Given that legal design and courts are imperfect, there is a difficult trade-off to resolve in the design of property laws in a financial contracting setting. Although we cannot resolve these trade-offs quantitatively, the analysis in this section suggests at least three general principles that are relevant for resolving this trade-off[26]:

Principle 1 The law should be less likely to enforce a right if it is *more costly for third-parties to discover* (higher κ)

Principle 2 The law should be less likely to enforce a right if it is more *redistributive* from third parties (V_x)

Principle 3 The law should be more likely to enforce a right if the *expected efficiency gains* are larger ($(1-\pi)(L-pX-(1-p)\gamma L+i_2)$)

6 Legal Rules and Optimal Property Rights

With these principles in mind, we now discuss some examples of legal rules regarding property rights. We highlight that in a variety of situations, the general principles in our model are often reflected in the way property rights are enforced in practice.

6.1 Principle 1: Discovery costs

Perfected and unperfected security interests

Our model predicts that the law will employ a more restrictive approach to enforcing rights against third-parties, all else equal, when these rights are more costly for a third party to discover. U.S. law regarding secured credit provides an illustration of this principle. Under Article 9 of the Uniform Commercial Code (UCC), a secured creditor can acquire important rights that bind third-parties, but only if the security interest is *perfected*. For example, a perfected security interest will follow the collateral if the debtor sells it to a third-party under most circumstances. Also, if the debtor pledges the same collateral to a subsequent lender, the first creditor will have priority over the second.

[26] We should note that some of the principles of optimal property law design derived form our model are also applied in the two party context of boilerplate terms. For example, courts occasionally refuse to enforce terms under the doctrine of *unconscionability* if these terms are seen to be particularly redistributive and unlikely to be discoverable (see Farnsworth, 1999, Rakoff, 1983, and Korobkin, 2003)

Under the UCC, obtaining perfection requires that the creditor give the world notice of the security interest, usually by recording it in a filing system that third-parties can check.[27] If the secured creditor fails to record, the security interest is said to have *attached but not perfected*. In this scenario, the law allows the secured lender to enforce contractual rights that are good against the borrower, such as the ability to declare default and accelerate the loan, but the law will not enforce property rights that bind third-party buyers or lenders against the asset who act without notice of the security interest.

The notice-filing system guarantees that a security interest (or the absence thereof) can be verified easily, which reduces the required investigation costs of third-parties.[28] Without such a system, the later lender ($P2$) must rely on the cooperation of the debtor (A) to make knowledge of the early lender's ($P1$) prior interests available at low cost. For the reasons we have discussed in the model, the debtor may have the incentive to make this information costly to discover. Hence, the law applies a restrictive approach to enforcing property rights when the interest is not recorded.

Perfected security interests and negative covenants

The legal restriction on the property rights of an unperfected secured creditor also applies to creditors with negative covenants in their contracts that prevent or limit future borrowing. The existence of these covenants in bond indentures, which are mostly unsecured, is well-documented (Smith and Warner 1979; Billett, King and Mauer 2007), but they are also common in bank loan agreements, most of which are secured (Nini, Smith and Sufi 2008). This suggests that negative covenants provide protection to creditors over and above the benefit of security, as is the case in our model.

Though the model demonstrates that enforcement of these covenants as property rights can be valuable in preventing overinvestment, the law often refuses to enforce them as prop-

[27] There are exceptions to this general rule. In some circumstances, giving notice (by filing, or by taking possession of the collateral) is not required. Under revised Article 9, sales of "payment intangibles" are automatically perfected and thus do not require notice filing. Schwarcz (2006) argues that this poses a problem for securitization of such assets, as potential buyers of these intangibles can not be certain about their priority status with respect to potential competing interests.

