Good Cop, Bad Cop: Complementarities between Debt and Equity in Disciplining Management*

Alexander Gümbel
Saïd Business School
and
Lincoln College
University of Oxford

Lucy White
Harvard Business School
and
University of Lausanne

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Correspondence address: Alexander Guembel, Lincoln College, Oxford, OX1 3DR, UK, Tel.: +44 1865 288 914, e-mail: alexander.guembel@sbs.ox.ac.uk or lwhite@hbs.edu

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Abstract

In this paper we demonstrate an inherent conflict that can arise in a firm between inducing *ex ante* efficient monitoring and liquidation decisions by outside claimholders. This tension arises because the choice of liquidation decision when firm prospects are uncertain will influence incentives for monitoring to produce information about firm prospects. We show that when high levels of outside monitoring are desirable in order to induce managerial effort, it can be useful to follow an inefficient liquidation policy, because this will provide greater incentives for the monitor. This result in turn has implications for firm capital structure: the quantity of information generated about firm prospects - and hence firm value - can be improved by *splitting* a firm's cash flow into a 'safe' claim (debt) and a 'risky' claim (equity) rather than selling a single claim, precisely because of the *ex post* conflicts of interest between claimholders that this creates. This generates a partial answer to the puzzle raised by Tirole (2001) as to why firms issue multiple securities when this leads to ex post conflicts of interest.

Keywords: Debt, Equity, Soft Budget Constraint, Monitoring.

JEL Classification: D82, G3

1. Introduction

Most firms issue multiple claims in order to finance their activities. This is puzzling, because multiple claims with differing cash flow and control rights generate costly externalities between security-holders. A geared firm, for example, may suffer from asset substitution whereby equity-holders may wish to increase the riskiness of assets in order to transfer wealth from creditors to themselves (Jensen and Meckling (1976)). Similarly, debt overhang may lead to underinvestment by equity-holders (Myers (1977)). Some theories of multiple securities (e.g., Allen and Gale (1988), Gorton and Pennacchi (1990), Boot and Thakor (1993), Fulghieri and Lukin (2001)) show that investor heterogeneity can render multiple claims optimal. But these theories leave unanswered the corporate governance implications of multiple claims. In particular, as Tirole (2001) argues, if one accepts that the holders of different claims face conflicts of interest with respect to the firm decisions, one might expect firms to try to achieve the best of both worlds by selling a single homogeneous claim to an intermediary which internalizes these conflicts and then achieves the benefits from diverse claims by selling on multiple claims with different cash flows to various different clienteles.

The objective of this paper is to provide a theory of multiple securities based on the corporate governance *benefits* of conflicting interests between multiple claimants. We consider a set-up where the provider or providers of capital have to take two different actions. Firstly, it will be necessary to decide at an interim date whether to liquidate or continue the firm's operations. Secondly, before this interim date arrives, but after the manager has chosen his effort level, it is possible to perform costly monitoring to provide information about the firm's value at the interim date, that is, about whether or not liquidation enhances or destroys value. Intuitively, since there are two different activities for outsiders to perform, it may be useful to have two different outside claimants with different claims. Yet this is not obvious since an aggregate claimant holding all the returns to the firm would have efficient incentives both to collect and to act upon information, and, one might expect the benefits to collecting information to be greatest when the informed party has control over decision-making (see Aghion and Tirole, 1997). Thus the existence of multiple activities to be carried out by outsiders does not *per se* generate a need for multiple outside claimants. But we show in this paper that it may do so if it is not *ex ante* optimal for the firm to set monitoring and control decisions to the *ex post* optimal levels, because then selling the firm to a single claimant will not achieve the desired outcome.

We demonstrate that there is an inherent tension between providing strong monitoring and liquidation incentives, so that monitoring incentives can be improved by the credible adoption of an *inefficient* liquidation policy. It follows from this that it can be optimal to split the function of exercising control over the firm and monitoring it between two different providers of capital with differing cash flow rights, which provide the right incentives for each of their roles. In other words, the externality which the claim-holder with control over the liquidation decision exerts on the monitoring claim-holder can be seen as part of the corporate design: it may indeed be inefficient to separate claims *ex post*, but it improves efficiency *ex ante*.

Of course, committing to a value-destroying strategy has a cost as well as an increased monitoring benefit, and the cost is that the organisation will typically choose the value-destroying action too often (whenever the monitor is uninformed). Why would one ever wish to impose an ex post inefficient liquidation policy? In our paper, we consider one particular application where this can be useful which has been much studied in the literature: the difficulty of inducing managerial effort. Our model thus contains two or potentially three active parties: the manager, the monitor and the party taking the liquidation/continuation decision. We begin by showing, that, as one would expect, the manager will exert more effort if the decision to continue or liquidate the firm is more informed - so that the more informed is the continuation decision, the lower the expected agency rents that must be paid to the manager. Therefore it is useful for the monitor to acquire more information about the future prospects of the firm. We then come to the key point of our paper: we show that the ex post incentive for the monitor to collect information under the efficient continuation policy may be lower than it would be under the inefficient continuation policy. The intuition for this result is that, if monitoring itself is unverifiable, the monitor can only be rewarded according to the final cash flows - which depend on the continuation decision. If the monitor's acquisition of information does not change the continuation decision, it does not change the cash flows which he receives, and so he has no incentive to collect that information. Now, if the firm can commit to employing a continuation decision that is expected to be value-destroying unless

the monitor obtains information, then the monitor's information will have a larger expected impact on cash flows than if the firm were committed to following the value-maximising policy. So there is a trade-off between employing a liquidation policy that maximizes the firm's future value and inducing high monitoring effort.

The existence of this trade-off allows us to generate a theory of firm capital structure. In particular, we show that if it is desirable to employ an inefficient liquidation decision to motivate high levels of monitoring, then the firm must issue multiple securities: one debt-like (with limited upside) and one equity-like (with limited downside), owned by *independent* claim-holders. Further, when this split is desirable, there will necessarily be an ex post conflict between the claim-holder who is given incentives to monitor and the claim-holder who holds control over the continuation/liquidation decision. We then go on to show that there is a range of model parameters where it is indeed optimal to divide functions, cash flows, and control rights in this way, hence providing one possible resolution to the puzzling question of why firms issue multiple securities outlined above.

In order to draw out the empirical implications of our theory, we need to distinguish between two possible regimes, depending on whether liquidation at the interim date enhances or destroys value. Consider first a firm that is sufficiently profitable ex ante that in the absence of further information the presumption is that operations should be continued. We call this the 'soft budget constraint' case, because the problem is that investors anticipate continuation and therefore have little reason to produce costly information. To be more specific, after the manager has taken his action, the only reason for investors to collect information is to be able to liquidate the firm if prospects turn out to be sufficiently bad – but if the manager has worked, it is unlikely that prospects are bad. The amount of information which a single principal would find it optimal to collect may therefore be too low to provide much incentive to the manager. Therefore a mechanism is required to allow the principal to commit to collecting more information than is ex post optimal. This can be achieved by dividing cash flows into two parts. Control should be allocated to the holder of a tough claim: debt. With little to gain from the upside, the debt-holder is willing to liquidate the firm unless a monitor generates positive information about the firm's prospects. On the other hand, such a monitor has an incentive to produce costly information only if his upside from continuing the firm is sufficiently high, i.e., his claim resembles an equity stake. But an equity-holder would be too soft in his continuation policy if he had control in the absence of information. Indeed, the threat of inefficient liquidation makes the equity-holder's monitoring incentives more high-powered. Intuitively, therefore, it may be optimal to split the cash flow rights precisely in order to generate externalities between claim-holders. Moreover, the equity claim needs to be concentrated in the hands of one agent so as to prevent a free rider problem among equity holders to monitor. Our model therefore makes the novel prediction that firms with a lot of creditor control (highly levered firms such as LBO companies, firms with a high proportion of short term debt and firms in financial distress), should have more concentrated equity ownership.

We also consider the opposite kind of firm, that is, one that will optimally be liquidated in the absence of information. We call this the 'start-up' case, because the parameters are such that these firms' value comes from the option to abandon or liquidate at the interim date, together with high cash flows in the unlikely event that the firm is successful. Monitoring incentives in these firms stem from the desire to identify the good state in which the firm

should be continued. However, given that the likelihood that the firm is profitable is small, the *expected* payoff from identifying the good state may also be relatively small, and so, correspondingly, are monitoring incentives. Nevertheless, monitoring may still be optimal ex ante, because it mitigates the managerial moral hazard problem. If liquidation is too frequent, the manager has no incentive to exert effort. We show that if control is now allocated to a soft claimant (equity) who will continue the firm in the absence of information, monitoring incentives for a tough (risky debt) claimant increase, because they are now driven by the larger payoff that can be obtained from avoiding value-destroying continuation in the bad state. Our theory may help explain the finding of Guedj (2005) and Guedj and Scharfstein (2005) that drug trials inside large companies are terminated more often than when they are carried out by small bio-tech firms that are allied with larger companies. Since they also find that these earlier terminations are, on the whole, efficient, this raises the question why alliances adopt inefficiently soft termination policies. Our theory provides one possible explanation for this finding.

