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Nearsighted Justice

by Dan Bernhardt and Ed Nosal

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Chapter 11 structures complex negotiations between creditors and debtors that are overseen by a bankruptcy court. This paper identifies conditions under which it is optimal for the court to sometimes err in determining whether a firm should be liquidated. Such errors can affect the optimal action choices by both good and bad entrepreneurs. We first characterize the optimal error rate without renegotiation, providing conditions under which it is optimal for the court both to sometimes mistakenly liquidate "good firms," but not "bad firms." When creditors and debtors can renegotiate to circumvent an error-riven court and creditors have all of the bargaining power, we show that for a broad class of action choices, a *blind* court—one that ignores all information and hence is equally likely to liquidate a good firm as a bad one—is optimal. For another class of action choices, the optimal court design places the burden of proof on the entrepreneur. The robust feature is that in the optimal court design, the court sometimes errs in determining whether a firm should be liquidated.

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"It may not be optimal for justice to be blind, but it can help if she's near-sighted."

"If parties can negotiate out of the way of blind justice, blind may be best."

1 Introduction

Chapter 11 structures complex negotiations between creditors and debtors that are overseen by a bankruptcy court. It is often unclear whether it is socially optimal for a bankrupt firm to be re-organized as a continuing entity, or whether it should be liquidated and the proceeds from liquidation distributed. If creditors and debtors cannot reach a settlement, then the bankruptcy court may impose one. This paper asks the following questions: Is it always optimal for the court to make the 'right' decision? If liquidation is efficient, should the court always mandate liquidation? If the bankrupt firm could be a profitable entity, should the court always allow it to re-structure under the existing management and continue? Or is it optimal for the court to sometimes make mistakes? How does the possibility of negotiated settlements affect the optimal design of the court?

At one level the answers to these questions are straightforward. In a world where more accurate appraisals of a firm's quality are more costly, the optimal allocation by a court of resources to evaluation of bankrupt firms will always reflect trade-offs between the marginal costs of better appraisals and the marginal benefit of decision-making based on more accurate appraisals. In this paper, we show that a court should also consider how the probability that it mis-identifies the quality of a bankrupt firm affects the *ex ante* behavior of management, and hence the probability that the firm becomes bankrupt.

We develop a simple model that abstracts completely from the increasing marginal costs of more accurate appraisals in order to focus on how the probabilities that the court errs affect both the actions taken by management and outcomes. In a sparsely-specified model of entrepreneurial finance we show that it may be optimal for the court to err occasionally. We consider an environment in which some entrepreneurs are better than others, and their skills are private information. It is efficient to liquidate an entrepreneur if and only if he is bad.

Entrepreneurs also cannot be trusted. An entrepreneur can take hidden actions that affect (a) the probability that the firm cannot meet its loan obligations, (b) expected period entrepreneurial profits, and (c) expected period project revenues. We consider a broad variety of action interpretations. For example, the action choices could be investment choices; some investments might be risky negative NPV investments that pay off in non-bankruptcy states, but increase the probability of low revenue, bankruptcy outcomes. Alternatively, the action choices could correspond to effort, the choice of whether to steal from the firm, the choice of whether to have a fire sale of inventory that raises current revenues at the expense of lower future revenues, and so on.

There are at least three issues that might concern the court:

1. To identify which entrepreneurs are good and which ones are bad, so that bad firms, but not good ones can be liquidated.

2. To discourage socially inefficient action choices prior to bankruptcy.

3. To internalize the effect of the court design on the incentives of entrepreneurs and creditors to reach a settlement rather than leave the outcome to be decided by an error-prone court; and the consequences for *ex ante* actions.

Unfortunately, these goals may conflict. One might like to use the threat of liquidation to discourage a good entrepreneur from taking negative NPV gambles or under-exerting effort. However, if a good entrepreneur is always identified as such by the bankruptcy court, then liquidation is not time consistent and, the entrepreneur realizing this, may take actions that reduce total surplus.

Conversely, if a bad entrepreneur is always identified as such by the bankruptcy court, he may want to take actions that reduce the probability of entering bankruptcy. For example, this aversion to bankruptcy may cause bad entrepreneurs to over-exert, or to engage in fire sales that inefficiently increase current revenues, reducing the probability of bankruptcy in the current period at the expense of future revenues. It may be socially desirable to design the court so that it makes some mistakes, thereby reducing a bad entrepreneur's aversion to bankruptcy.

Thus, for both good entrepreneurs and bad, it may be optimal for the court to err occasionally:

1. The threat of mistakenly liquidating a good firm may be sufficient to keep it from, for example, taking negative NPV gambles that raise the probability of entering bankruptcy.

2. The possibility that a bad firm is *not* identified by the court as such, may encourage a bad entrepreneur to take actions that land the firm in bankruptcy with a higher probability. The direct total surplus associated with the action that lands the firm in bankruptcy can be either positive (if it discourages fire sales), or negative (if it causes a bad entrepreneur to under-exert, or to choose excessively safe, lower NPV projects). Even if the direct surplus effect of the court design on action choice is negative, it may still be optimal for the court to err if, as a result, more bad entrepreneurs are liquidated at early dates.

We characterize the optimal rate at which the court should make mistakes, both when creditors and entrepreneurs cannot bargain prior to the court's decision, and when they may be able to reach a settlement that would obviate the need for the court to make a decision. The analyses with and without renegotiation provide bounds on the benefits of a court that makes mistakes. When renegotiation is infeasible, any liquidating mistakes by the court must be incurred, making an error-riven court less attractive, although not necessarily sub-optimal.

In contrast, the possibility of renegotiation allows the court to be designed as a potentially costly back-up threat, but one that, in equilibrium, need not be used: the *threat* that the court may make the wrong decision may be enough to encourage the parties to reach a settlement rather than take their chances with an unreliable court. The analysis with renegotiation is subtle, because the creditor does not know the entrepreneur's type. The creditor must design payments that discourage a good entrepreneur from passing himself off as bad in order to receive a payment for liquidation, rather than make a payment to avoid going to court; and discourage a bad entrepreneur from passing himself off as good in order to circumvent the court and continue to operate.

Stark results obtain when an entrepreneur and creditor can always renegotiate to circumvent an error-riven court. We characterize the optimal court design for two broad classes of action choices, those where it is optimal to

1. Discourage good entrepreneurs from taking actions that raise bankruptcy probabilities (theft, perk consumption, risky NPV investments, shirking), while discouraging bad entrepreneurs from taking actions that lower bankruptcy probabilities (fire sales, working too hard, excessively safe low NPV investments).

2. Discourage both good entrepreneurs and bad from taking actions that raise bankruptcy probabilities.

For the first class of economies, a simple *blind* court design always dominates a court that never errs. Indeed, a blind court can sometimes implement the social optimum. That is, not only should the court always be *near-sighted* and err in the identification of entrepreneurs, but it should ignore *all* information, essentially making liquidation decisions on the basis of a fair coin flip. Even when a blind court cannot always induce *ex ante* entrepreneurs to take optimal actions, as long as it is optimal to encourage bad entrepreneurs to take actions that increase the chance that they are liquidated, then a *blind* court dominates a court that makes no errors. For the second class of economies, the social optimum can be implemented by placing a very stringent burden of proof on entrepreneurs. The burden of proof is stringent in the sense that, although a bad entrepreneur is never able to pass himself off as being good, a good entrepreneur may sometimes fail to convince that court that he is, in fact, good.

While the optimal court design differs depending on the nature of the action choice, the key features that they share are (i) the optimal court designs are simple, and easily implemented, and (ii) the optimal court design is one in which the court errs.

Although we pose the model in the context of Chapter 11 bankruptcy, the problem that we analyze is more fundamental. The general formulation is a dynamic principal-agent costly state verification environment in which the agent's type is unknown and the principal and agent's interests are not aligned over action choice. The principal must choose the quality of an evaluation technology to employ to verify the agent's type, and the outcome of the evaluation affects whether the agent is retained. Sequential rationality implies that only the agent's type is relevant for continuation decisions, but type-contingent continuation probabilities affect the agent's decisions about which action to take.

We could have presented our analysis in the context of shareholders in a firm who must decide whether to incur the costs of investigating whether or not to replace management. Shareholders do not want to incur the costs of investigating good managers, but they do want to discourage good managers from taking actions that lower the firm value (build personal empires, steal, etc.); shareholders may also want bad managers to take actions that lead to signals (lower immediate profits) indicating that the managers should be investigated and replaced. Shareholders may optimally choose a noisy evaluation technology for managers, both for reasons of costs and because the possibility of mistakes may provide the right incentives for management: The noisy technology may help deter inefficient action choices by good managers, and help identify bad managers.

So, too, the analysis could have been posed in a venture capital/equity finance context. Here, ongoing projects require a second-period injection of capital, and a financier must decide whether to provide the capital. The financier will set a revenue standard such that if revenues exceed that level, it will provide financing; while for lesser levels, the financier will evaluate the entrepreneur, and depending on the (noisy) signal received decide whether to provide the additional capital. *Ex ante*, the financier commits to the quality of the data on an entrepreneur that he will collect.

Our paper is related to least four different literatures: the law and economics literature on optimal court design; the law and economics literature on contracting in the face of an imperfect and/or costly court; the bankruptcy literature; and the literature on the hold-up problem. We will discuss, in turn, how our paper contributes to each of these areas.