[28] In addition to mere recording, the standardization of the security interest also likely reduces investigation costs, and allows the court to be certain that $P1's$ information can be obtained at low cost. We analyze standardization in an extension to this paper.

erty rights in practice.[29][30] The exceptions to this general rule have occurred when the court verifies that the subsequent lender had *actual knowledge* of the negative covenant and violated it willingly. In such situations, courts have created remedies for the negative covenant holders that bind the subsequent lender.[31]

The usual rationale given for the difference between the perfected security interest and the negative covenant is the absence of a registration system for covenants that reduce verification costs (Bjerre 1999). Like an unrecorded security interest, discovery of a negative covenant requires the cooperation of the borrower, which is less reliable than a recording system. Enforcing the negative covenant (or the unperfected security interest) against $P2$ when he has actual knowledge is also consistent with our model. If the court can verify that $P2$ was aware and understood the negative covenant, then there is no cost to enforcing $P1$'s rights exactly as he intends. Importantly, however, the law generally does not place the burden on $P2$ to discover and fully understand negative covenants, which helps limit $P2$'s required verification costs.[32]

One interesting recent example of the law's treatment of negative covenants is the case Hechinger Liquidation Trust v. BankBoston Retail Fin., Inc. In that case, unsecured bondholders ($P1$) argued that Hechinger (A) violated the terms of a negative pledge covenant when it issued secured debt to Chase ($P2$), who provided financing for Hechinger's acquisition of Builders Square. The negative pledge contained an exception that allowed Hechinger to issue new secured debt to purchase new assets, as long as the new assets exceeded the value of the secured debt.[33] The two sides offered competing valuations of Builders Square to

[29] The oldest known case on this subject is Knott v. Shepherdstown Manufacturing, 5 S.E. 266 (W. Va. 1888) in which the court found that the breach of the negative covenant gave rise only to a claim for damages against the borrower.

[30] Similarly, an unsecured creditor can not subordinate future unsecured creditors unless they explicitly agree to the subordination (Schwartz 1989)

[31] In the case First Wyoming Bank v. Mudge (748 P.2d 713 Wyo. 1988) a negative pledge holder was able to recover damages from a later secured lender who knowingly violated the negative pledge clause.

[32] This does not fully resolve the issue from a normative standpoint, of course. Bjerre (1999) argues that Article 9 should be expanded to allow registration of negative pledge clauses (prohibitions on future secured debt), thus allowing them to bind third-parties. Pursuing this logic further, the law could allow *any* negative covenant to be publicized, including stronger covenants (such as the ones we model here through the Φ parameter) that void any subsequent debt, secured or otherwise. In a prior version of this paper (Ayotte and Bolton 2007) we discuss this issue in more detail.

[33] This description of the facts is somewhat oversimplified, in that the interpretation of the negative pledge

show that the negative pledge was, or was not, violated.

Instead of making the decision based on the accuracy of the competing valuations, the judge ruled that the bondholders were not entitled to an *equitable lien*, a property right which would have elevated their priority in Hechinger's bankruptcy. The judge argued that, irrespective of the actual value of Builder's Square, the secured creditor did not have *actual knowledge* that they were violating the negative pledge when they made the loan. This finding relied on the fact that Chase conducted due diligence in good faith, and relied on outsiders' opinions that the negative pledge was not violated by the secured loan:

> It is uncontroverted that the 1997 Transactions [which included Chase's loan] were negotiated in good faith, at arms-length and with reliance upon professional advice and opinions with respect to compliance with the terms of the Negative Pledge...Even if the court were to adopt plaintiff's expert's testimony with respect to the value of Builders Square, the court finds no evidence that Chase Bank or defendants [BankBoston, who acquired the loan from Chase] had actual knowledge of that valuation, that they were under no legal duty to know that valuation and, therefore, there is no basis in law or equity to impose a lien based on that valuation.[34]

In addition to demonstrating the law's willingness to limit property rights to negative covenant holders, this case also illustrates the real-world nature of investigation costs. Not only must contractual terms be discovered (as the negative pledge was discovered by Chase), but they must also be interpreted and understood by third-parties, and this understanding may be costly to achieve. The court's ruling in this case serves to limit the required investigation by third-parties into the meaning of terms in pre-existing contracts that are subjective or ambiguous.

6.2 Principle 2: Redistributive rights

Fraudulent conveyance

Our model suggests that the law adds value by refusing to enforce a division of rights that is particularly *redistributive* from third-parties. The law of fraudulent conveyance is intended

clause itself was disputed, not only the valuation of the target.