The plan of this paper is as follows. Section 2 describes the basic model and assumptions. Section 3 derives optimal incentive contracts for the manager, the monitor and the party charged with making the liquidation decision. Section 4 sets out the main result that a division of labour between a monitoring and a controlling agent may be necessary to induce monitoring under some circumstances. It shows that to achieve this the firm must issue a pair of securities that can be interpreted as debt and equity. Section 5 then shows under which circumstances inducing monitoring is worth the sacrifice in the efficiency in the continuation decision. We introduce the possibility of renegotiation in section 6 and section 7 discusses some related literature on security design. Section 8 discusses and interprets our results, and provides empirical implications. Section 9 concludes. Appendix A shows robustness of our main results with respect to two model extensions: (i) renegotiation between multiple claim-holders over the liquidation decision at the interim date, and (ii) allowing the manager to perform the monitoring function. All proofs are relegated to Appendix B.

2. The Basic Model

This section starts with a description of the model set-up, followed by a discussion of key assumptions. We base our model on a simplified version of the set-up used by Dewatripont and Tirole (1994), but extend their model to endogenise the monitoring activity.

There are three dates $t = 0, 1, 2$. At date 0, the owner of a production technology can set up a firm to undertake a project requiring up-front investment I. There are two possible date 2 values R_ω of the firm (project), depending on the realization of a random variable $\omega \in \{l, h\}$, where $R_h > R_l$. There is a continuum of risk-neutral agents in the economy who can potentially buy claims in and provide financing for the firm, as well as undertaking monitoring of the firm's prospects and taking decisions as to its continuation (to be explained below). In addition, the firm must employ a manager to run the project. The manager has a zero reservation utility, is risk-neutral, has no wealth and enjoys limited liability. At $t = 0$, the manager of the firm chooses an unobservable effort $e \in \{\underline{e}, \overline{e}\}$, where $0 \leq \underline{e} < \overline{e} \leq 1$. If the manager chooses high effort $\overline{e}$, he pays a non-monetary cost $k(\overline{e}) = \gamma$, whereas low effort $\underline{e}$ comes at zero cost $k(\underline{e}) = 0$. If effort is high, the probability of the high state $\omega = h$, is given by $\overline{e}$, and if effort is low, the probability of the high state is $\underline{e}$. We denote the

improvement in the probability of the high state by $\Delta e \equiv \overline{e} - \underline{e}$. The manager also receives a private benefit from control given by b if the firm continues to operate into the second period $t = 2$.

At the interim date 1, after financing but before outcomes, information about the firm's future prospects may become available. This takes the form of a signal $s \in \{l, h, \varnothing\}$ observed by all investors about the future state of the world ω. With probability $\underline{\theta}$ the signal is perfectly informative about the true state of the world ($s = \omega$). With complementary probability $1-\underline{\theta}$ the signal is uninformative ($s = \varnothing$). There is a monitoring technology, which can increase the amount of information that is generated. If an agent uses the monitoring technology, (the agent is said to 'monitor') the probability of an informative signal $s = \omega$ becoming available increases to $\overline{\theta} > \underline{\theta}$. Again, with complementary probability $1 - \overline{\theta}$ no signal is produced ($s = \varnothing$). We denote by $\Delta\theta \equiv \overline{\theta} - \underline{\theta}$ the improvement in the probability of producing an informative signal that results from monitoring. Monitoring accrues a cost $f\left(\overline{\theta}\right) = c \geq 0$ and $f\left(\underline{\theta}\right) = 0$ to the agent undertaking this task. We assume that the monitoring activity itself cannot be publicly observed. However, the signal realization can be observed by all investors, but not verified, i.e., we assume that contracts cannot be made contingent on the signal realization.

Also at date $t = 1$, but after the signal has been observed, an agent can choose an action C (continue operations) or S (stop) at date 1. We refer to the agent who has the right to take this action as the "controlling stakeholder". The allocation of control (i.e., the right to choose C or S) will be determined endogenously in order to maximise the value of the firm. Action S corresponds to terminating the project and liquidating the firm. Doing so yields the liquidation value L, and implies that the manager will not receive his private benefit from continuation. Choosing action C means that instead, firm returns will be realized at date 2, R_h or R_l according to the state of the world, and the manager will receive b. We assume that the manager's presence is essential for the continuation of the firm, so that the firm cannot be continued without him, for example because running the project requires particular skills that only the current manager has. The advantage of gaining information at the interim date is that the continuation decision will be made with more information. We denote by $A : \{l, h, \varnothing\} \to \{C, S\}$ a mapping from the signal realization onto the liquidation decision, i.e. $A(s)$ specifies a signal contingent liquidation policy. Since we assume that the signal is non-contractible, any such policy will have to be incentive compatible for the party in control at the time of taking the decision.

We assume that $R_h > L > R_l + b$ so that it is efficient for liquidation to occur in the low state but not in the high state. As will become clear below, we can then restrict attention to liquidation policies that always continue the firm after the high signal ($A(h) = C$), and always liquidate the firm after a low signal ($A(l) = S$). Where liquidation policies differ is whether they continue or liquidate the firm *in the absence of information*. We will say that the firm's liquidation policy is 'soft' if the firm is continued when no information is available: $A(\varnothing) = C$. The 'tough' liquidation policy is to liquidate the firm in the absence of information: $A(\varnothing) = S$. For ease of exposition we only allow for pure strategies as liquidation policies. In section 5 we briefly discuss why allowing for mixed liquidation strategies would not change our qualitative results.

We are interested in a setting where the project has negative net present value if the

manager chooses low effort.[1] Define $\underline{R} \equiv \underline{e} R_h + (1 - \underline{e}) R_l$ as the expected return when effort is low. If the soft liquidation policy $A(\varnothing) = C$ is employed, the project has a negative NPV when

$$\underline{R} + (1 - \underline{e}) \overline{\theta} (L - R_l) - c < I, \quad \text{and} \tag{1}$$

$$\underline{R} + (1 - \underline{e}) \underline{\theta} (L - R_l) < I. \tag{2}$$

according to whether the monitor exerts effort to collect information or not. Firm value is thus equal to its value if it were always continued ($\underline{R}$) plus the gain in value from liquidating the firm when the bad state is discovered ($(1 - \underline{e}) \theta (L - R_l)$), where $\theta = \overline{\theta}$ if the monitoring cost c is incurred, and $\theta = \underline{\theta}$ otherwise.

Similarly, under the tough liquidation policy $A(\varnothing) = S$, the analogous conditions are:

$$\underline{R} + (1 - \underline{e}) \overline{\theta} (L - R_l) - \left(1 - \overline{\theta}\right) (\underline{R} - L) - c < I, \quad \text{and} \tag{3}$$

$$\underline{R} + (1 - \underline{e}) \underline{\theta} (L - R_l) - (1 - \underline{\theta}) (\underline{R} - L) < I. \tag{4}$$

In addition to the first two terms, which are familiar from (1) and (2), we now have the additional term $-\left(1 - \overline{\theta}\right) (\underline{R} - L)$. This term represents the change in expected firm value from liquidating the firm in the absence of information. A loss in expected firm value results when $\underline{R} > L$ and liquidation is inefficient at the interim date. On the other hand, when $\underline{R} < L$, liquidating in the absence of information is interim optimal and adds to the firm value.

Moreover, we will make a distinction between parameter values where the total financial gain from continuation in the absence of information is larger (smaller) than the liquidation value. Defining by $\overline{R} \equiv \overline{e} R_h + (1 - \overline{e}) R_l$ the expected cash generated from continuation, when $s = \varnothing$ and the manager has chosen $\overline{e}$, we say that the soft (tough) liquidation policy enhances (destroys) firm value if $\overline{R} > L$ $\left(\overline{R} < L\right)$.[2]

2.1 *The Optimization Problem*

We assume that the ownership rights for the initial project reside with a risk-neutral investor who maximizes his expected payoff by choosing (i) a wage contract for the manager, (ii) a monitoring contract, (iii) and a control contract, specifying who has the right to take the $t = 1$ continuation decision. Moreover, the manager has no wealth, but the monitor and the controlling agent are not wealth constrained. Hence, the initial project owner needs to determine a price at which he sells the monitoring and control contracts. Finally, the initial owner needs to decide whether to allocate the monitoring contract and the control rights to the same or different agents. We denote this choice by an indicator variable $\lambda = 0$, if one agent is the monitor and also takes the continuation decision, or $\lambda = 1$ if two different agents are in charge of each.

[1] Note that we do not yet make assumptions to ensure that the firm has positive NPV when the manager does exert effort. It is more convenient to impose these directly in 5 when we derive our result (proposition 2), because we do not require that the project has positive NPV when the manager exerts effort under any liquidation policy (and choice of monitoring level), but only that it has positive NPV under the ex ante optimal liquidation policy.

[2] Our focus on value at the interim date excludes the manager's private benefits. Interim efficiency would be defined with respect to a comparison between $\overline{R} + b$ and L.