Our paper contributes to the general law and economics literature on the optimal design of the court. Existing research on court design focuses on how best to design the court in order to *elicit* information from informed parties. This research builds on the "games of persuasion" literature introduced by Milgrom (1981) and Milgrom and Roberts (1986). Here, an interested party who has private information attempts to influence an asymmetrically-informed decision maker. In law contexts, the interested parties are a plaintiff and a defendant in a trial and the decision maker is a judge. The judge, who wants to make the socially optimal decision, has to rule for one party, and his decision is based on the information that he receives. The issues that arise are:

- Should a trial be based on an adversarial system, where the plaintiff and defendant present verifiable information to the judge and the judge makes his decision on the information presented; or should the judge try to uncover the information himself (Shin (1998))?
- Should a judge restrict the information that can be presented (Fishman and Hagerty (1990))?
- Which interested party must provide the evidence in order to "win" the trial; that is, who should bear the burden of proof (Hay and Spier (1997), Shin (1994), Sobel (1985))?

In this literature, the answers to these questions ultimately depend upon the quality of the signal that the decision maker receives. For example, if restricting the information that the decision maker receives increases the quality or the informativeness of the signal, then information should be restricted, as this raises the probability of a correct decision. Most starkly, if, as in our model, the decision maker has access to a costless technology that perfectly reveals the hidden information, then in virtually all games of persuasion, the decision maker would use this technology.

What distinguishes our analysis from this literature is that in these games of persuasion the analysis is *ex post*. That is, the actions that landed a plaintiff and defendant in front of a judge are not examined: the analysis begins with the plaintiff and defendant in trial. It follows immediately that better information is always preferred. In sharp contrast, our analysis explicitly models the *ex ante* actions that could lead to a bankruptcy trial. Now the optimal signal that the judge receives must strike a balance between *ex ante* and *ex post* considerations. Were the standard literature to incorporate *ex ante* decision making into their persuasion games, then our analysis strongly suggests that the most informative signal would be sub-optimal. One can interpret our paper as contributing to this literature by modeling the *ex ante* decisions of the interested parties and examining the implications for the optimal signal strength that the decision maker receives.

Our paper is also related to the law and economics literature on contracting in the face of an imperfect or costly court. For example, Spier (1994) examines a situation where a victim can experience either a mild or severe accident and the injurer can undertake costly precautions that can reduce the probability and severity of an accident. If a court can observe the level of harm at "low" cost, then it is optimal to set higher damage awards for higher levels of harm. In this situation, the potential injurer invests in the first-best level of precaution. If, instead, it is sufficiently costly for court to observe harm, the court sets a constant damage award and all victims and injurers settle out of court. Although the court uses no resources, the potential injurer under-invests in precaution. As in our paper, court behavior influences *ex ante* behavior. But, in important contrast, the first-best outcome would be achieved if the court costlessly observed the truth; in our model the first-best is unattainable if the court observes the truth. Grossman and Katz (1983) consider a situation where a court makes mistakes and a risk-averse defendant is either innocent or guilty. Here, plea bargains—which are effective renegotiations—are optimal because they separate the innocent from the guilty (guilty parties accept the plea bargain and innocent parties go to court). Thus, as in our paper, allowing parties to renegotiate outside of court raises welfare; but again in Grossman and Katz' environment it is always optimal for the court not to err.

Our paper is closely related to the bankruptcy literature that explores how the optimal design of bankruptcy law may introduce *ex post* distortions in resource allocations in order to alter the *ex ante* behavior of management. Berkovitch et al. (1998) argues that "The structured bargaining imposed by an optimal bankruptcy law provides the entrepreneur with optimal *ex ante* incentives by placing him in a superior bargaining position in the negotiations triggered by financial distress. The bankruptcy law serves as a commitment device and is required to enforce this re-balancing of the relative bargaining strengths of the claimants *ex post*." Giammarino and Nosal (1994) provide conditions where Chapter 11, as an option, can increase efficiency by providing management with additional *ex post* bargaining strength. The additional bargaining strength implies that management now has an incentive to take actions that enhance social welfare. Bernhardt and Lu (1998) model the dynamic features of Chapter 11, exploring how the time allotted management to make restructuring offers affects both *ex post* outcomes such as the timing of liquidation and settlement outcomes, as well as the *ex ante* effects on such managerial actions as effort and project selection.

Finally, our paper is related to the hold-up literature begun by Williamson (1985). In a typical hold-up problem model, agents take actions, observe outcomes, possibly renegotiate contracts, or go to court and make final exchanges. In the standard model, the court costlessly enforces only those aspects of the contract that it can verify and some key attribute is unverifiable. When a seller's action is a costly investment that enhances the value of its good to the buyer, Che and Hausch (1999) find that if the court cannot verify the investment, then even if the amount traded is verifiable, under-investment necessarily results. However, in a recent working paper, Willingston (2002) shows that when the court is "blind," in the sense that it randomly decides whether the seller breached, then it is possible to devise a contract in which the seller makes the optimal investment. This result mirrors ours in number of ways. Because the court makes errors, the parties prefer to renegotiate the original contract to eliminate *ex post* inefficiencies, and it is the fact the court makes errors that promotes optimal *ex ante* behavior.

The next section presents the basic model. We identify the costs and benefits associated with the courts making mistakes and develop the intuition for why courts may optimally choose to err. By imposing only weak structure on the lending contract (in particular, the lending environment need not be competitive), the nature of the possible action choices that an entrepreneur could take and how they affect bankruptcy probabilities, the section provides insights into the nature of the liquidation mistakes that the courts might make. The intuition underlying the analysis is made more transparent by giving the court complete flexibility in the choice of monitoring technology for each type of entrepreneur. In practice, however, the court generally does not have this kind of flexibility in choosing type contingent monitoring technologies. We, therefore, consider how the results are altered when the court's choices are more constrained. We do this for two broad sets of economies: In section 3 the action choice corresponds either to undertaking perk consumption or having a fire sale, while in section 4 the action corresponds to theft or shirking. Section 5 concludes.

2 Unconstrained court evaluation technologies

A single risk-neutral entrepreneur requires external funding of one unit of capital to finance an *ex ante* positive NPV project. The potentially two-period-lived project is financed by a risk-neutral investor through the financing contract C. Neither entrepreneur nor investor discount payoffs. The contract, which we describe below, specifies both the payments to the investor as a function of observed project revenues, as well as a revenue cutoff such that for lower revenues the entrepreneur is in default, cannot "meet" its contractual obligations and "enters bankruptcy."

The project offers random payoffs in two periods. The project is either good or bad. The timing of events is such that the entrepreneur does not know the project type when the financial contract is negotiated with the investor, but does learn the type prior to taking any actions. The project's (or entrepreneur's) type, $\epsilon \in \{g, b\}$, is private information to the entrepreneur. Let $p(\epsilon)$ be the probability that the entrepreneur is type ϵ.

In the first period, entrepreneur ϵ chooses an action, a_ϵ. Both the entrepreneur's type, ϵ, and his action choice, a_ϵ, may affect:

- Total expected period project revenues, $R_t(\epsilon, a_\epsilon)$, $t = 1, 2$.
- Entrepreneurial expected period profits, $\pi_t(\epsilon, a_\epsilon)$, $t = 1, 2$.
- The probability $B(\epsilon, a_\epsilon)$ that a firm defaults on its contractual obligations at date 1.
- The value $z(\epsilon, a_\epsilon)$ of a firm that is liquidated at the end of period 1.

The expected period payment to creditors is just the difference between expected period project revenues and expected entrepreneurial profits: $R_t(\epsilon, a_\epsilon) - \pi_t(\epsilon, a_\epsilon)$.

To simplify the presentation, we restrict attention to two action choices for each type of entrepreneur, $a_\epsilon \in \{a_\epsilon^1, a_\epsilon^2\}$. We use "$\Delta$" to capture the difference in the variables from taking action a_ϵ^1 instead of action a_ϵ^2. Thus, $\Delta R_t(\epsilon) \equiv R_t(\epsilon, a_\epsilon^1) - R_t(\epsilon, a_\epsilon^2)$ is the difference in expected period t revenues from taking action a_ϵ^1 rather than a_ϵ^2, and so on.

The key assumption that we make is that if entrepreneur ϵ takes action a_ϵ^1 then he is more likely to default and end up in bankruptcy than if he takes action a_ϵ^2:

A1: $\Delta B(\epsilon) \equiv B(\epsilon, a_\epsilon^1) - B(\epsilon, a_\epsilon^2) > 0$.

Assumption **A1** reduces to a normalization of the action choice if action choices have the same signed impact on bankruptcy for both entrepreneur types.

Our formulation admits a broad variety of interpretations for the actions. For example, an entrepreneur could be choosing whether or not to invest in a risky, negative NPV project that raises expected period 1 profits at the expense of expected total period 1 project revenues and an increased likelihood of bankruptcy. Then action a_ϵ^1 would correspond to making the risky, negative NPV investment. Alternatively, a_ϵ^1 could correspond to stealing from period 1 investments, which again raises expected profits at the expense of reducing expected period 1 project revenues and raising the likelihood of bankruptcy. Another possibility is that the entrepreneur could be choosing whether or not to have a "fire sale" of existing inventory at bargain prices. In this case action a_ϵ^2 would correspond to having a fire sale, since a fire sale raises period 1 revenues and period 1 profits, and reduces the likelihood of immediate bankruptcy. However, a fire sale reduces future revenues, profits and liquidation values. With a slight modification of the model (to allow for non-pecuniary payoffs), action a_ϵ^1 could correspond to shirking (working less hard), while action a_ϵ^2 could correspond to working hard (working harder).