[34] 287 B.R. 145, D. Del (2002)

to invalidate exactly these redistributive transfers of rights. Under the Uniform Fraudulent Transfers Act (UFTA), an unsecured creditor can invalidate a transaction if it satisfies the conditions for *actual fraud* or *constructive fraud*. Actual fraud requires demonstrating fraudulent intent on the part of the parties to the transaction (in this context, A and $P1$) to redistribute from $P2$. The tests for constructive fraud require the creditor to demonstrate that the transaction left the firm in poor financial condition, so that it is insufficiently capitalized, or unlikely to be able to pay future debts when they come due.[35] It is exactly these transactions that are likely to be redistributive from $P2$.

Fraudulent conveyance attacks have arisen in leveraged buyouts that subsequently fail. To make the example concrete, consider a redistributive transaction between $P1$ and A, similar to the transaction we discuss following Lemma 5. Concretely, suppose $P1$ and A engage in a leveraged recapitalization at date 1, whereby $P1$ lends money to a corporation controlled by A in exchange for a large debt claim secured by A's assets. The corporation pays A the proceeds from the debt issue as a dividend at date 1, leaving A's firm highly levered. If the corporation later borrows from $P2$, and then files for bankruptcy, $P2$ may be able to attack the recapitalization as a fraudulent conveyance, and unwind the security interest given to $P1$.

Notably, consistent with Principle 1, some courts have taken the cost of discovery into account, refusing to apply fraudulent conveyance law to protect future creditors in situations where the cost of becoming informed about past transactions is sufficiently low. In the case *Kupetz v. Wolf*, the court refused to protect creditors who invested after a well-publicized leveraged buyout:

> "Because fraudulent conveyance statutes were designed to protect creditors from secret transactions by debtors, the same rules should not apply when the transaction is made public. *Future creditors may not complain when they knew or could easily have found out about the transaction.* This certainly appears to be the case in this particular LBO. The transaction was well-publicized and the Trustee has not claimed or presented evidence that any of the future creditors were not aware of Wolf & Vine's financial dealings." [emphasis added][36]

[35] Constructive fraud can be established if the creditor can show that the debtor firm a) received less than reasonably equivalent value for the transfer, and b) that the debtor was in a precarious financial situation at the time of the transfer (Blum, 2004).

[36] 845 F.2d 842 (9th Cir. 1988)

The proper role for fraudulent conveyance law is a topic that has received attention in existing legal scholarship. Baird and Jackson (1985) argue that creditors can use protective covenants to prevent fraudulent conveyances (such as a leveraged buyout that dilutes earlier unsecured creditors) voluntarily if they so choose, but firms can not "contract out" of fraudulent conveyance protection if courts apply it erroneously. Our model is consistent with this argument, as it does not justify any mandatory restrictions on $P1$'s ability to weaken *his own* rights against $P2$ that are provided by default in the law.[37]

Nevertheless, our model can be used to explain why the law might refuse to enforce a contract between A and $P1$ that weakens $P2$'s rights, by preventing $P2$ from using the fraudulent conveyance remedy, as this would require $P2$'s investigation to discover a right that may be harmful to him. In this context, our model implies that there is a valid trade-off between the benefits of reducing investigation expenditures and credit-rationing, and the costs of ineffective or incorrect enforcement of this standard by courts.

Piercing the corporate veil

Though our discussion focuses on security interests and negative covenants as a means of protecting $P1$'s claims against dilution by $P2$, another means of giving $P1$ priority over $P2$ is through the creation of separate legal entities. For example, A might create a parent company and a wholly-owned subsidiary, and allow $P1$ to lend at the parent level, while $P2$ lends at the subsidiary level. This would imply that $P2$ would be senior to $P1$ with respect to assets held at the subsidiary level, but $P2$ would have no ability to reach the assets at the parent level if the subsidiary's assets are not sufficient to repay $P2$.