The payoffs to all of the above three contracts can only be made contingent on the firm's three possible cash flow realizations R_l, L, and R_h. If the firm was continued at $t = 1$, the state of the world ω determines whether cash flows are low (R_l) or high (R_h). If the firm is stopped, then cash flows are equal to the firm's liquidation value L. Assume that any cash raised over and above the investment requirement can be expropriated by the manager. If investment occurs, the firm's possible cash flows are therefore given by R_l, L and R_h. Contractual payments can then be made contingent on the realization of a variable $\varphi \in \{l, L, h\}$ indicating whether cash flows were $CF_{\varphi=l} = R_l, CF_{\varphi=L} = L$ or $CF_{\varphi=h} = R_h$. All contracts can thus be described as three dimensional vectors. The wage contract is denoted by $\mathbf{w} = (w_l, w_L, w_h)$, the monitoring contract is $\mathbf{m} = (m_l, m_L, m_h)$ and the control contract is $\mathbf{a} = (a_l, a_L, a_h)$. The price at which the monitoring and control contracts are sold can be denoted by $P_{\mathbf{m}}$ and $P_{\mathbf{a}}$, respectively.

In line with much of the existing literature on optimal security design, we assume that the payments made to any party have to be non-decreasing in the underlying payoff and satisfy limited liability (see for example Harris and Raviv, 1989, Nachman and Noe, 1994). That is, we assume,

$$\begin{aligned} 0 \leq w_l \leq w_L \leq w_h, \\ 0 \leq m_l \leq m_L \leq m_h, \\ 0 \leq a_l \leq a_L \leq a_h. \end{aligned} \tag{5}$$

In addition, we assume that all payments must be made from the cash flows generated by the firm:

$$w_\varphi + m_\varphi + a_\varphi \leq CF_\varphi. \tag{6}$$

The manager then chooses his effort level e^* so as to maximize expected utility:

$$e^* \in \arg\max E\left(w_\varphi\right) - k\left(e\right) \tag{7}$$

Since, the manager has no initial wealth his participation constraint can be written as

$$E\left(w_\varphi | e^*\right) - k\left(e^*\right) \geq 0. \tag{8}$$

Consider first the case where the monitor and the controlling stakeholder are different agents $(\lambda = 1)$. The monitor chooses the level of monitoring so as to maximize expected utility:

$$\theta^* \in \arg\max E\left(m_\varphi\right) - f\left(\theta\right) \tag{9}$$

Similarly, the controlling party chooses the continuation decision so as to maximize his expected continuation payoffs:

$$A\left(s\right) \in \arg\max E\left(a_\varphi\right), \qquad s \in \{l, h, \varnothing\}. \tag{10}$$

The participation constraints of the monitoring and controlling stakeholders can be written as

$$E\left(m_\varphi | \theta^*\right) - f\left(\theta^*\right) - P_{\mathbf{m}} \geq 0, \tag{11}$$

$$E\left(a_\varphi\right) - P_{\mathbf{a}} \geq 0. \tag{12}$$

Suppose now the same party who monitors also takes the continuation decision ($\lambda = 0$). Then by definition, the payoffs a_φ and m_φ are identical and the incentive compatibility constraints (9) and (10) remain unchanged. However, the participation constraint changes, because the stakeholder buys only one claim. In particular, his maximum willingness to pay for the claim will be determined by the more binding of the two constraints (11) and (12), which clearly is constraint (11). Hence, the initial owner only receives one payment for the one claim he sells, given by (11).

Since there are many risk-neutral agents with wealth who compete ex ante to be awarded the monitoring and the control contracts, the initial owner solves the following problem

$$\max_{\lambda,\mathbf{w},\mathbf{m},\mathbf{a}} V = E\left(CF_\varphi - w_\varphi - m_\varphi - a_\varphi\right) + P_{\mathbf{m}} + \lambda P_{\mathbf{a}} - I \tag{13}$$

$$s.t.$$

$$V \geq 0$$

$$(5) - (12).$$

Note, moreover, that the above formulation imposes no restrictions on the identity of the monitor and controller, i.e., the investor can choose himself or an outsider as the monitoring and/or the controlling party. In the appendix we will also analyse the case that the manager himself may act as monitor or the party in control of the continuation decision.

As a solution concept for the game we use pure strategy Perfect Bayesian Nash equilibrium, i.e., all agents optimize their expected payoffs given their belief about the strategy chosen by the other players. In equilibrium these beliefs are correct. Moreover, all agents update their beliefs according to Bayes' rule.

2.2 *Discussion of the model set-up*

2.2.1 Why are signals observable but non-contractible?

We rule out by assumption contracts that reward the monitor directly for delivering a signal. Following Dewatripont and Tirole (1994), we argue that in reality it may be difficult to write into the contract ex ante what constitutes good, bad and uninformative news, even though this will be evident to the parties ex post, since the number of possible items of news (good, bad, irrelevant) that could possibly (but do not actually) arrive is likely to be very large. The action (continue or liquidate) may also under some circumstances be hard to describe, although given the uncontractibility of the signal realization, we do not require this. Under these circumstances, implementation of continuation policies requires an allocation of control rights specifying who has the right to decide as to whether the firm will continue or not; and, if the outcome of monitoring is not describable this control will have to be uncontingent.

The assumption that some future contingencies cannot be contracted upon, although they are observed by the contracting parties, is central to the literature on incomplete contracts. The approach has been used extensively in a variety of applications, notably to develop a theory of the firm based on property rights (Grossman and Hart, 1986, Hart and Moore, 1990), and to understand long-term 'relational contracts' (Bull, 1987, MacLeod and Malcomson, 1989). In corporate finance this assumption is used by Aghion and Bolton (1992) and Dewatripont and Tirole (1994) to explain the commonly observed state contingent allocation

of control rights across debt and equity contracts.[3] Specifically, these two papers assume that there is a signal about future cash flows that is observed by all parties, but that is not contractible. Control rights are then important because the range of outcomes for which liquidation occurs will depend on how control over the liquidation decision is allocated conditional on the observed signal. If the signal was contractible the concept of control rights would have no content since the signal contingent continuation decision could be agreed upon contractually ex ante and there would be no need to give control over the decision to any particular party ex post. In order to make a contribution to the literature on control rights we need to make the same assumption on the observability and non-contractibility of the signal.[4]

2.2.2 Why are security payoffs non-decreasing in firm value?

Financial contracts in practice display the property that payoffs are non-decreasing in underlying firm cash flows. Since we are not aiming to explain this feature of contracts, we take it as a constraint and investigate its implications for the interaction between monitoring and liquidation incentives. A number of reasons have been put forward in the literature as to why financial securities' payoffs are non-decreasing in firm value (see for example Innes, 1990). Firstly, decreasing payoffs may provide some security holders with an incentive to sabotage the firm. Secondly, if it is possible to manipulate performance upwards (for example by hidden borrowing) then payoffs that are decreasing in performance might be undermined by such manipulation. Avoiding sabotage or manipulation by other means may be costly, so removing the incentives for doing so from the securities' payoff structures may be optimal.

Nevertheless financial market participants can have decreasing payoffs when they hold a short position or an unhedged put option in a firm's shares. However, the total size of such positions tends to be a relatively small fraction of firm value.[5] Hence, it is doubtful whether allowing in our analysis for short positions or derivatives that may have decreasing payoff functions would relax the monitor's incentive compatibility constraint substantially, once one takes into account the relatively small fraction of such (unhedged) instruments outstanding in practice.

2.2.3 Why are contractual claims paid out of the firm's cash flows?

This assumption rules out that the firm raises more funds than are necessary for the investment and retains this money as cash inside the firm. If this were possible, then the firm could 'raise the stakes' for the monitor, by promising large payments in some states (say if the firm continues and cash flow is high) and no payment in others. This is similar

[3] There are numerous papers in corporate finance that make this assumption, among others, Berglöf and von Thadden (1994), Rajan and Winton (1995), Harris and Raviv (1995), Bolton and Scharfstein (1996) and von Thadden, Berglöf and Roland (2003).

[4] The merit of this assumption has been debated extensively (see, among others, Tirole (1999), Hart and Moore (1999) and Maskin and Tirole (1999)). More recently, the assumption has been defended on behavioural grounds (Hart and Moore, 2007) and by showing that the mechanisms that may overcome the incompleteness problem are not robust to small deviations from common knowledge of the publicly observed signal (Aghion, Fudenberg and Holden, 2007).

[5] According to Desai et.al. (2002) the median short interest as a fraction of shares outstanding in Nasdaq firms was between 0.08% and 0.16% in the years 1988-1994.

to having the monitor 'post a bond' up front, which is lost in some states, but paid back in others. As will become clear below, our argument for splitting the monitoring from the control functions relies on the firm's constraints to reward the monitor in certain states. The above assumption is therefore central to our argument.