Indeed, the actions contemplated by the two types of entrepreneurs could even differ. For example, suppose that the bad entrepreneur is in financial distress, but the good entrepreneur is not. The bad entrepreneur might be choosing between a fire sale (a_b^2) and no fire sale (a_b^1), while the good entrepreneur is choosing whether to steal some of the firm's first period cash flows (a_g^1) or not (a_g^2). Depending on the action interpretation, it could be socially optimal for the entrepreneur to take the high default action a_ϵ^1 (if action a_ϵ^2 represents a fire sale, or working excessively hard); or the low default action a_ϵ^2 (if action a_ϵ^1 represents a negative NPV gamble, theft or shirking).

If a project is liquidated after the first period, then it pays $z(\epsilon, a_\epsilon)$ to creditors and nothing to the entrepreneur. We assume that it is efficient to liquidate a project run by a bad entrepreneur, but inefficient to liquidate a project run by a good entrepreneur:

A2: $R_2(g, a_g) > z(g, a_g)$ and $R_2(b, a_b) < z(b, a_b)$.

We also assume that the potential liquidation value is not observed by the court when making decisions, and that if renegotiation is feasible, then terms cannot depend on $z(\epsilon, a_\epsilon)$. These assumptions simply ensure that the liquidation value does not reveal type in our sparsely specified environment. We will also discuss the impact of intermediate divisions between the entrepreneur and creditor of the liquidation proceeds later.

Observed first period project revenues are implicit in the bankruptcy probability specification. We do not directly specify realized first period project revenues in order to be consistent with a variety of possible forms of action choice, including, for example, theft—which leads to a distinction between realized and observed first period revenues—and shirking or risky investments—where realized and observed first period revenues correspond.

To be consistent with a variety of economic environments we impose little structure on the financing contract between entrepreneur and investor. In equilibrium, the investor must expect to get back at least his one unit of capital investment from the firm. The analysis is consistent with standard limited liability loan contracts, but also holds for more general financing contracts.

If the firm "meets" its first period contractual obligations, then the entrepreneur retains control of the assets. If the firm defaults, then at a cost of c, that is incurred by the creditor, the bankruptcy court evaluates the firm's future prospects. The court then determines whether (a) the firm should be liquidated; or (b) the entrepreneur should retain control and continue to operate the firm in the second period. We assume that the bankruptcy costs are not so high, as to cease to make liquidation valuable: $z(\epsilon, a_\epsilon) > c > 0$.

Initially, we preclude the possibility that the entrepreneur and creditors can renegotiate a settlement to circumvent the bankruptcy court. As a result, the entrepreneur retains control of the firm in the second period if and only if either (a) he meets his first period contractual obligations, or (b) he fails to meet his first period contractual obligations, *but* the court chooses not to liquidate the entrepreneur.

We model the design of the bankruptcy court as a pair $(\gamma(g), \gamma(b))$, where $\gamma(\epsilon)$ is the probability that the court concludes that the project has a negative NPV. If the entrepreneur defaults in period 1 and the court concludes that the project has a negative NPV, then the firm is liquidated and the liquidated value, $z(\epsilon, a_\epsilon) > 0$, is transferred to creditors. Assumption **A2** implies that identifying whether a project has a negative NPV amounts to identifying the entrepreneur's type. Hence, $\gamma(\epsilon)$ can be interpreted as the probability that a type ϵ firm is liquidated if it defaults in the first period. Society (or the court) is benevolent, choosing $(\gamma(g), \gamma(b))$ to maximize *ex ante* total expected revenues net of bankruptcy costs.

We interpret the court design $(\gamma(g), \gamma(b))$, as the choice of a "monitoring technology," where the technology attempts to assess whether the project that has gone into default has a positive NPV. This interpretation is sufficiently important to discuss in detail. The accuracy of the monitoring technology's assessment depends on the information provided. If, for example, all relevant information regarding the project's value is available and provided, then, in principle, the monitoring technology could determine the project's type with complete accuracy; if all relevant information is not provided, then monitoring errors may be made. To highlight the intuition, we first place no restrictions on the evaluation technologies to which the court has access.

In practice, owing to "natural" informational asymmetries that exist between creditors and debtors, the court may be unable to gather all relevant information. As a result, a court must sometimes make undesigned mistakes, imposing lower bounds on the error probabilities. Our analysis is best interpreted within the context of asking how the court should choose its design—the rules of evidence that restrict the information which creditors and firms can present and hence the information to which the court has access—in order to structure the probability of errors in such a way as to enhance social welfare. Our analysis can be interpreted as providing a rationale for the imposition of these kinds of rules: such rules cause courts to make (more) errors and we will show that increasing errors is often optimal.

To illustrate how the court might design the rules of evidence so as to generate the "right" $(\gamma(g), \gamma(b))$, suppose that it is optimal for the court to liquidate all bad firms, but to err occasionally in the identification of good firms. As a result, some good entrepreneurs who default are (unfortunately) liquidated, but this possibility of liquidation may cause a good entrepreneur to make better decisions when running the firm. The court could implement such rules of evidence by placing the entire burden of proof on the entrepreneur: the firm is liquidated unless the entrepreneur can prove that he is "good." Since bad entrepreneurs can never do so, the choice of the error-making probability amounts to restricting the rules of evidence about what evidence a good entrepreneur can provide to attain the "right" error-making probability.

The court's unrestricted evaluation technology provides a best case scenario for an error-riven court. We later consider how outcomes are affected when the court has access only to a more limited set of feasible monitoring technologies.

Let $\Pi(\epsilon, a_\epsilon, \gamma(\epsilon))$ be the expected lifetime entrepreneurial profits of a type ϵ entrepreneur who takes action $a_\epsilon \in \{a_\epsilon^1, a_\epsilon^2\}$ given $\gamma(\epsilon)$ and C:

$$\Pi(\epsilon, a_\epsilon, \gamma(\epsilon)) = [\pi_1(\epsilon, a_\epsilon) + (1 - B(\epsilon, a_\epsilon)\gamma(\epsilon))\pi_2(\epsilon, a_\epsilon)].$$

A type ϵ entrepreneur will choose the high default probability action, $a_\epsilon = a_\epsilon^1$, if it is in his best interest to do so, i.e. if $\Pi(\epsilon, \gamma(\epsilon), a_\epsilon^1) - \Pi(\epsilon, \gamma(\epsilon), a_\epsilon^2) > 0$. After some manipulation, we see that a type ϵ entrepreneur will choose the high default action if

$$\gamma(\epsilon) < \frac{\Delta\pi_1(\epsilon) + \Delta\pi_2(\epsilon)}{B(\epsilon, a_\epsilon^1)\pi_2(\epsilon, a_\epsilon^1) - B(\epsilon, a_\epsilon^2)\pi_2(\epsilon, a_\epsilon^2)} \equiv \gamma^*(\epsilon). \tag{1}$$

Were the court's liquidation probability to exceed $\gamma^*(\epsilon)$, then the entrepreneur would choose the low probability default action, a_ϵ^2; were $\gamma(\epsilon) < \gamma^*(\epsilon)$, then the entrepreneur would always choose the high probability default action a_ϵ^1. $\gamma^*(\epsilon)$ can be loosely interpreted as the entrepreneur's private benefit-cost ratio associated with taking the high default probability action. The numerator represents the potential increase in lifetime benefits to the entrepreneur from taking the high default probability action, while the denominator represents the increased second period loss due to the reduced probability of receiving a payoff in period 2 associated with taking the high default action.

Hence, given liquidation probability $\gamma(\epsilon)$, a type ϵ entrepreneur will choose action

$$a_\epsilon^* = \begin{cases} a_\epsilon^1 \text{ if } \gamma(\epsilon) \leq \gamma^*(\epsilon) \\ a_\epsilon^2 \text{ if } \gamma(\epsilon) > \gamma^*(\epsilon) \end{cases} \quad \epsilon \in \{g, b\}. \tag{2}$$

2.1 Optimal choices of $\gamma(\epsilon)$

2.1.1 Good Entrepreneurs

To discourage a good entrepreneur from taking the high default probability action, i.e., from taking the action $a_g = a_g^1$, equation (1) implies that the court must choose a sufficiently high liquidation probability $\gamma(g) \geq \gamma^*(g)$. It follows immediately that,

Lemma 1: *If the court chooses to discourage the high default probability action by a good entrepreneur, then it optimally liquidates a good firm that enters bankruptcy with probability* $\gamma(g) = \gamma^*(g)$ *. If, instead, the court chooses not to discourage the high default action by a good entrepreneur, then it optimally chooses* $\gamma(g) = 0$*.*

Setting $\gamma(g) > \gamma^*(g)$, i.e. mis-identifying a good firm as bad with a probability exceeding $\gamma^*(g)$, discourages a good entrepreneur from taking the high default probability action, but does so at an unnecessarily higher cost—an excessively high proportion of good entrepreneurs is liquidated. The associated total net expected revenues from discouraging the high default action are:

$$R_1(g, a_g^2) + [1 - B(g, a_g^2)]R_2(g, a_g^2) + B(g, a_g^2)[(1 - \gamma^*(g))R_2(g, a_g^2) + \gamma^*(g)z(g, a_g^2) - c]. \tag{3}$$

If courts choose to encourage the high default probability action $a_g = a_g^1$, then the liquidation probability must be set so that $\gamma(g) < \gamma^*(g)$. Clearly, in such a case it is optimal to set $\gamma(g) = 0$ since it is not optimal to liquidate good firms. In this case, total net expected revenues are

$$R_1(g, a_g^1) + R_2(g, a_g^1) - B(g, a_g^1)c. \quad (4)$$

Proposition 1: *It is optimal to encourage the low default probability action for good entrepreneurs,* $a_g = a_g^2$, *if and only if*

$$-\Delta R_1(g) - \Delta R_2(g) + \Delta B(g)c > (R_2(g, a_g^2) - z(g, a_g^2))B(g, a_g^2)\gamma^*(g). \quad (5)$$

The left-hand side reflects the potential gains from discouraging a good entrepreneur from taking the high default probability action: expected lifetime project revenues are increased and the firm is less likely to incur investigation costs in bankruptcy. The right-hand side reflects the costs: to discourage a good entrepreneur from taking the high default action, the court must occasionally mistakenly identifying bankrupt good entrepreneurs as bad, and liquidate them.