When such multi-tiered organizational structures exist, $P2$'s information about which entity owns which assets, and the nature of the relationship between the two entities, is obviously important. As we have seen, A might have an incentive to disguise the fact that $P2$ is lending to an under-capitalized subsidiary rather than a well-capitalized parent company. When such misrepresentation is possible due to vague boundaries between entities, creditors can attempt to pierce the veil of the subsidiary and pursue the parent's assets to satisfy their claims. While the application of veil-piercing by courts is difficult to generalize, Thompson (1991) finds that the most common reasoning includes undercapitalization of the

[37] Moreover, in such a context, A would have every incentive to reveal this contractual term to $P2$, as it would result in more generous lending terms from $P2$. This is not true in the opposite case (where A and $P1$ restrict $P2$'s rights), as A has the incentive to disguise this information.

subsidiary and the misrepresentation of entity boundaries by the firm. The first rationale is consistent with Principle 2: the more thinly-capitalized the subsidiary, the lower the recovery for the later lender if veil-piercing is not allowed.[38] The second rationale is consistent with Principle 1, that in misrepresenting the boundary of the entity, the firm increased the costs of discovery to third-parties.

6.3 Principle 3: Efficiency

Limitations on anti-assignment clauses

Our model suggests a trade-off in legal design between limiting verification costs, and allowing for divisions of rights that enhance efficiency. One example of balancing these competing forces can be found in the treatment of contractual anti-assignment clauses. For instance, a firm operating as a franchisee (A) may desire to grant a security interest in his franchisee rights to a lender ($P2$) as a means of obtaining cheaper credit, but the franchisor ($P1$) may value the right to restrict who can become a franchisee. In a different context, a bank (A) might wish to sell its rights to payment on a loan to an investor ($P2$), but the borrower ($P1$) may be concerned about who his creditors are in the future.

These applications are a slight departure from the model in that the principals are not both lenders, but the underlying trade-off is similar. If the law allows complete contractual freedom between $P1$ and A to limit A's ability to assign his rights to $P2$, this could result in redistribution from an uninformed $P2$ who attempts to acquire A's rights, and later finds himself empty-handed. The possibility of this outcome would increase the required investigation of potential $P2$'s before agreeing with A, and potentially limit the liquidity of these financial contracts in secondary markets if $P2$ attempts to resell them.[39] On the other hand, limiting the scope of $P1$ and A to create such restraints might hinder efficient contracting. For example, after making a loan to a borrower, a relationship bank might be tempted to assign a loan to a lender who would be unwilling to forgive minor covenant

[38] Easterbrook and Fischel (1985) argues, in the same spirit as our model, that allowing for veil-piercing in these contexts can be understood as a means of providing incentives for firms to disclose their undercapitalization to creditors when a full investigation of the firm's finances is prohibitively costly.

[39] Some anecdotal evidence from Canada supports this feature of our model. In Quebec and Ontario, anti-assignment provisions are not part of the commercial code. As a result, Fingerhut (2006), in an article targeted at practicing lawyers, warns that "additional due diligence is called for when the collateral includes Quebec or Ontario receivables."

violations, simply because this "tough" lender is willing to buy the loan at a high price.[40] Allowing these restraints on assignment to be enforceable helps the bank commit to the relationship with the borrower.

Article 9 of the UCC resolves this tension in a way that balances the key trade-offs of efficiency gains against verification costs. In contexts such as the examples above, the UCC invalidates agreements between A and $P1$ that attempt to restrict assignability to $P2$.[41] This restriction allows potential third-parties to lend against or purchase these assets without taking the steps to verify that these anti-assignment clauses are not present. To protect $P1$, however, the law allows a contractual anti-assignment provision to limit $P2$'s rights to *enforce* the security interest against $P1$. Thus, a borrower in a commercial lending context can ensure that he will not be subject to the aggressive collection tactics of an unknown loan buyer if he contracts for this protection, yet the loan buyer can be certain that in purchasing rights to payment, his potential losses from failing to discover an anti-assignment clause are limited.[42]

7 Conclusion

In this paper, we adopt a definition of property rights that departs from the existing economics literature (Grossman and Hart, 1986) but builds on recent legal scholarship, which emphasizes that property rights are rights that bind third-parties. A key concern with granting property rights then is that third-parties may be imperfectly informed about pre-existing rights that may affect them. In a financial contracting context, these concepts are particularly important because borrowers may become insolvent. As a result, lenders are particularly worried about the presence of rights that bind other lenders with competing

[40] Consistent with this logic, Guner (2007) finds that borrowers extract concessions from banks that are likely to sell loans through lower interest rates.