In reality there are many reasons to believe that posting a bond, or raising substantially more funds than are necessary for investment, may be impossible or undesirable. Firstly, raising additional cash beyond investment requirements is likely to increase agency costs, because managers in practice have considerable control over how to (ab)use such funds (see Jensen, 1986). Secondly, the rate of return that can be earned on the funds committed to posted bonds (or excess funding) is likely to be lower than the opportunity cost of capital for the provider of these funds. This could be either because fund providers may have superior ability to invest funds compared to a passive investment, or because external capital is simply more costly for agency reasons. Moreover, the time period between when funds are raised (or bonds posted) and when the monitoring / liquidation decisions are taken may be substantial. Differences in rates of return may thus accumulate to significant amounts of cash and may make it undesirable to commit these extra funds. Thirdly, fund providers may be unwilling or unable to commit very large sums to a particular firm, either because they are risk averse, or because they are subject to capital rationing. Again, committing extra funds may be difficult or undesirable under these conditions.

2.2.4 Why is the allocation of control rights uncontingent?

Control rights in practice are contingent on whether the firm functions as a going concern or has defaulted. Control rights in our model, however, are not contingent. This follows directly from our assumption that signals are non-contractible, because the signal is the only information available at date 1, so if the signal cannot be contracted on there is nothing else upon which the allocation of control rights could be made contingent. Other papers have shown that the contingent allocation of control rights may be optimal and we do not attempt to replicate this finding in our model. Instead we want to focus on the split between the monitoring and control functions and it is more straightforward to do so in a simpler setting where control rights are uncontingent.

It is, however, straightforward to see how our model could be extended to allow for the contingent allocation of control rights. This could be done by introducing an additional interim date $t = 0.5$, at which a cash flow is received after managerial effort has been chosen, but before monitoring occurs. Control rights could then be allocated contingent on the interim cash flow. Suppose if the cash flow is high, it is common knowledge that the date 2 cash flows will be such that liquidation is never optimal. The optimal allocation of control rights at the beginning of this sub-game is then straightforwardly to the equity holder. Suppose if the interim cash flow is low, we are in the situation modelled in the paper, i.e., optimal continuation does depend on the monitoring outcome. Our analysis can then be applied to this sub-game in order to examine which allocation of control rights is optimal after a low interim cash flow realization. Our results then show that the optimal (contingent) control right allocation interacts with the provision of monitoring incentives, and that typically these functions should be split from one another.

3. Optimal Contracting

3.1 *Wage payments*

We now derive the optimal wage payments to the manager taking as given the liquidation policy and assuming that an agent other than the manager is employed to monitor the firm. That is, we derive the wage contract that maximises expected firm value under the soft liquidation policy $A(\varnothing) = C$ and under the tough liquidation policy $A(\varnothing) = S$. Since the manager does not have wealth to pay ex ante for the agency rent that he will extract ex post, the firm's founder will be interested in choosing the wage contract which induces the manager to exert high effort at the lowest possible expected cost given the liquidation policy. As we will explain below, the amount that the manager will need to be paid to induce effort depends on the probability with which he anticipates the informative signal to be available (θ). Thus we write the optimal (i.e., least cost) wage contract as a function of the manager's belief about θ.[6] We denote by w_{φ}^{C} and w_{φ}^{S} the wage payments under the soft and the tough liquidation policy, respectively.

Lemma 1 *The wage contracts that result in the lowest expected payment to the manager whilst rendering high managerial effort incentive compatible are as follows:*

(a) under the soft liquidation policy ($A(\varnothing) = C$)

$$\begin{aligned} w_h^C(\theta) &= \max\{\frac{\gamma}{\Delta e} - \theta b, 0\}, \\ w_L^C(\theta) &= w_l^C(\theta) = 0, \end{aligned} \tag{14}$$

and

(b) under the tough liquidation policy ($A(\varnothing) = S$)

$$\begin{aligned} w_h^S(\theta) &= \max\{\frac{\gamma}{\theta \Delta e} - b, 0\}, \\ w_L^S(\theta) &= w_l^S(\theta) = 0, \end{aligned} \tag{15}$$

where $\theta \in \{\underline{\theta}, \overline{\theta}\}$.

When the private benefits of control b are large, implicit incentives are sufficient to motivate the manager to exert high effort $\overline{e}$. That is, the threat to liquidate the firm after receiving negative information $s = l$ results in a loss of private benefits and provides an incentive for the manager to exert effort. This is in line with previous work on the ex ante effort incentives provided by a termination threat (e.g., Dewatripont and Tirole, 1994, Fluck, 1998, and others). On the other hand, the liquidation policy when the decision maker is uninformed ($s = \varnothing$) does not affect the manager's effort incentive compatibility constraint. This is because the manager's effort level cannot change the liquidation decision when the latter is uninformed. Hence, the liquidation threat improves implicit incentives in our setting only when the negative signal $s = l$ is obtained, but not when there is no information.

[6] This notation is *not* intended to imply that the actual wage payment will depend on the actual choice of monitoring intensity, since the level of monitoring is not verifiable. Instead, it just indicates that the optimal wage policy depends upon the expected monitoring intensity.

Implicit incentives thus work more effectively when the signal quality is higher. In (14) and (15), a larger θ reduces the requirement for explicit wage payment. Monitoring can therefore help to resolve the agency problem between the investor and the manager. Again, this is a standard result in this type of model (see, for example, v. Thadden, 1995).

Note that in our set-up the liquidation policy has, by construction, no direct impact on managerial incentives. All effects will therefore stem from the liquidation policy's impact on monitoring incentives.[7]

3.2 *Monitoring and control incentives*

Consider now the contract that induces monitoring, again as a function of the monitor's belief about the level of effort e exerted by the manager, and depending on the liquidation policy. Note that liquidating the firm after good news $s = h$ or continuing after bad news $s = l$ cannot be optimal for the following reason. Firstly, by assumption $R_h > L > R_l + b$ these actions are inefficient. Secondly, it reduces the amount of cash that is available for distribution to the monitor (and anyone else) in the state where he has produced information. Similarly, continuing the firm after $s = l$ also reduces the available cash in the state where information has been produced. It follows immediately that $A(s = h) = S$ and $A(s = l) = C$ cannot improve monitoring incentives. Finally, continuing in the good state and liquidating in the bad state provides maximum incentives for the manager and thus reduces incentive pay. It thus follows that $A(h) = S$ or $A(l) = C$ cannot be part of an (ex ante or ex post) optimal liquidation policy. We therefore only need to consider liquidation decisions following $s = \varnothing$. As before, we distinguish between the soft and tough liquidation policy cases:

Lemma 2 *Under the soft liquidation policy $A(\varnothing) = C$ the monitor chooses $\overline{\theta}$ if and only if*

$$\begin{aligned} m_h^C(e) - m_L^C(e) &\geq 0, \\ m_L^C(e) - m_l^C(e) &\geq \frac{c}{(1-e)\Delta\theta}. \end{aligned} \tag{16}$$

Under the tough liquidation policy $A(\varnothing) = S$ the monitor chooses $\overline{\theta}$ if and only if

$$\begin{aligned} m_h^S(e) - m_L^S(e) &\geq \frac{c}{e\Delta\theta}, \\ m_L^S(e) - m_l^S(e) &\geq 0. \end{aligned} \tag{17}$$

The monitor's incentives derive from the payoff received in the states in which the signal changes the liquidation decision. If the signal does not change the liquidation decision, then there is no additional payoff from producing it and therefore no incentive to exert costly effort to do so. Under the soft liquidation policy, the default choice is to continue the firm, so the monitor has no incentive to learn that the firm's prospects are good (R_h), because then the firm will be continued anyway and he will receive m_h whether or not he provided information. The monitor's information will change the decision only when it is negative

[7] This contrasts with Dewatripont and Tirole (1994) who assume an information structure that allows for inefficient termination to improve incentives directly. This is because they allow for the possibility of information that is weakly negative, such that termination is inefficient, but sufficiently informative to affect managerial incentives.

(suggesting that the firm will earn only R_l from continuation), so any incentive compatible payoff to the monitor must reward him when the firm is liquidated (m_L) compared to when it is continued in the bad state (m_l).

Conversely, under the tough liquidation policy, a positive signal that the outcome will be R_h now improves the liquidation decision by allowing value enhancing continuation. The monitor's incentive payment m_h therefore needs to reward him for identifying the high state instead of accepting the 'default' payment m_L.

Finally, it is straightforward to set out the payoff requirements a_h, a_L, and a_l to the controlling stakeholder, such that either the soft or the tough policy is incentive compatible. Assume that in case of indifference, the controlling stakeholder chooses the action that maximizes expected future cash flows generated by the firm.[8] Since we always want to continue the firm after the high signal, but liquidate it after the bad signal we require $a_h \geq a_L \geq a_l$. The soft liquidation policy is incentive compatible if the controlling party prefers continuation in the absence of information:

$$\overline{e}a_h + (1-\overline{e})a_l \geq a_L. \tag{18}$$

The tough liquidation policy is obviously incentive compatible when the inequality (18) is reversed.