It is useful to rewrite equation (5) in terms of $\gamma^*(g)$. Doing so reveals that it is optimal to discourage a good entrepreneur from taking the high default probability action if and only if the court does not have to make too many mistakes in order to induce a good entrepreneur to take action a_g^2 i.e., if and only if

$$\gamma^*(g) = \frac{\sum_t \Delta\pi_t(g)}{B(g, a_g^1)\pi_2(g, a_g^1) - B(g, a_g^2)\pi_2(g, a_g^2)} < \frac{-\sum_t \Delta R_t(g) + \Delta B(g)c}{B(g, a_g^2)(R_2(g, a_g^2) - z(g, a_g^2))} \equiv \gamma^{\text{court}}(g). \quad (6)$$

The left-hand side of the inequality reflects a good entrepreneur's private trade-off from *undertaking* the high default probability action, while the right-hand side of the inequality reflects the society's trade-off from *discouraging* this action. Good entrepreneurs refrain from taking the high default action if, relatively speaking, the probability of liquidation is high enough—i.e., if $B(g, a_g^1)$ is sufficiently larger than $B(g, a_g^2)$—and/or if the potential profit gain from taking the high default action, $\sum_t \Delta\pi_t(g)$, is small. It is socially optimal to discourage a good entrepreneur from taking the high default action if the requisite liquidation probability, $\gamma^*(g)$, is, relatively speaking, "small enough." The requisite liquidation probability will be (relatively) small if the changes in lifetime revenues and changes in bankruptcy rates are large and if the expected costs associated with liquidating a good entrepreneur, $B(g, a_g^2)(R_2(g, a_g^2) - z(g, a_g^2))$, are not too large.

Note that for some interpretations of the action choice, it would never be optimal to design a court that mis-identifies good entrepreneurs: for some action choice interpretations a good entrepreneur's private interests over action choice are aligned with society's (as long as bankruptcy costs are not too high). For example, let action a_g^2 correspond to having a fire sale and a_g^1 correspond to not having a fire sale. Although a fire sale decreases the probability of default in the first period, it requires that the entrepreneur inefficiently liquidate resources which implies that $R_1(g, a_g^2) + R_2(g, a_g^2) < R_1(g, a_g^1) + R_2(g, a_g^1)$. Therefore, $\sum_t \Delta R_t(g) > 0$. But then the right-hand side of (6) is negative provided that bankruptcy costs are not too high; it is, therefore, optimal for the court to set $\gamma(g) = 0$. Intuitively, the court would not encourage the low default probability fire sale action since it entails social costs with no offsetting benefits. So, too, if action a_g^2 corresponds to "working too hard," then interests are aligned.

In contrast, if action a_g^1 corresponds to theft or a risky negative NPV investment, then action a_g^1 is socially inefficient in the sense that $R_1(g, a_g^1) + R_2(g, a_g^1) < R_1(g, a_g^2) + R_2(g, a_g^2)$. Since $\sum_t \Delta R_t(g) < 0$, there are social benefits associated with discouraging the high default (theft) action. If this benefit is sufficiently great, i.e., if inequality (6) holds, then by its choice of liquidation probability, the court will encourage a good entrepreneur to take the low default (no theft) action.

These observations highlight that the optimal design of the court will depend crucially on the nature of action choices that entrepreneurs are likely to undertake that have the biggest impact on payoffs. In this paper, we do not take a stand on which action choices are most important, but merely derive the consequences of the way in which action choices affect payoffs for the court's optimal design.

2.1.2 Bad Entrepreneurs

Lemma 2: If *the court chooses to discourage bad entrepreneurs from taking the high default probability action, then it always liquidates bad firms that enter bankruptcy. If, instead, the court chooses to encourage the high default action by bad entrepreneurs, then it liquidates bad firms with probability* $\gamma(b) = \gamma^*(b)$.

Any liquidation probability $\gamma(b) \in (\gamma^*(b), 1]$ will discourage bad entrepreneurs from choosing the high default probability action (e.g., taking a risky negative NPV project, stealing, shirking, no fire sale). It follows immediately that the court should choose the liquidation probability that induces $a_b = a_b^2$ at the minimum cost, i.e., it should choose $\gamma(b) = 1$. That is, given that bad entrepreneurs do not choose the high default action, it is optimal to identify all bad entrepreneurs who go bankrupt. In this case, total expected revenues are:

$$R_1(b, a_b^2) + [1 - B(b, a_b^2)]R_2(b, a_b^2) + B(b, a_b^2)(z(b, a_b^2) - c). \tag{7}$$

If, instead, courts wish to encourage bad entrepreneurs to take the high default action, then it is optimal to set $\gamma(b) = \gamma^*(b)$; i.e., it is optimal to select the largest liquidation probability consistent with a bad entrepreneur choosing $a_b = a_b^1$ (e.g., preventing a fire sale that shifts cash flows ahead at the expense of total expected revenues). In this case, total expected revenues are

$$R_1(b, a_b^1) + (1 - B(b, a_b^1))R_2(b, a_b^1) + B(b, a_b^1)[(1 - \gamma^*(b))R_2(b, a_b^1) + \gamma^*(b)z(b, a_b^2) - c]. \quad (8)$$

Proposition 2: *It is optimal for the court to encourage bad entrepreneurs to take the high default probability action if and only if*

$$-\Delta R_1(b) - \Delta R_2(b) + \Delta B(b)c < B(b, a_b^1)\gamma^*(b)(z(b, a_b^1) - R_2(b, a_b^1)) - B(b, a_b^2)(z(b, a_b^2) - R_2(b, a_b^2)). \quad (9)$$

The left-hand side of equation (9) reflects the loss incurred resulting from encouraging bad entrepreneurs to take the high default probability action. The right-hand side reflects the potential gains: If $\gamma^*(b)B(b, a_b^1) > B(b, a_b^2)$, then more bad entrepreneurs will be identified if they take the high default action, even though some will slip through because the court makes mistakes in order to have the opportunity to identify bad entrepreneurs. If the above inequality does not hold, then it is always optimal to set $\gamma(b) = 1$.

Rewriting equation (9) in terms of $\gamma^*(b)$, reveals that it is optimal to encourage the high default action if and only if the court does not have to make too many mistakes in order to induce a bad entrepreneur to take the low default action, i.e., if and only if

$$\begin{aligned}\gamma^*(b) = & \frac{\sum_t \Delta \pi_t(b)}{B(b, a_b^1)\pi_2(b, a_b^1) - B(b, a_b^2)\pi_2(b, a_b^2)} \\ & > \frac{-\sum_t \Delta R_t(b) + \Delta B(b)c + B(b, a_b^2)(z(b, a_b^2) - R_2(b, a_b^2))}{B(b, a_b^1)(z(b, a_b^1) - R_2(b, a_b^1))} \equiv \gamma^{\text{court}}(b). \quad (10)\end{aligned}$$

Again, the right-hand side represents the social benefit-cost ratio from discouraging a bad entrepreneur from taking the high default probability action, while the left-hand side represents a bad entrepreneur's private trade-off for undertaking the high default action. A bad entrepreneur will take the high default action only if he is sufficiently likely to be mistaken by the court for a good entrepreneur. Intuitively, encouraging a bad entrepreneur to take the high default action tends to be optimal if

- The action is attractive to a bad entrepreneur (i.e., his potential profit gain, $\Delta\pi_1(b) + \Delta\pi_2(b)$, is high, and profits foregone in a liquidation, $B(b, a_b^1)\pi_2(b, a_b^1) - B(b, a_b^2)\pi_2(b, a_b^2)$, are low),
- The social benefits associated with getting a bad entrepreneur to take the low default probability action, $-\Delta R_1(b) - \Delta R_2(b) + \Delta B(b)c + B(b, a_b^2)(z(b, a_b^2) - R_2(b, a_b^2))$ are low and the expected social cost associated with liquidating a bad entrepreneur, $B(b, a_b^1)(z(b, a_b^1 - R_2(b, a_b^1))$ is high.