[41] The discussion applies to collateral covered by UCC §9-408 which includes, among other things, "general intangibles" such as franchise and licensing agreements, and sales of "payment intangibles" such as commercial loans. For a thorough discussion of these issues, see Morse (2001), Plank (2001) and Schwarcz (1999).

[42] The reader might wonder what the value of a security interest in the intangible to $P2$ would be in the presence of an anti-assignment clause if $P2$ can not enforce his rights against $P1$. If $P2$ were a secured lender to A against the intangible, the protection $P2$ would obtain in this case is, among other things, the right to adequate protection payments if A files for bankruptcy. For an example, see Plank (2001), p. 331.

claims.

We develop a formal theoretical model in which lenders and borrowers are rational, in that they anticipate the strategic behavior of other players, and can write sophisticated contracts that attempt to mitigate inefficient, opportunistic behavior. If information is costless to acquire, a legal environment that allows parties maximum flexibility to create and enforce any allocation of divided property rights is optimal. When observability is costly, however, there can be a role for the legal system to limit the space of property rights that are enforceable.

If the law permits full enforceability, third-parties will not participate without conducting sufficient investigation to reassure themselves that redistribution at their expense has not occurred. In equilibrium, these deadweight reading costs are borne by the borrowing firms. There is no way for firms to reduce these costs, due to an inability to commit to protecting third-parties from redistribution. But, the law can add value by providing firms with a credible mechanism to make this commitment. If the cost of discovering a right is large enough, and the right is potentially redistributive, then the law will optimally refuse to enforce such a right. The law in our model can be seen as mandatory, in that the law will mandate a relationship between the enforceability of a right and the cost of discovering that right by third-parties which cannot be adjusted by contract. On the other hand, if contracting parties can demonstrate to a court that they made third-parties aware of their pre-existing rights, then our model suggests the rights should be enforced.

In our investigation into existing law, we find several examples that broadly confirm the qualitative trade-offs in the model. Laws that govern financial contracting in which third-parties are affected often limit the ability of early lenders to create enforceable property rights that can be redistributive. The law will not enforce a property right when it is unlikely that the right has an efficiency rationale, and it will enforce the right when knowledge about the right is relatively inexpensive for a third-party to acquire.

While our formal model is intended to add an additional element of realism to the study of legal design in a financial contracting setting, there are other important factors that our analysis does not address. For instance, many of the mandatory standards in the law that are intended to protect third-parties also entail substantial ex-post litigation costs. If accessing courts is costly, and judges make errors, later lenders could threaten to use the legal protections we document above in an opportunistic way as a means of extracting value

from earlier lenders. This could lead to deadweight costs and inefficient allocations and tip the scales toward a more permissive (Coasean) legal environment. Also, the ability of the early lender to protect himself by monitoring the firm's contracting with the later lender is not present in the current model. Adding the possibility of costly monitoring would imply that $P1$ has other means of protecting himself from dilution by $P2$, reducing the cost of less-permissive legal rules.

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8 Appendix

Proof of Proposition 1:

Note first that under the contract written between $P1$ and A, $P2$ is not willing to lend to A at date 2 in the bad state. By lending i_2 principal $P2$ gets an expected repayment which is less than the loan i_2. Indeed, the most $P2$ can hope to get is

$$pi_2 + (1-p)\max\{0, \gamma L - F_1\} = pi_2$$

since

$$\gamma L - F_1 = \gamma L - \frac{i_1 - (1-\pi)L}{\pi} =$$
$$\frac{\pi\gamma L + (1-\pi)L - i_1}{\pi} < \frac{L - i_1}{\pi} < 0.$$

Next, $P2$ is willing to lend to A at date 2 in the good state under the contract written between $P1$ and A, since $X - (i_2 + F_1) > \frac{c}{1-p}$, or

$$\pi(X - \frac{c}{1-p} - i_2) - (1-\pi)L \geq i_1$$

by assumption **A3.** And when $X - (i_2 + F_1) > \frac{c}{1-p}$, A's best response is to choose high effort ($e = 1$), since then:

$$X - (i_2 + F_1) - c > p(X - (i_2 + F_1)) \tag{7}$$

as

$$F_1 \leq \bar{F}_1 \equiv X - \frac{c}{1-p} - i_2$$

by assumption **A3**, and by definition of $\bar{F}_1$,

$$X - \bar{F}_1 \geq \frac{c}{1-p}.$$

The RHS of (**??**) is A's expected payoff under the low effort choice ($e = 0$), since when the project fails and only yields a liquidation value γL the firm's total liabilities $(i_2 + F_1)$ exceed its assets γL, so that A gets zero. When A chooses high effort the firm gets a cash flow of X for sure at date 3. The firm's debt is therefore safe, so that $P1$ is willing to lend i_1 in return for a debt repayment of the same amount at date 3.