4. Monitoring Feasibility in General

In this section we outline the parameter values for which it is possible to write an incentive compatible monitoring contract. We say that $\overline{\theta}$ is *feasible*, if the parameter values are such that it is possible to write a contract that renders $\overline{\theta}$ incentive compatible for the monitor. As we saw in the previous section, the incentives for monitoring depend on the liquidation policy, so, depending on the potential gain from continuation $R_h - L$ compared to liquidation $L - R_l$, $\overline{\theta}$ may be feasible regardless of the liquidation policy, or may only be feasible under a specific liquidation policy. Moreover, as will become clear below, it may also be necessary to split the control function from the monitoring function. This happens when the liquidation policy that is needed in order to render monitoring incentive compatible would not actually be implemented by the monitor. The result is summarized in the following proposition.

Proposition 1 *If*

(i) $L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$ *and* $R_h - L \geq \frac{c}{\overline{e}\Delta\theta} + w_h^S(\overline{\theta})$ *then* $\overline{\theta}$ *is feasible regardless of the liquidation policy. Control rights can (but do not have to) be allocated to the monitor* ($\lambda = 0, 1$).

(ii) $L - R_l < \frac{c}{(1-\overline{e})\Delta\theta}$ *and* $R_h - L > \frac{c}{\overline{e}\Delta\theta} + w_h^S(\overline{\theta})$ *then* $\overline{\theta}$ *is feasible only if the tough liquidation policy is chosen and control rights are allocated to another stakeholder* ($\lambda = 1$),

(iiia) $L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$ *and* $\frac{c}{\overline{e}\Delta\theta} + w_h^C(\overline{\theta}) \leq R_h - L < \frac{c}{\overline{e}\Delta\theta} + w_h^S(\overline{\theta})$ *then* $\overline{\theta}$ *is feasible only if the soft policy is chosen. Control rights can be allocated to the monitor* ($\lambda = 0, 1$).

(iiib) $L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$ *and* $w_h^C(\overline{\theta}) < R_h - L < \frac{c}{\overline{e}\Delta\theta} + w_h^C(\overline{\theta})$ *then* $\overline{\theta}$ *is feasible only if the soft policy is chosen and control rights are allocated to another stakeholder* ($\lambda = 1$).

(iv) For all other parameters $\overline{\theta}$ *is not feasible.*

[8] We will discuss the role of this assumption when we allow for renegotiation in section 6.

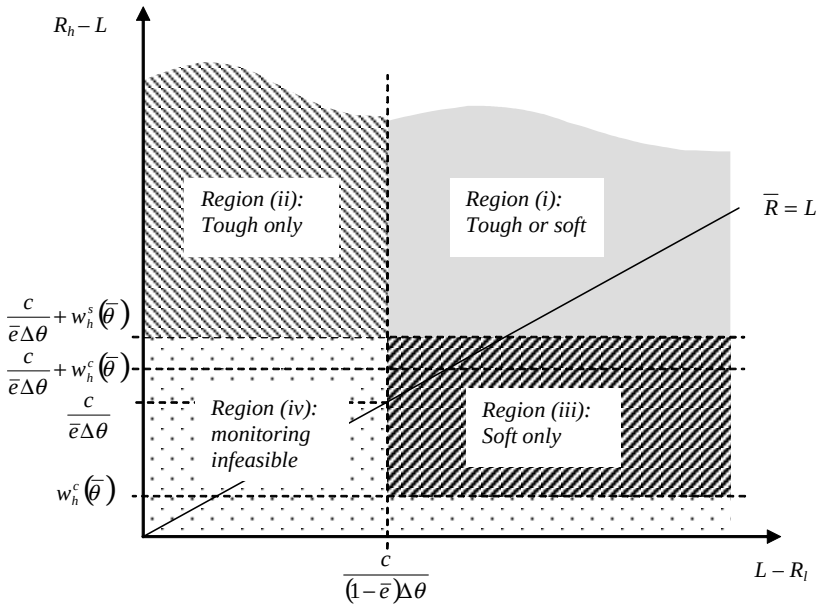

Figure 1: Shows parameter regions for which monitoring is feasible under (i) either liquidation policy, (ii) only the tough policy, (iii) only the soft policy, or (iv) never.

Monitoring can be made incentive compatible under the soft liquidation policy when the expected gain from identifying the *bad* state is sufficiently high ($L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$), since under the soft policy, the goal of monitoring is to identify and liquidate the firm in the bad state rather than following the soft policy of continuing. Given limited liability, it is intuitive that it may not be possible to induce monitoring when this gain is too low, because the rewards from identifying the negative information are not large enough to provide incentives for acquiring it. Similarly, when the gain from identifying the high state is sufficiently high ($R_h - L \geq \frac{c}{\overline{e}\Delta\theta} + w_h^S(\overline{\theta})$), then the tough liquidation policy can achieve monitoring. Correspondingly, proposition 1 identifies four regions: it may be feasible to induce monitoring under (i) either liquidation policy, (ii) the tough policy only, (iii) the soft policy only, or (iv) monitoring is never feasible. These regions are depicted in Figure 1.

Proposition 1 also sets out conditions under which, in each of the regions of figure 1, it will be necessary to split the functions of monitoring and control. These additional partitions are illustrated in figure 2. It can be seen that for much of the illustrated range, it will be necessary to divide functions in this way, and that whether it is necessary to do so depends on the expected cash flows from continuation compared to liquidation (shown by the line $\overline{R} = L$). In the remainder of this section, we provide some intuition for why it is sometimes necessary to split the functions of monitoring and control over the liquidation decision, and how this can be done using capital structure. We have two cases to consider: monitoring under the tough liquidation policy and monitoring under the soft liquidation policy.

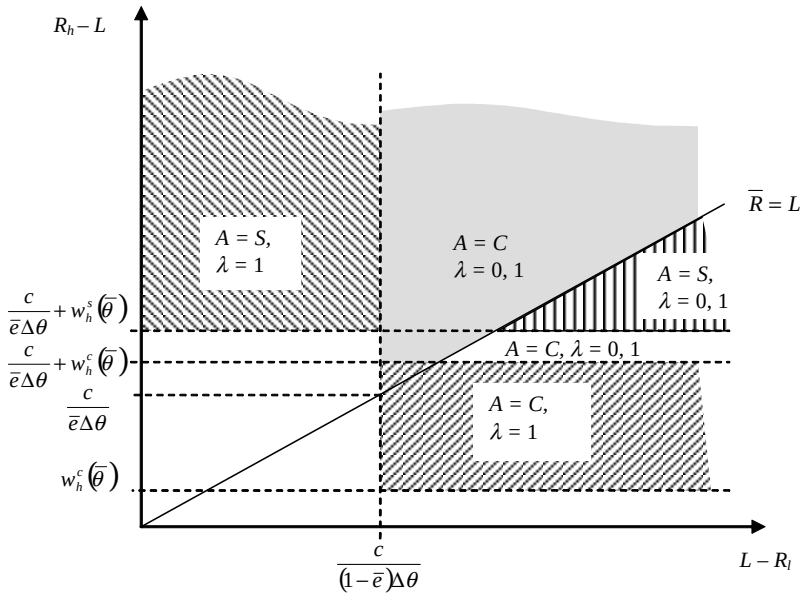

Figure 2: Shows the regions of $R_h - L$ and $L - R_l$ for which monitoring is feasible under the soft and the tough liquidation policies. To the East of $\frac{c}{(1-\overline{e})\Delta\theta}$ monitoring is feasible under the soft, and to the North of $\frac{c}{\overline{e}\Delta\theta} + w_h^s(\overline{\theta})$ under the tough liquidation policy. When monitoring is feasible under both policies, the diagram proposes the policy that maximizes expected future cash flows (soft above the diagonal line $\overline{R} = L$ and tough below it). Moreover, the regions indicate whether a split of control from the monitor is necessary to achieve monitoring ($\lambda = 1$).

4.1 *The Tough Liquidation Policy and the Soft Budget Constraint Problem*

Part (ii) of proposition 1 above suggests that in order to induce monitoring, the tough policy needs to be implemented and it is necessary that the monitor and the controlling stakeholder are different parties. Why can these two functions not both be performed by a single investor? The tension between monitoring and control becomes apparent once one realizes that the interim efficient liquidation policy in region (ii) is the soft policy, i.e., precisely the policy under which monitoring is not incentive compatible. We can state:

Corollary 1 *Suppose parameters are in region (ii) and the monitor's contract satisfies the incentive compatibility constraint (17). If the monitor also had control rights he would always continue the firm at the interim date following $s = \varnothing$, i.e., he would implement the soft liquidation policy. Anticipating this he would not monitor. In consequence, if the firm owner wants to ensure that monitoring is undertaken, he will have to make sure that the tough policy, which is ex post value-destroying, is adopted.*

This follows directly from the condition of when the soft policy is value enhancing: $\overline{R} \geq L$,which can be rewritten as $\overline{e}\,(R_h - L) \geq (1 - \overline{e})\,(L - R_l)$ and always holds in region (ii). This is illustrated in Figure 2. Points above (below) the diagonal line $\overline{R} = L$ indicate that

continuation in the absence of information is value enhancing (destroying). When we are to the left of the vertical line $\frac{c}{(1-\overline{e})\Delta\theta}$, but above $\overline{R} = L$ an interim inefficient tough liquidation policy is necessary in order to motivate monitoring.