Comparing $\gamma^{\text{court}}(b)$ with $\gamma^{\text{court}}(g)$, we see that there is an additional consideration in the court design for the bad entrepreneur: The court may want to encourage bad entrepreneurs to take the high default action in order to increase the probability that bad entrepreneurs go into bankruptcy, and hence the probability that they are liquidated.

The interests of a bad entrepreneur and society are never aligned over bankruptcy, in the sense that bad entrepreneurs prefer a lower bankruptcy probability, whereas society prefers a higher bankruptcy probability. Excepting this consideration, however, whether a bad entrepreneur's interests are aligned with society's interests depends on the action interpretation in ways similarly to those discussed for good entrepreneurs.

3 Confiscation: Perk consumption and Fire Sales

We now focus on specific interpretations of the action choices. In particular, we assume that an entrepreneur can confiscate some of the firm's resources. The confiscated resources can be used either to supplement first period revenues or for the entrepreneur's personal consumption. In a fire sale, an entrepreneur confiscates some of the firm's infrastructure, liquidates it in the market and then uses the liquidation proceeds to supplement first period revenues. A fire sale raises current period revenues and profits, and lowers default probabilities at the expense of future period revenues and profits, as well as total revenues. A bad entrepreneur may have an incentive to have a fire sale to avoid default. Alternatively, an entrepreneur can consume the proceeds from the liquidated infrastructure as well as some of the firm's first period cash flow. As with a fire sale, an entrepreneur who "consumes perks" reduces future revenues and profits, but doing so reduces rather than raises first period revenues and default rates. A good entrepreneur might be tempted to engage in perk consumption since he may be unlikely to be liquidated in default.

For the bad entrepreneur, action a_b^2 corresponds to undertaking a fire sale. A fire sale entails a socially inefficient liquidation of inventory or infrastructure by the entrepreneur, which means that $R_1(b, a_b^1) + z(b, a_b^1) > R_1(b, a_b^2) + z(b, a_b^2)$ and $R_1(b, a_b^1) + R_2(b, a_b^1) > R_1(b, a_b^2) + R_2(b, a_b^2)$. A bad entrepreneur may want to pursue a fire sale in order increase first period expected revenues and profits, but it is at the expense of second period revenues, profits and liquidation values. For a good entrepreneur, action a_g^1 corresponds to consuming perks: "stealing" cash flows and/or infrastructure and consuming them. To the extent that a good entrepreneur must conceal these activities, real resources are used which means that $R_1(g, a_g^2) + R_2(g, a_g^2) > R_1(g, a_g^1) + R_2(g, a_g^1)$ and $R_1(g, a_g^2) + z(g, a_g^2) > R_1(g, a_g^1) + z(g, a_g^1)$. A good entrepreneur may want to steal in order to increase first period profits, albeit at the expense of first period revenues and second period profits, revenues and liquidation values.

Section 2 considered a court that was unconstrained in its signal choices. In practice, the court may be more limited both by what evidence is feasible to provide and in how it can design signal qualities through its choice of rules of evidence, etc. In this section we consider how outcomes are affected when the court has access only to a more limited class of signals. A natural choice for a restricted class of signals is that where the court is as likely to mis-identify a bad entrepreneur as good, as it is to mis-identify a good entrepreneur as bad: $\gamma(b) = 1 - \gamma(g)$. That is, the court makes "symmetric" errors across different types. Not only might this be viewed as natural choice, but it turns out that this choice has optimality properties for the types of action choices considered here.

3.1 No Renegotiation

When a court makes errors, both parties have an incentive to renegotiate the existing contract to circumvent the error-riven court. The gains to renegotiation generally rise when the court selects its monitoring policy from a more restricted class. To distinguish most sharply how each feature—a court that errs and renegotiation—affects outcomes, we proceed in two steps. First, *in an environment with no renegotiation*, we contrast outcomes when the court must adopt the symmetric evaluation technology with those where the court faces no restrictions on the evaluation technology. We then analyze how the possibility of renegotiation affects the outcomes.

Suppose first that $\gamma^*(b) < 1 - \gamma^*(g)$. Then the optimal error rate is one of

- $\gamma(g) = 0 = 1 - \gamma(b)$. Here all defaulting entrepreneurs are perfectly identified. However, good entrepreneurs consume perks and bad entrepreneurs have fire sales.
- $\gamma(g) = \gamma^*(g) < 1 - \gamma^*(b)$. Good entrepreneurs are induced to refrain from consuming perks but bad entrepreneurs continue to engage in fire sales[1] (and hence does not reduce the probability that he is funded in the second period). Defaulting entrepreneurs of both types are no longer perfectly identified.
- $\gamma(g) = 1 - \gamma^*(b) > \gamma^*(g)$. Good entrepreneurs now refrain from consuming perks, but at a slightly higher error rate than when the court was unconstrained. As a result, more good entrepreneurs are liquidated. This higher error rate may be justified since it prevents bad entrepreneurs from having a fire sale.

Any other error rate unnecessarily introduces greater rates of error than one of these alternatives, while inducing the same behavior by entrepreneurs. The key observation is that to choose the error

[1] Since $1 - \gamma(b) = \gamma(g) = \gamma^*(g)$, then $1 - \gamma(b) < 1 - \gamma^*(b)$ or $\gamma(b) > \gamma^*(b)$.

probability efficiently for one entrepreneur type one must introduce inefficiencies for the other entrepreneur type. For example, if $\gamma(g) = \gamma^*(g)$, then a good type is efficiently induced not to consume perks, but a bad entrepreneur's behavior is unaffected by the introduction of court error. As a result, the bad entrepreneur may be mis-identified and hence not liquidated following a default. This reduces the value of a error-prone court, perhaps to the point that it is optimal to have a court that makes no errors.

If, instead $\gamma^*(b) > 1 - \gamma^*(g)$, then the optimal error rate is one of

- $\gamma(g) = 0 = 1 - \gamma(b)$. Again, all defaulting entrepreneurs are perfectly identified, but good entrepreneurs consume perks and bad entrepreneurs have fire sales.
- $\gamma(g) = 1 - \gamma^*(b) < \gamma^*(g)$. Bad entrepreneurs cease to conduct fire sales. Good entrepreneurs continue to consume perks and in default are sometimes liquidated.
- $\gamma(g) = \gamma^*(g) > 1 - \gamma^*(b)$. Good entrepreneur are induced not to consume perks and bad entrepreneurs continue to refrain from fire sales. However, the error rate now exceeds that required to induce bad entrepreneurs from having fire sales.

The more limited evaluation technology reduces the value of designing a court that makes errors, relative to an environment in which the court is unconstrained in its evaluation technology. Qualitatively, the value of noisy evaluation is reduced because to alter the behavior of one type but not the other, the court also must err for the second type; and to affect the behavior of both types, generically, the error rate must be unnecessarily high for one type. The costs of such mis-designs depend on the specification of the economy in the expected ways (e.g. upon the productivities of each entrepreneurial type if re-financed, the costs of the action choices, etc.). Generally, however, the optimal design of the court's monitoring technology should not be error free, because with an error-free court, entrepreneurs take actions that are socially sub-optimal. Indeed, the optimal error rate may be *increased* because, with an unconstrained evaluation technology, it may be optimal to err for one type of entrepreneur, but not the other;[2] but with the more limited evaluation technology, the court sometimes errs in identifying both types.

We now explore how the analysis is altered by renegotiation. Incorporating a single signal quality generally reduces the value of an error-riven court. In contrast, if the parties can sometimes renegotiate and reach a settlement, this circumvents the error-making by the court, leaving only the incentive effects for entrepreneurs and raising the value of a court that errs. In what follows, we characterize conditions under which if creditors and debtors can always renegotiate and creditors

[2] Recall that this asymmetric technology can be implemented by placing the entire burden of proof on one party.

have all of the bargaining power then a blind court design can implement the social optimum. Further, we identify situations where a completely uninformed court can implement the social optimum and where it cannot.

Qualitatively, both factors are relevant: while the court may have limited flexibility in conditioning signal quality on type, the parties can probably only sometimes renegotiate to reach a private settlement (*e.g.* because a bankrupt entrepreneur may lack access to the funds required to make the payment to the creditor that would circumvent the bankruptcy court). In such environments, it would be optimal for the court only to be "near-sighted," but not completely "blind."

3.2 Renegotiation

Chapter 11 bankruptcy is characterized by a prolonged and involved bargaining session between the firm and creditors. Creditors and entrepreneur may be able to renegotiate in bankruptcy and reach a superior outcome by agreeing on the efficient liquidation decision. In particular, a bad entrepreneur and creditor may agree to liquidate the firm and provide the entrepreneur with some of the liquidation payoffs; or a good entrepreneur may offer the creditor a greater share of the firm's proceeds if the creditor lets the firm operate. In both cases, agents circumvent the error-prone court.

If an entrepreneur defaults, a cost of c is incurred (which represents the cost associated with renegotiation and/or using the court). If the entrepreneur and creditor fail to resolve their dispute via renegotiation, the court then evaluates the entrepreneur and liquidates according to $(\gamma(b), \gamma(g))$, where $\gamma(b) = 1 - \gamma(g)$. We assume that while the creditor does not observe the entrepreneur's type or the action taken, and that the creditor has all of the bargaining power in any renegotiations.

We do not place any restrictions on when renegotiation can occur. For example, if the entrepreneur does *not* default, then the creditor can propose always a renegotiation offer, which the entrepreneur can accept or reject.