8.0.1 The Bayes-Nash Equilibrium and Proposition 3

An equilibrium of our game is taken to be a *Bayes-Nash equilibrium*, where:

1. All agents play a best response given their beliefs, and
2. All players' updated beliefs are consistent with all agents' best responses.

More concretely,

a $P1$ and A choose C_1 at date 1 given $P2$'s expected equilibrium best response,

b A chooses the contract offer C_2 optimally at date 2 given the past choice of C_1 at date 1 and given $P2$'s beliefs $\nu_2(C_1 \mid C_2, \sigma)$,

c $P2$ best responds by deciding whether or not to lend when σ is observed. (We assume that $P2$ incurs any reading costs that will be reimbursed by A, irrespective of his beliefs).

d $P2$'s updated beliefs $\nu_2(C_1)$ and $\nu_2(C_1 \mid C_2, \sigma)$ are consistent with the equilibrium choices, C_1 and C_2.

Under these assumptions, and under the initial belief-function $\nu_2(C_1) = 1$ and the updated belief function $\nu_2(C_1^{fb} \mid C_2 = (i_2, i_2, P1, \rho), \sigma = 0) = 1$ for $\rho \geq \rho^*$ and $\nu_2(C_1^{fb} \mid C_2, \Omega(C_1)) = 0$ otherwise, the *least-cost separating* Bayes-Nash equilibrium of the full contracting game is stated in Proposition 3.

The proof of Proposition 3 is as follows:

Proof. Given that under reading intensity ρ^* we have

$$X - i_2 - c = \left(\frac{\rho^*}{\rho^* + \kappa}\right) L + \left(1 - \frac{\rho^*}{\rho^* + \kappa}\right)(X - c), \tag{8}$$

it is a (weak) best response for $P1$ and A to agree to contract C_1^{fb} provided that $\pi(\bar{F}_1 - \rho^*) + (1 - \pi)L \geq i_1$, so that P1's participation constraint is satisfied given equilibrium play. Given the choice of C_1^{fb}, $P2's$ investigation will produce $\sigma = 0$. Thus, $P2$'s equilibrium beliefs $\nu_2(C_1) = 1$ and $\nu_2(C_1^{fb} \mid C_2 = (i_2, i_2, P1, \rho^*), \Omega(C_1) = C_1^{fb}) = 1$ are consistent with $P1$ and A's equilibrium play. It is a (weak) best response for A to offer contract $C_2 = (i_2, i_2, P1, \rho^*)$ at date 2, and a (weak) best response for $P2$ to accept C_2 in the good state, and reject it in the bad state. In particular, A cannot obtain a higher payoff by offering any other contract $C_2 = (i_2, i_2, P1, \rho)$, with $\rho \neq \rho^*$ at date 2. Indeed, any contract with $\rho > \rho^*$ would involve unnecessarily high reading cost expenditures, and any contract such that $\rho < \rho^*$ would be rejected by $P2$ given his updated beliefs, yielding a payoff of $L + \rho^*$ to $P1$ and A. To show this is less than $X - i_2 - c$, note that $\pi(\bar{F}_1 - \rho^*) + (1 - \pi)L \geq i_1$. Combining this assumption with $L < i_1$, and the definition of $\bar{F}_1$, it follows that $X - i_2 - c > \bar{F}_1 > L + \rho^*$.

Finally, note that if $\pi(\bar{F}_1 - \rho^*) + (1 - \pi)L < i_1$, P1's participation constraint can not be satisfied, so he will not lend at date 1 given these proposed contracts. Since this is the least-cost separating equilibrium by definition, there is no equilibrium with lending by both $P1$ and $P2$. ■