To gain intuition for this result, consider the case where the original investor remains the only claim holder in the firm. Suppose further that he finds it optimal to continue the firm in the absence of information. For reasons that will become obvious in the following, we will refer to this as the 'soft budget constraint' case, and it occurs when

$$\overline{e}(R_h - w_h^c(\overline{\theta})) + (1 - \overline{e})R_l > L. \tag{SBC}$$

The investor's incentives to monitor in this situation are given by (16) with $m_L = L$ and $m_l = R_l$:

$$(1 - \overline{e})(L - R_l) \geq \frac{c}{\Delta\theta}. \tag{19}$$

When all claims on the firm are held by a single party, that party's incentives to monitor come from the fact that with better information, the loss of value $(1 - \overline{e})(L - R_l)$ from mistaken continuation can be avoided more often. This observation can be contrasted with monitoring incentives when the tough policy is followed (e.g., equation (17)), where incentives come instead from ensuring continuation when $s = h$. The monitoring incentive compatibility constraint of a single claimant if the tough policy were followed would then be given by:

$$\overline{e}(R_h - w_h^c(\overline{\theta}) - L) \geq \frac{c}{\Delta\theta}. \tag{20}$$

Comparing the two expressions, we can see that if the "downside" from continuing, $(1-\overline{e})(L-R_l)$ is relatively limited compared to the "upside" $\overline{e}(R_h-w_h^c(\overline{\theta})-L)$, then the investor has less incentive to monitor under the soft continuation policy than under the tough continuation policy, so that it may be optimal to monitor under the latter but not the former. But unfortunately, though a single claimholder might like to threaten the manager with a larger monitoring effort to reduce wages, he cannot commit to following the tough policy since he has control of the continuation decision and, under the assumption of a soft budget constraint, prefers ex post to follow the soft policy. Intuitively, this is why splitting monitoring from control can be helpful. The starkness of the dilemma is revealed by rearranging (SBC) to show that it is equivalent to $\overline{e}(R_h - L - w_h^c(\overline{\theta})) > (1 - \overline{e})(L - R_l)$, i.e., the LHS of 19 $<$ the LHS of 20. In other words, *the investor would have more incentive to monitor the firm under the tough policy precisely when the soft policy is ex post optimal.* It can therefore be the case that the soft liquidation policy does not provide sufficient monitoring incentives precisely when it constitutes the interim efficient liquidation policy. Therefore, putting control in the hands of a different party who does not monitor but does implement an interim inefficient liquidation policy may improve monitoring incentives, since these can then come from the relatively large upside of the project.

4.2 *Implementation of the Tough Policy Using Capital Structure*

We next explore how the separation of ownership and control just outlined can be implemented using capital structure.

Lemma 3 *When* $R_l + \frac{c}{(1-\overline{e})\Delta\theta} \geq L > R_l + b$, *the regime* $\left\{A(\varnothing) = S, \overline{\theta}, \overline{e}\right\}$ *can be implemented by splitting the firm's capital structure into debt and equity, where debt has face value* $D = L + d$, $0 \leq d \leq \min\left\{\frac{1-\overline{e}}{\overline{e}}\left(L - R_l\right), R_h - w_h^S(\overline{\theta}) - L - \frac{c}{\overline{e}\Delta\theta}\right\}$. *Moreover, control rights are assigned to the debt-holder and monitoring is carried out by the equity-holder.*

From proposition 1 we know that the only way in which monitoring can be implemented for $R_l + \frac{c}{(1-\overline{e})\Delta\theta} \geq L$ is by splitting the capital structure into two claims, with one claim-holder performing the monitoring, and the other having control over the liquidation decision. When the goal is to implement a tough liquidation policy, an optimal capital structure is to give control to the holder of a debt-like claim (the 'bad cop'), which implements a tough liquidation policy even though continuation might be efficient - because this claim-holder does not benefit from the upside of continuation. On the other hand, the holder of an equity-like claim (the 'good cop') carries out monitoring. This separation generates an externality between claim-holders at the interim date whereby the creditor, who has control, shuts down the firm in a state of the world ($s = \varnothing$) in which the equity-holder would have preferred continuation. However, this potentially interim inefficient shut-down decision is necessary in order to provide the equity-holder with sufficient incentives ex ante to produce information about the firm's prospects.

4.3 *Soft liquidation and monitoring incentives*

We now consider the region identified by proposition 1, in which it is feasible to induce monitoring only under the *soft* liquidation policy: region (iiib) where $L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$ and $w_h^C(\overline{\theta}) < R_h - L < \frac{c}{\overline{e}\Delta\theta} + w_h^C(\overline{\theta})$. Referring back to figure 2 and the proposition, it is necessary to split control from the monitoring function in this region. In other words, in direct contrast to the soft budget constraint problem outlined in the previous section, here we have a project that is not worth continuing in the absence of information: the soft liquidation policy destroys value and it would be better to follow the tough liquidation policy.

Corollary 2 *Suppose parameters are in region (iiib) and the monitor's contract satisfies the incentive compatibility constraint (16). If the monitor also had control rights he would always stop the firm at the interim date following* $s = \varnothing$, *i.e., he would implement the tough liquidation policy. Anticipating this he would not monitor. In consequence, if the firm owner wants to ensure that monitoring is undertaken, he will have to make sure that the soft policy, which is ex post value-destroying, is adopted.*

Intuitively, the problem is now the reverse of that outlined in section 4.1. If a single claim-holder were to be entitled to all the returns on the firm, he would want to liquidate in the absence of information, precisely because the expected upside gain is, by hypothesis, relatively small compared to the downside loss. But this implies that the payoffs available to provide monitoring incentives under the efficient tough liquidation policy are limited, because the benefit of monitoring under the tough policy is that sometimes one acquires the high signal, leading to the upside of continuation rather than liquidation. By contrast, if the value destroying soft policy were used, incentives to monitor come from avoiding the downside which, since continuation destroys value, must be relatively large. So, once again, *it may be necessary to use the soft liquidation policy to induce monitoring precisely when*

that policy destroys value. This is what the lower right rectangle in figure 2 illustrates.

If, in this region of the parameter space, all claims on the firm were held by a single investor, he could not commit to a soft continuation policy, and hence cannot implement a high monitoring effort. However, monitoring can be achieved by allocating control to a party that is soft in liquidation, i.e., a junior claimant, and to get a senior claimant to monitor. The threat of inefficient continuation now forces the senior claimant to find negative information to persuade the controlling party to liquidate the firm. In this case the claims that ensure monitoring and the appropriate liquidation incentives are given in the following lemma.

Lemma 4 *In region (iiib), $\overline{\theta}$ is feasible only if claims (capital structure) are split into a junior claim with control rights, such as common equity, and a risky senior claim, for example debt or preferred shares, with face value L.*

Compared to the case in section 4.2 where the liquidation policy had to be excessively tough to induce monitoring there is still a gain to splitting firm returns into debt (or another senior claim) and equity (or another junior claim with control rights, such as preferred stock or convertible debt with control rights attached). Again, the purpose is to generate an ex post externality between claims that will both result in an inefficient liquidation policy, and, as a consequence, motivate greater monitoring effort. Relative to the previous case, however, the monitoring and control functions are now switched. The capital structure which now achieves monitoring requires control to be placed in the hands of the residual, junior claim, for example common equity. This claim benefits from the upside, but is worthless in liquidation and therefore ensures that the liquidation decision is soft. Monitoring is best carried out by a senior claim that stands to lose $L - R_l$ in the bad state, but has limited upside potential. This could be for example risky debt, or preferred shares that have a claim on the firm in liquidation. Interestingly, the equity-holder can still be thought of as the "good cop", because he implements a soft liquidation policy, which is congruent with the manager's interests. The debt-holder on the other hand is a "bad cop" in the sense that he incurs a high effort level trying to uncover negative information about the manager's performance, which is obviously not in the manager's interest.

5. Optimal Choice of Monitoring Level and Liquidation Policy

In the previous section we highlighted two situations where in order to induce monitoring, it was necessary to employ a liquidation policy that destroyed value at the interim date. Monitoring then carries an indirect cost of destroying value, in addition to the direct monitoring cost c. This result naturally prompts the question whether it is actually worthwhile to induce monitoring? Hence, in this section, we turn to a complete characterization of when it is optimal to choose a particular liquidation policy and allocation of control in order to achieve monitoring. Note that we have already ruled out by assumption that any regime with low effort is desirable. We can therefore restrict attention to four regimes: two high monitoring regimes $\{A(\varnothing) = S, \overline{\theta}, \overline{e}\}, \{A(\varnothing) = C, \overline{\theta}, \overline{e}\}$, and two regimes without monitoring $\{A(\varnothing) = S, \underline{\theta}, \overline{e}\}, \{A(\varnothing) = C, \underline{\theta}, \overline{e}\}$. The following proposition sets out the parameter values for each regime, using the parameter regions defined in proposition 1.