We assume that $0 < \gamma^*(g) < \gamma^*(b) < 1$. The fact that both critical values are strictly between zero and one implies that the court can influence the behavior of entrepreneurs through its choice of $\gamma(g)$. Since $\gamma^*(g) < \gamma^*(b)$, good entrepreneurs should be liquidated less frequently than bad if there are no constraints on the evaluation technology.

In renegotiation, a bad entrepreneur would want to liquidate rather than take his chances in court *if* the creditor pays him at least $(1 - \gamma(b))\pi_2(b, a_b)$ in return, where a_b is the action that the bad entrepreneur took in period 1. This payment corresponds to the bad entrepreneur's expected payment if he takes his chances in court. Similarly, a good entrepreneur would pay the creditor up to $\gamma(g)\pi_2(g, a_g)$, in exchange for avoiding the court and operating the firm in period 2. Consider the following renegotiation offer that the creditor might make following a default in an equilibrium where, at date 1, good entrepreneurs take action a_g and bad entrepreneurs take action a_b.

Renegotiation Offer: "If you (the entrepreneur) agree to liquidate, then you will receive $P(b, a_b)$; if you do not want to liquidate and continue into period 2, then to avoid running the risk of the court erring, you must pay me (the creditor) an additional $\gamma(g)\pi_2(g, a_g)$ in period 2. If you reject this offer, you will go to court."

Suppose that the creditor makes this renegotiation offer *and* $P(b, a_b)$ is such that neither type of entrepreneur rejects it in order to take their chances in court. A good entrepreneur would prefer to pay $\gamma(g)\pi_2(g)$ in exchange for running the firm in period 2 to taking the liquidation contract meant for a bad entrepreneur if the liquidation payment, $P(b, a_b)$, is not "too high," i.e., if

A. $(1 - \gamma(g))\pi_2(g, a_g) \geq P(b, a_b)$.

A bad entrepreneur would agree to liquidate, rather than make a payment that would enable him to circumvent the court and run the firm in period 2, if the liquidation payment, $P(b, a_b)$, is "sufficiently high," i.e., if

B. $P(b, a_b) \geq \pi_2(b, a_b) - \gamma(g)\pi_2(g, a_g)$.

Together, conditions **A** and **B** imply that $(1-\gamma(g))\pi_2(g, a_g) \geq P(b) \geq \pi_2(b, a_b) - \gamma(g)\pi_2(g, a_g)$. Note that if $\pi_2(g, a_g) > \pi_2(b, a_b)$, then there *always* exists a $P(b, a_b)$ that satisfies conditions **A** and **B**. This "efficient liquidation" renegotiation offer is *incentive compatible* if

1. It satisfies conditions **A** and **B**, *and*
2. The creditor is willing to make an offer that satisfies conditions **A** and **B**.

It is incentive compatible for a bad entrepreneur to accept the renegotiation offer and liquidate if and only if doing so dominates both (i) not settling and taking its chances in court, which has expected payoff $(1 - \gamma(b))\pi_2(b, a_b)$; and (ii) passing himself off as a good entrepreneur, and circumventing the court in return for the payment of $\gamma(g)\pi_2(g, a_g)$. *If* the creditor makes an incentive compatible renegotiation offer, then the creditor will make the smallest payment necessary to induce a bad entrepreneur to liquidate, setting

$$P(b) = \max\{\pi_2(b, a_b) - \gamma(g)\pi_2(g, a_g), (1 - \gamma(b))\pi_2(b, a_b)\}.$$

However, it may not be in the creditor's best interest to make this "efficient liquidation" renegotiation offer. For example, if the payment to the bad entrepreneur necessary to ensure incentive compatibility is too high, the creditor may prefer to make a renegotiation offer in which $P(b, a_b) = 0$. In this situation, a good entrepreneur would pay $\gamma(g))\pi_2(g, a_g)$ in order to continue operating the firm in period 2, but a bad entrepreneur would reject the offer and take his chances in court.

The question then arises: When would the creditor prefer to make an efficient liquidation renegotiation offer that both entrepreneur types would prefer to taking their chances in court?

Lemma 3: *Suppose that $\pi_2(g, a_g) > \pi_2(b, a_b)$. Then, if bad entrepreneurs prefer taking their chances in court to mimicking good entrepreneurs, i.e. if*

$$(1 - \gamma(b))\pi_2(b, a_b) \geq \pi_2(b, a_b) - \gamma(g)\pi_2(g, a_g), \tag{11}$$

then the creditor always makes an efficient liquidation renegotiation offer, setting $P(b, a_b) = (1 - \gamma(b))\pi_2(b, a_b)$. If, instead, bad entrepreneurs prefer to mimic good entrepreneurs to taking their chances in court, so that (11) does not hold, then the creditor makes an efficient liquidation renegotiation offer with $P(b, a_b) = \pi_2(b, a_b) - \gamma(g)\pi_2(g, a_g)$, only if

$$\gamma(g)(z(b, a_b) - R_2(b, a_b) + \pi_2(b, a_b) + \pi_2(g, a_g)) \geq \pi_2(b, a_b). \tag{12}$$

Proof: If (11) holds, the creditor's payoff from renegotiation offer $P(b, a_b) = (1 - \gamma(b))\pi_2(b, a_b)$ is

$$z(b, a_b) - (1 - \gamma(b))\pi_2(b, a_b). \tag{13}$$

If he instead offers $P(b, a_b) = 0$, he expects

$$\gamma(b)z(b, a_b) + (1 - \gamma(b))(R_2(b, a_b) - \pi_2(b, a_b)). \tag{14}$$

Since $z(b, a_b) > R_2(b, a_b)$ it follows that (13) exceeds (14). The bad entrepreneur is indifferent between accepting $P(b, a_b)$ and going to court, so he accepts.

If, instead, (11) does not hold, then the payoff from making an incentive compatible efficient liquidation renegotiation offer is

$$z(b, a_b) - (\pi_2(b, a_b) - \gamma(g)\pi_2(g, a_g)),$$

while the payoff from making the renegotiation offer with $P(b, a_b) = 0$ is

$$\gamma(b)z(b, a_b) + (1 - \gamma(b))(R_2(b, a_b) - \pi_2(b, a_b)).$$

The payoffs from the efficient liquidation renegotiation offer are greater only if (12) holds. ■

Definition: *"Blind justice" is a court design where $\gamma(g) = \gamma(b) = 0.5$.*

If the court design is blind, then the court ignores all information, essentially deciding whether or not to liquidate an entrepreneur on the basis of a fair coin flip.

Corollary 1: *If the court design is blind and if $\pi_2(g, a_g) > \pi_2(b, a_b)$, then creditors will make entrepreneurs an efficient liquidation renegotiation offer.*

Proof: If $\gamma(g) = \gamma(b) = 0.5$, then condition (12) is satisfied. ■

Corollary 1 implies the following key result:

Proposition 3: *It is never optimal to have an error-free court.*

Proof: Here we prove that "blind justice" dominates an error-free court. An error-free court makes efficient liquidation decisions, but both entrepreneurs choose socially inefficient actions, $a_g = a_g^1$ and $a_b = a_b^2$. When justice is blind, Corollary 1 ensures that if $\pi_2(g, a_g) > \pi_2(b, a_b)$ then the creditor will make an efficient liquidation renegotiation offer, so that again all liquidation outcomes are socially efficient. The actions that entrepreneurs take depend upon the magnitudes of the critical values $\gamma^*(g)$ and $\gamma^*(b)$. If $\gamma^*(g) \leq 0.5 \leq \gamma^*(b)$, then the good entrepreneur chooses not to steal, $a_g = a_g^2$, and the bad entrepreneur does not have a fire sale, $a_b = a_b^1$, since $\gamma^*(g) \leq \gamma(g)$ and $\gamma^*(b) \geq \gamma(b)$. These are the socially optimal actions and, therefore, they strictly dominate the actions induced by an error-free court. (Note that since $\pi_2(g, a_g^2) > \pi_2(b, a_b^1)$, the creditor will, in fact, make an efficient liquidation renegotiation offer.) If $\gamma^*(g) < \gamma^*(b) < 0.5$, then the good entrepreneur does not steal, $a_g = a_g^2$, and the bad entrepreneur has a fire sale, $a_b = a_b^2$. This outcome strictly dominates the outcome induced by an error-free court, since here, the good entrepreneur takes the socially optimal action. The creditor makes an efficient liquidation renegotiation offer because $\pi_2(g, a_g^2) > \pi_2(b, a_b^2)$. Finally, if $0.5 < \gamma^*(g) < \gamma^*(b)$, then the good entrepreneur steals, $a_g = a_g^1$, and the bad entrepreneur does not have a fire sale, $a_b = a_b^1$, and $\pi_2(g, a_g^1) > \pi_2(b, a_b^1)$, which implies that the creditor makes an efficient liquidation renegotiation offer. Therefore, blind justice always performs strictly better than an error-free court. ■

Suppose now that the entrepreneur does not default at date 1. Even in the absence of a default, it is still optimal for the bad entrepreneur to be liquidated. It is possible to achieve this outcome if the creditor and entrepreneur can renegotiate their initial contract at the end of period 1. For example, suppose that after achieving a level of first period revenues results in "no default," the creditor offers the entrepreneur $\pi_2(b, a_b)$ in exchange for liquidating his firm, where a_b represents the equilibrium action taken by the bad entrepreneur. The bad entrepreneur will be indifferent between accepting this offer and producing in the second period, so the bad entrepreneur will accept this offer. For all of the possible equilibrium configurations that might emerge, it will always be the case that $\pi_2(g, a_g) > \pi_2(b, a_b)$ implying, the good entrepreneur will always reject the renegotiation offer. Therefore, when the court is blind, the socially optimal liquidation decisions will always be implemented, via renegotiation, both in and out of default.

Renegotiation introduces a subtle issue, albeit one that does not affect the above analysis: Renegotiation *may* alter the "critical values," $\gamma^*(g)$ and $\gamma^*(b)$, that determine whether each entrepreneur type takes the high default probability action. Recall that those values were defined for a contract that is not subject to renegotiation (equation (4)). However, when renegotiation is possible, the initial contract between the entrepreneur and the creditor is altered. If, for example, credit markets are competitive at the time that the initial contract is negotiated, then the entrepreneur extracts all of the surplus generated by renegotiation.[3]

In fact, when credit markets are competitive, the incentives when renegotiation is feasible correspond to those where it is infeasible: $\gamma^*(g)$ and $\gamma^*(b)$ *are* the appropriate critical values under renegotiation. To see this, let C^N represent that contract that maximizes the entrepreneur's expected payoff conditional on: (1) satisfying the creditor's participation constraint; (2) the court using $\gamma(g) = \gamma(b) = \gamma = 0.5$; and (3) no renegotiation. Let the initial contract that the entrepreneur offers when renegotiation is possible, C^R, take the form $C^R = (\alpha^*; C^N)$, where α^* is an up front lump sum payment from the creditor to the entrepreneur. Given competitive credit markets, the lump sum payment effectively transfers all gains from renegotiation to the entrepreneur. The lump sum payment (see the appendix) has the form

$$\alpha^* = p(g)\alpha^*(g, a_g) + p(b)\alpha^*(b, a_b),$$

where $p(\epsilon)$ is the *ex ante* probability that the entrepreneur is type ϵ and $\alpha^*(\epsilon, a_\epsilon)$ represents the lump sum transfer of gains that flows to the entrepreneur of type ϵ when he is induced to take action a_ϵ. Since contract C^R only differs from contract C^N by a lump sum payment, C^R provides the same entrepreneurial incentives in terms of action choice as C^N.

The equilibrium path is characterized by:

1. The court (or society) chooses $(\gamma(g) = 0.5, \gamma(b) = 0.5)$.

2. The entrepreneur offers contract $C^R = (\alpha^*; C^N)$, which is accepted by the creditor.

[3] If credit markets are not competitive, then the entrepreneur cannot extract all of the surplus associated with renegotiation. Qualitatively, the results presented below are not sensitive to the assumed nature of credit markets, although the precise form of the initial contract is.

3. The entrepreneur takes actions

   (a) $a_g = a_g^2$ and $a_b = a_b^1$ if $\gamma^*(g) \leq 0.5 \leq \gamma^*(b)$, i.e., the good entrepreneur does not steal and the bad entrepreneur does not have a fire sale.

   (b) $a_g = a_g^2$ and $a_b = a_b^2$ if $\gamma^*(g) < \gamma^*(b) < 0.5$, i.e., the good entrepreneur does not steal and the bad entrepreneur has a fire sale.

   (c) $a_g = a_g^1$ and $a_b = a_b^1$ if $0.5 < \gamma^*(g) < \gamma^*(b)$, i.e., the good entrepreneur steals and the bad entrepreneur does not have a fire sale.

4. If the entrepreneur does not default, then the creditor offers the entrepreneur $\pi_2(b, a_b)$ in exchange for liquidating the project: The good entrepreneur will not accept this offer (since $\pi_2(g, a_g) > \pi_2(b, a_b)$) and the bad entrepreneur will accept.

5. If the entrepreneur defaults, then the creditor makes the above mentioned renegotiation offer resulting in the liquidation of the bad entrepreneur and the continuation of the good entrepreneur.

The equilibrium is characterized by efficient liquidations and continuations: Along the equilibrium path, the bad entrepreneur is always liquidated and the good entrepreneur is never liquidated. Note that, depending upon model parameters, there can be equilibria where bad entrepreneurs have fire sales and equilibria where they do not; there can be equilibria where good entrepreneurs steal and equilibria where they do not.

In summary, if the entrepreneur and creditor can always renegotiate, and it is optimal (i) to encourage bad entrepreneurs to take the high default action in order to reduce their survival probability, and (ii) to encourage good entrepreneurs to take the low default action, then a blind court design cannot be improved upon if creditors and entrepreneurs can always renegotiate their way around the court. Note that our model predicts that even though the firm does not default, renegotiations and liquidations may occur and, in the event of default, parties will always settle out of court. We typcially *do not* observe liquidations outside of default and *do* observe defaulting parties using the court to reshedule their debts. It is the simple and stylized structure of our model that delivers these predictions. We now consider, in turn, how each of these predictions are modified when our model is generalized in rather natural directions.

As we discussed earlier, renegotiation both in and out of bankruptcy may break down. For example, suppose that with some relatively small probability, good entrepreneurs have an alternative opportunity that would pay w, where it is the case that (1) it is socially inefficient for a good entrepreneur to take action w, $w < R_2(g, a_g) - z(g, a_g)$, and (2) in the absence of a renegotiation offer, it is not attractive for a good entrepreneur to pursue the alternative opportunity, $\pi_2(g, a_g) > w$, but (3) if the good entrepreneur can obtain the payment meant to induce the bad entrepreneur to default, then the opportunity becomes attractive, $w + P(b, a_b) > \pi_2(g, a_g)$. Then, if most entrepreneurs who do not go into default are good, it may not be optimal for creditors to negotiate with entrepreneurs outside of bankruptcy. That is, even if only a few good entrepreneurs have such an outside opportunity, the cost of those good entrepreneurs with outside opportunities passing themselves off as bad in order to obtain the payment meant for a bad entrepreneur may exceed the gain from inducing bad entrepreneurs to liquidate. Casual observation suggests that such renegotiations are infrequent. Conversely, it may be that only a small fraction of entrepreneurs in bankruptcy are both good and have outside alternatives, and hence would take offer meant for the bad entrepreneur. Then there is only a small cost to making the above renegotiation offer in bankruptcy. In such a circumstance, precisely *because* renegotiation outside of bankruptcy becomes infeasible, the value of a blind court design may rise relative to that of a court that does not err: more bad entrepreneurs are liquidated if the court design is blind.

Our model predicts that defaulting parties will always settle out of court. This stark result is an artifact of our assumption that there are only two types of entrepreneurs. Suppose, instead, that there are many type of entrepreneurs. In the event of a default, as above, the creditor makes a renegotiation offer to the entrepreneur that specifies: (i) a payment to the entrepreneur for liquidating the firm; (ii) a payment from the entrepreneur to in order to continue operating into period 2; or (iii) going to court. With many types of entrepreneurs, only the very high quality entrepreneurs agree to pay in order to continue; only the very low quality entrepreneurs accept a payment and liquidate; and entrepreneurs of intermediate quality go to court. It follows that entrepreneurs who reorganize out of court are more successful, on average, in the future than entrepreneurs who survive and reorganize under the supervision of a court. This prediction is consistent with the evidence reported by Gilson, John and Lang (1990).

4 Stealing

In this section we assume that the entrepreneur's action choice is either "steal" or "do not steal," and examine the implications for burden of proof and court design. Here, stealing corresponds to the high default probability action, a_ϵ^1, and not stealing corresponds to the low default probability action, a_ϵ^2. Stealing is not socially optimal of either type of entrepreneur. We simplify the analysis by assuming that the liquidation value, second period revenues and second period profits are unaffected by first period action choices, and that the liquidation value is the same for both entrepreneurial types. As a result, the second period profit, second period revenue and the liquidation value simplify to $\pi_2(\epsilon)$, $R_2(\epsilon)$ and z, respectively. Since it is optimal to liquidate a bad entrepreneur and to let a good entrepreneur continue in the second period, we have $R_2(b) < z < R_2(g)$. Many principal-agent models interpret the agent's action as being an effort level and that the agent can either "work hard" or "shirk;" it is assumed that it is socially optimal for agents to work hard. By slightly modifying our model to allow for the non-pecuniary payoff associated with effort one could interpret action a_ϵ^1 as shirking and action a_ϵ^2 as working hard.

If society were unconstrained in its choice of liquidation probabilities and were only concerned about getting liquidation decisions right, then it would choose $\gamma(g) = 0$ and $\gamma(b) = 1$.[4] That is, the court would never liquidate a good entrepreneur and would always liquidate a bad entrepreneur. Provided that $0 < \gamma^*(\epsilon) < 1$ for $\epsilon \in \{b, g\}$, these liquidation probabilities deliver the socially optimal outcome for the bad entrepreneur, but would induce the good entrepreneur to steal. To induce the good entrepreneur to not to steal, the court must choose a liquidation probability for the good entrepreneur of at least $\gamma^*(g)$.

Consider the following burden of proof rule: An entrepreneur must demonstrate to the court that he is good, or else he will be liquidated. The burden of proof must be sufficiently stringent that a bad entrepreneur is unable to prove to the court that he is good and that a good entrepreneur cannot not always convince the court that he is good. Occasionally a good entrepreneur will be liquidated by the court. Such a burden of proof rule implies that the court liquidates a good entrepreneur with probability $\gamma(g)$, where $\gamma(g) > 0$ and liquidates a bad entrepreneur with probability $\gamma(b) = 1$.