Proposition 2 *(a) In region (i) the equilibrium level of monitoring is $\overline{\theta}$. In region (iv) the equilibrium level of monitoring is $\underline{\theta}$ (provided the project has positive NPV). In both regions the liquidation policy is the soft policy if and only if*

$$\overline{R} \geq L. \tag{21}$$

(b) In region (ii) ($\overline{\theta}$ is feasible only under the tough policy), the equilibrium level of monitoring is $\overline{\theta}$ and the liquidation policy is tough $\{A(\varnothing) = S, \overline{\theta}, \overline{e}\}$ if and only if

$$\overline{e}\left(w_h^C\left(\underline{\theta}\right) - \overline{\theta} w_h^S\left(\overline{\theta}\right)\right) + \left(1-\overline{e}\right)\Delta\theta\left(L - R_l\right) \geq c + \left(1-\overline{\theta}\right)\left(\overline{R} - L\right), \tag{22}$$

and

$$\overline{e}\overline{\theta}\left(R_h - w_h^S\left(\overline{\theta}\right) - L\right) \geq I - L + c. \tag{23}$$

(c) In region (iii) ($\overline{\theta}$ is feasible only under the soft policy), the equilibrium level of monitoring is $\overline{\theta}$ and the liquidation policy is soft $\{A(\varnothing) = C, \overline{\theta}, \overline{e}\}$ if and only if

$$\overline{e}\left(\underline{\theta} w_h^S\left(\underline{\theta}\right) - w_h^C\left(\overline{\theta}\right)\right) + \overline{e}\Delta\theta\left(R_h - L\right) \geq c + \left(1-\overline{\theta}\right)\left(L - \overline{R}\right), \tag{24}$$

and

$$\overline{e}\left(R_h - w_h^C\left(\overline{\theta}\right) - L\right) - \left(1-\overline{e}\right)\left(1-\overline{\theta}\right)\left(L - R_l\right) \geq I - L + c. \tag{25}$$

The different optimal policies in different parts of the parameter space set out in proposition 2 are illustrated in figure 3 for a specific numerical example, which takes figure 2 and adds the constraints from proposition 2.[9] The first part of the proposition makes the obvious point that when monitoring is incentive compatible under either (or neither) liquidation policy, the only determinant for optimality is whether continuation in the absence of information destroys or increases value. Thus in the top right quadrant of figure 3, monitoring is optimal ($\theta = \overline{\theta}$) and the continuation policy is the one that maximises future cash flows: $A = S$ below the line $\overline{R} = L$, and $A = C$ above it.

The interesting regions from our point of view are those where the upside from continuation is large relative to the downside or vice versa, that is, the top left quadrant and the bottom right quadrant, since in these regions it may be optimal to follow a value reducing continuation policy in order to induce monitoring, and hence to split financial claims and monitoring and control. The figure and the proposition indicate that this is indeed the optimal policy as long as making the "wrong" liquidation decision is not too costly, that is, as long as we are not too far from the thick $\overline{R} = L$ line. Thus, for example, it is optimal to follow the tough continuation policy in the dark upper left-hand region of figure 3, even though this policy is inefficient, because it makes monitoring incentive compatible and hence reduces wage payments to the manager. However, eventually, as this liquidation policy becomes more inefficient (i.e., moving towards the top left in the diagram), it is preferable to give up on inducing monitoring and induce managerial effort through greater wage payments, because liquidating the firm in the absence of information is too costly. Note that equation (23) in part (b) of the proposition guarantees that the firm has positive NPV under the tough policy with monitoring.

[9] We ignore non-binding constraints in Figure 3 so as to make the picture more accessible. See the figure legend for the chosen parameter values.

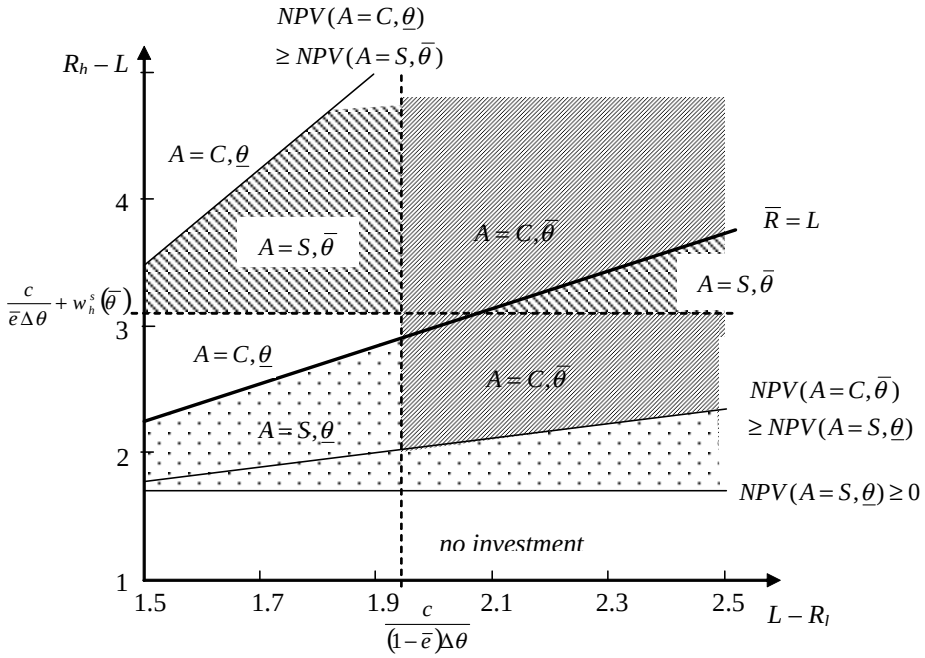

Figure 3: Depicts the optimal liquidation and monitoring policies as a function of $L - R_l$ and $R_h - L$. The model parameters are: $\overline{e} = 0.4, \underline{e} = 0.03, \overline{\theta} = 0.8, \underline{\theta} = 0.5, c = 0.35$, $\gamma = 0.5, b = 1.5, I = 2.6$ and $L = 2.5$.

It can also be the case that the soft liquidation policy is optimal when being tough enhances value. Condition (24) characterizes the set of parameters under which this is the case. The cost and benefits of using this policy in order to improve monitoring incentives are analogous to the previous case. There is again the direct cost of monitoring, and the (potential) cost of implementing an interim continuation decision that destroys value (in region (iii) we have $\overline{R} < L$). In that case liquidating the firm in the absence of information is optimal at the interim date, but it is necessary to continue in order to render monitoring incentive compatible. The benefit of monitoring is, just like before, a reduction in wage payments and an improvement in the quality of the liquidation decision. It is optimal to induce monitoring by employing the soft policy as long as this does not destroy too much value: that is, close to the $\overline{R} = L$ line; but as we get too far below and to the right of this line ($L - R_l$ increases and $R_h - L$ drops), continuing in the uninformed state is more costly than simply paying the manager a higher wage to induce effort. Eventually, as these parameters drop further, financing the firm is no longer a positive NPV project. The lowest horizontal line in figure 3 shows the boundary for positive NPV projects with the tough policy and no monitoring - no investment is optimal below this line. The boundary of the region we are interested in, where implementing the soft policy and monitoring is optimal and requires a split in control, is marked by the upward sloping line above it, which guarantees that the soft policy with monitoring generates more value than the tough policy without monitoring. Similarly, for optimality we also require a positive project NPV under the soft policy, which is captured in (25).

In the above treatment we restricted attention to *pure* liquidation strategies. Allowing for mixed strategies, however, would strengthen our main results. Note that a mixed liquidation strategy could generally improve upon the pure strategy solution. This is because the monitor's incentive compatibility constraint could be satisfied in regions (ii) and (iiib) even though the value-destroying liquidation decision was adopted with probability less than 1. It is then optimal to choose the lowest probability of value-destroying liquidation that maintains monitoring incentive compatibility. The amount of information generated by the monitor would then remain constant, but less value would (in expectation) be destroyed. Note, however, that implementing the mixed liquidation strategy will still require a separation of the monitoring function from control. The controlling stakeholder is only willing to implement a mixed strategy if he is indifferent between liquidating and continuing the firm. But precisely because he is indifferent he has no incentive to produce information. To put it differently, the monitor must have a cash flow sensitive claim in order to have an incentive to monitor, but as a result of this sensitivity to liquidation policy he cannot implement a mixed liquidation strategy. Allowing for mixed strategies thus would enlarge the parameter set for which a separation of monitoring from control is optimal and hence strengthen our results. We do not pursue this extension here as it would considerably complicate the analysis without changing the overall message of the paper: that financial claims must be split in firms where it is difficult, yet desirable, to induce claim-holder monitoring.

6. Renegotiation

In section 4 it was shown that an inefficient liquidation policy is sometimes necessary in order to render the costly monitoring activity incentive compatible. This raises the question of whether our results are robust to allowing for the renegotiation of the continuation decision. It turns out that our main results are robust to allowing for renegotiation between claim-holders, as long as the stakeholder with control rights has some bargaining power at the renegotiation stage. The reasons for this are essentially the same as in Dewatripont and Tirole (1994). To provide some intuition for why this is so, we consider a special case of our model which closely follows their set-up. We discuss renegotiation more generally in the Appendix.