Suppose that an entrepreneur defaults. As in Section 3.2, the creditor has an incentive to renegotiate the existing contract in order to eliminate the risk of surplus loss that occurs when a good entrepreneur is liquidated. In contrast to the previous section, however, creditors do not have an incentive to renegotiate with a bad entrepreneur—if they could identify —since a bad entrepreneur will be liquidated with probability one by the court. Unfortunately for the creditor, however, he cannot distinguish between good entrepreneurs and bad. Consider the following renegotiation offer that a creditor might make to an entrepreneur following a default:

Renegotiation Offer: "If you (the entrepreneur) want to avoid running the risk of the court erring, you must pay me (the creditor) an additional $\gamma(g)\pi_2(g)$ in period 2. If you reject this offer, then you will go to court."

Good entrepreneurs will accept the renegotiation offer and agree to pay the creditor an additional $\gamma(g)\pi_2(g)$ in period 2. Note, however, if $\gamma(g)\pi_2(g)$ is not "sufficiently large," then bad entre-

[4] Note that these probabilities satisfy the single signal quality restriction.

preneurs will also accept this offer. Bad entrepreneurs will *not* accept offer if $\pi_2(b) - \gamma(g)\pi_2(g) \leq 0$. Thus, if

$$\gamma(g) \geq \frac{\pi_2(b)}{\pi_2(g)},$$

the bad entrepreneur will reject the renegotiation offer, go to court, and be liquidated with probability one. If the courts adopt a "stringent" burden of proof rule, stringent in the sense that it always liquidates bad entrepreneurs and liquidates the good entrepreneur with probability of (at least) $\pi_2(b)/\pi_2(g)$, then the liquidation probabilities will result in socially optimal liquidation decisions. But what about the actions that the entrepreneur takes at date 1?

Since the burden of proof rule implies that $\gamma(b) = 1$, the bad entrepreneur will always work hard, i.e., $a_b = a_b^1$, since $\gamma^*(b) < \gamma(b) = 1$. The good entrepreneur will work hard if $\gamma(g) \geq \gamma^*(g)$. Hence, society can induce the good entrepreneur to work hard and at the same time generate a socially optimal liquidation decision in the event of default if

$$\gamma(g) \geq \max\{\frac{\pi_2(b)}{\pi_2(g)}, \gamma^*(g)\}. \tag{15}$$

If the court's liquidation probability for the good entrepreneur satisfies (15), then the good entrepreneur will have an incentive to work hard in the first period—since $\gamma(g) \geq \gamma^*(g)$—and a bad entrepreneur who defaults will submit to liquidation—since $\gamma(g) \geq \pi_2(b)/\pi_2(g)$.

Note that if the court liquidates any entrepreneur that it faces with probability one, i.e., $\gamma(g) = \gamma(b) = 1$, then at date 1, no entrepreneur steals/all work hard. In addition, a defaulting bad entrepreneur will be liquidated and a defaulting good entrepreneur will, via renegotiation, continue to operate at date 2. That is, if the burden of proof is so stringent that *no one* can demonstrate that he is good, then the first-best outcome can be achieved. This is a rather odd result because it implies that the court simply liquidates anyone who approaches it. Suppose, however, that there is a some chance that renegotiation between the creditor and the defaulting entrepreneur can break down—due to, say, a coordination failure—in which case the entrepreneur faces the court upon default. If the entrepreneur happens to be bad, then there is no social loss associated with the breakdown in renegotiation. But, if the entrepreneur is good, then there is a social loss because he is always liquidated. To minimize the probability of liquidating the good entrepreneur if renegotiation breaks down and, at the same time, provide incentives for a good entrepreneur to work hard/not steal, the court's liquidation probability should be set equal to the right-hand side of (15).

The equilibrium path for this economic environment is characterized by:

1. The court (or society) imposes a burden of proof rule that implies that $\gamma(b) = 1$ and $\gamma(g) = \max\{\pi_2(b)/\pi_2(g), \gamma^*(g)\}$.

2. The entrepreneur offers contract $C^R = (\alpha^{**}, C^N)$, which is accepted by the creditor.[5]

3. The good entrepreneur chooses action $a_g = a_g^2$ and the bad entrepreneur chooses action $a_b = a_b^2$.

4. If there is no default, the creditor offers the entrepreneur $\pi_2(b)$ in exchange for liquidation: the bad entrepreneur will accept the offer and the good entrepreneur will not.

5. If there is a default, the creditor asks for an additional payment of $\gamma(g)\pi_2(g)$ in period 2 or else the entrepreneur goes to court: the good entrepreneur accepts this offer and the bad entrepreneur does not and is ultimately liquidated by the court.

5 Conclusion

This paper shows that the optimal design of a bankruptcy court is generally one in which the court occasionally makes errs, sometimes mistakenly liquidating good entrepreneurs, and failing to liquidated bad ones. A mistake-prone court

1. May discourage good entrepreneurs from taking actions that lower total firm value (theft, shirking, risky negative NPV investments) by raising the cost to them of entering bankruptcy.

2. May encourage 'bad' entrepreneurs to take actions that increase the probability that they will enter bankruptcy (desist from fire sales) and hence liquidated.

We first provide conditions under which even where renegotiation is not possible, an error-prone court is preferred to an error-free court. The optimality of the error-riven court depends on the benefits of inducing entrepreneurs to take the socially optimal action relative to the costs of sometimes making incorrect liquidation decisions.

We then consider the optimal court design when creditors and debtors can renegotiation to circumvent an error-riven court and creditors have all of the bargaining power. Very generally, we illustrate that the optimal court design is one where the court makes mistakes. The crucial caveat to this is that there does not exist a "one type fits all" burden of proof rule, that is optimal independent of the types of actions that agents may take.

If it is optimal to discourage good entrepreneurs from taking actions that raise bankruptcy probabilities (theft, perk consumption, risky NPV investments, shirking), while discouraging bad

[5] As in the previous section, C^N represents the contract where renegotiation is not possible and $\gamma(b) = 1$ and $\gamma(g) = \max\{\pi_2(b)/\pi_2(g), \gamma^*(g)\}$. The parameter α^{**} represents an up-front lump sum payment that transfers all of the gains from renegotiation to the entrepreneur.

entrepreneurs from taking actions that lower bankruptcy probabilities (fire sales, working excessively hard, excessively safe investments), then we show that a blind court, which does not use *any* information, dominates an error-free court. Facing a blind court, creditors and debtors negotiate the 'correct' liquidation decision following a default, so that a blind court design induces the same liquidation decisions as an error-free court. In addition, the blind court design induces entrepreneurs to take better actions. Thus, for this class of action choices, the same simple blind court design leads to better outcomes.

However, if it is instead optimal to discourage bad entrepreneurs from taking actions that raise bankruptcy probabilities, then we show that the optimal court design places the burden of proof on the entrepreneur. As a result, the court would sometimes mistakenly liquidating good entrepreneurs who are unable to document their quality. While the optimal court design is again simple to implement, it differs from that where the goal is to discourage bad entrepreneurs from liquidating some of the firm to avoid bankruptcy.

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Appendix

To understand the expressions for the components of α^*, suppose the court chooses $\gamma(g) = \gamma(b) = \gamma = .5$ when renegotiation is not possible and the contract that is in place is C^N. With contract C^N in place and a blind court, the entrepreneur will choose action a_g^2 if he is good and action a_b^1 if he is bad. If renegotiation is possible when the court is blind, then bad entrepreneurs will be liquidated and good entrepreneurs will continue. Consider the following lump sum payment that is attributable to the good entrepreneur,

$$\alpha^*(g, a_g^2) = B(g, a_g^2))(\pi_2(g; a_g^2) + R_2(g, a_g^2) - z),$$

This lump sum payment has two components: (1) the surplus generated through renegotiation with the good entrepreneur, $\gamma B(g, a_g^2)(R_2(g, a_g^2) - z)$, and (2) the payment that the good entrepreneur gives the creditor if he defaults, $\gamma B(g, a_g^2)\pi_2(g; a_g^2)$. Now consider a lump sum payment that is attributable to the bad entrepreneur,

$$\alpha^*(b, a_b^1) = ((1-\gamma)B(b, a_b^1) + (1 - B(b, a_b^1)) + (z - R_2(b) - \pi_2(b, a_b^1).$$

To understand this lump sum payment, note that following a default, renegotiation generates surplus $(1-\gamma)(z - R_2(b))$, and the entrepreneur receive portion $(1-\gamma)\pi_2(b, a_b^1)$ of the total surplus; when the entrepreneur does not default, renegotiation generates a surplus of $(z - R_2(b))$ and the entrepreneur receives a portion $\pi_2(b, a_b^1)$.

When the court is blind and renegotiation is possible suppose that the creditor and entrepreneur negotiate the contract C^N with an additional up front lump sum payment of

$$\alpha^* = p(g)\alpha^*(g, a_g^2) + p(b)\alpha^*(b, a_b^1).$$

Since α^* is an up-front lump sum payment, contract $C^R = (\alpha^*, C^N)$ provides the entrepreneur with the same incentives when renegotiation is possible as does contract C^N when renegotiation is not possible. By construction, α^* transfers all gains from renegotiation to the entrepreneur.

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