Consider the special case of section 4.1 whereby the interim efficient liquidation policy is soft, but the tough policy is required for monitoring incentive compatibility. (The argument for the converse case of section 4.3 follows similarly.) In this case the potentially relevant parties in renegotiation are a debt holder with a claim $D = L + d$, an equity holder (the monitor), (potentially) further non-monitoring equity-holders, and the manager. The simplest case to consider is the one where the monitor is the residual claimant on the entire surplus from continuation: that is, there are no other outside equity-holders and parameters are such that $w_h^s(\theta) = 0$; i.e., the monitoring technology is sufficiently good that the loss of private benefits if the manager does not exert high effort is sufficient to motivate him.[10]

Let us now investigate what happens when the debt and the equity-holder are allowed to renegotiate. We model the renegotiation game as follows. After the equity-holder exerts effort and generates (or fails to generate) his signal at $t = 1$, with probability α, he will have

[10] As will become clear below, setting $m_h = R_h - D$ maximises the monitor's incentives to collect information under these circumstances.

an opportunity to make a take-it-or-leave-it offer to the debt-holder to buy out his debt. With complementary probability $1-\alpha$, the debt-holder makes a take-it-or-leave-it offer to sell his debt to the equity-holder. We assume that in case of indifference an offer is accepted. Finally, whoever is holding the debt after this round of bargaining chooses an action C or S, returns are realized, and all parties receive the payoffs associated with their claims. We assume that if at this stage the debt-holder is indifferent to continuation, she chooses action C.

Suppose the signal $s = h$ is received at $t = 1$. Note firstly that with $d \geq 0$, the debt-holder prefers to continue the firm.[11] Anticipating that the debt-holder will choose action C, the equity-holder has no incentive to buy out the debt. If he can make an offer he will therefore offer 0 and the offer will be rejected (alternatively he could offer the fair value $L+d$ and the debt-holder would accept, but this makes no difference to the equity-holder's overall surplus). If the debt-holder has the opportunity to make an offer, and offers above $L + d$ the equity-holder will reject, because, as we just observed, any 'threat' to stop the firm is not credible. Any offer below $L + d$ would be accepted, but the debt-holder would incur a loss and therefore will not make such an offer. Hence, he is indifferent between making an offer that will be rejected, or offering to sell at the fair value $L + d$. In any case the firm will be continued and the surplus remains unchanged by the possibility of renegotiation when $s = h$.

Suppose the signal $s = l$ obtains at $t = 1$. Similar to the case above, there is again agreement between the debt and the equity-holder over the continuation decision; in this case $A = S$. It is easy to see that by a similar argument as above renegotiation will neither change the continuation decision nor the distribution of surplus between the debt and equity-holder when $s = l$.

Suppose now that $s = \varnothing$. Since we are in the 'soft budget constraint' case, gains from renegotiation exist. Without renegotiation, the debt-holder would choose S, and so the parties will wish to bargain to reach efficiency. If the equity-holder makes an offer, he will offer the debt-holder the value of the debt in the absence of renegotiation, i.e. L, and the debt-holder will accept. The equity holder's payoff is then $\overline{e}R_h + (1-\overline{e})R_l - L$. If the debt-holder makes an offer he will offer the debt at the highest price that will still be accepted by the equity holder. This is $\overline{e}R_h + (1-\overline{e})R_l$, resulting in a zero payoff to the equity-holder.

Thus the equity-holder now has an incentive to monitor if:

$$\begin{aligned} &\overline{e}\overline{\theta}\left(R_h - D\right) + (1-\overline{\theta})\alpha\left[\overline{e}\left(R_h - L\right) + (1-\overline{e})(R_l - L)\right] - c \\ &\geq \overline{e}\underline{\theta}\left(R_h - D\right) + (1-\underline{\theta})\alpha\left[\overline{e}\left(R_h - L\right) + (1-\overline{e})(R_l - L)\right], \end{aligned} \tag{26}$$

which can be simplified to yield:

$$\overline{e}[(1-\alpha)\left(R_h - L\right) + (L - D)] + \alpha(1-\overline{e})(L - R_l) \geq \frac{c}{\Delta\theta} \tag{27}$$

Clearly, while the size of the debt claim was not pinned down uniquely before (see lemma 3), with renegotiation it makes sense to set $D = L$ (i.e., let $d = 0$). By comparison with equation

[11] If $d = 0$ the debt-holder is indifferent but continues by assumption. We can relax this assumption and achieve the same outcomes by setting an arbitrarily small $d > 0$. This gives the debt-holder a strict incentive to continue.

(19), this will represent strictly (weakly) more monitoring than the aggregate claim whenever $\alpha < (\leqslant)1$. Thus our result that splitting claims improves incentives to collect information is robust to renegotiation between claim-holders as long as the equity-holder does not have full bargaining power at $t = 1$. Intuitively, if the equity-holder has full bargaining power at $t = 1$, he internalizes all the benefits of his monitoring and thus acts exactly like the aggregate claimant, nullifying the benefits of splitting financial claims.

This result suggests that changes in law or security design which improve the bargaining power of creditors in renegotiation may be valuable in generating more information about the firm and thence providing greater incentives to managers. Similarly, when splitting claims the initial investor may wish to consider implementing mechanisms to limit the monitor's ex post bargaining power and enhance that of the debt-holder, and more generally to make renegotiation between the various parties more difficult. Thus issuing multiple creditor claims, so that some creditors may have an incentive to 'hold out' in bankruptcy, may in fact encourage equity-holder monitoring (by increasing the expected fraction of the surplus that creditors extract (Bolton and Scharfstein 1996)), although a formal analysis of this is outside the scope of this paper.[12] Note, by contrast, that the dispersion of equity claims will generally be undesirable in this case, because it may dilute monitoring incentives. We will return to this point when we discuss the empirical implications of our theory in section 8.

Finally, since a country's bankruptcy code significantly affects bargaining power in renegotiation, our theory may throw light on the monitoring incentives provided to claim-holders by different financial systems. In particular, under chapter 11 of US bankruptcy law, equity-holders are effectively able to stay in control of a firm even when it is in financial distress; creditors' ability to seize the company's assets and liquidate them is severely limited. There is a large literature on the pros and cons of chapter 11. Some of the main trade-offs identified in this literature to date essentially boil down to the following: while chapter 11 may mitigate ex post inefficiencies from excessive liquidation, it may be detrimental for managerial incentives ex ante, because debt cannot exercise the effective threat of liquidation envisaged by, e.g., Dewatripont and Tirole (1994). Our model suggests another problem: since creditors have little power in renegotiation, equity-holders may have a severely reduced incentive to monitor the firm's prospects, further dulling managerial incentives. Risky debt may be the only way to achieve monitoring in this situation, i.e., unlike in economies where it is easier to implement a tough liquidation policy (e.g. the UK), it may be more likely that monitoring is performed by risky debt-holders than equity-holders in the US. This is because the only way a creditor can achieve firm liquidation under soft bankruptcy procedures is if he can convince a court that the firm's prospects are so poor that liquidation is the best option. In other words, a *creditor* (who, from section 4.3 must hold risky debt) must monitor to generate the signal $s = l$ in order to be able to liquidate the firm. In contrast, when bankruptcy law allows firms to commit to employing tough liquidation procedures (such as chapter 7, which is used mostly by smaller firms in the US), we have shown that it may instead be optimal to arrange capital structure such that the firm is under threat of information unless

[12] This observation relies on the fact that creditors cannot credibly hold out for a larger return when the state is known, for the reasons laid out above. On renegotiation design more generally, see Aghion, Dewatripont and Rey (1994), and on the design of bankruptcy procedures in particular, see Aghion, Hart and Moore (1992). Eraslan (2007) undertakes a detailed analysis of the bargaining game between the various stakeholders in bankruptcy.

an *equity-holder* monitor generates the signal $s = h$.

7. Related Literature

The possibility of a trade-off between ex ante incentives and ex post inefficiency alluded to in the introduction and throughout this paper is well understood in the literature (see for example Crémer, 1995). Our paper is novel in applying this line of argument to the *monitoring incentive of a security holder*. In contrast, the existing literature (e.g., Aghion and Bolton (1992), Berglöf and v. Thadden (1994), Dewatripont and Tirole (1994), Bolton and Scharfstein (1996) and v. Thadden, Berglöf and Roland (2003)) sees the threat of inefficient closure decisions *per se* largely as a way of providing *incentives for managers*. Capital structure is then designed to affect directly the relationship between a provider of capital and the manager. A residual claim (i.e., equity) then arises in these models in order to pick up the slack in claims on cash flows, but without any apparent governance role.

To highlight the differences between our paper and this literature, we set our model up such that the manager's incentives were directly affected *only* by the monitoring effort, and by construction *not* at all by an ex post inefficient shut down policy (recall that in section 3 the continuation policy followed when the monitor is uninformed does not affect managerial incentives). In our model ex post inefficient shutdown serves only to provide stronger incentives for the monitoring claim-holder. It affects the manager only indirectly, by ensuring that the monitor will collect more information about whether or not the firm is performing well. Thus the mechanism which we focus on is different to that in the existing literature.

This structure allows us to focus on a problem ignored in the above papers: the interaction between incentives for liquidation policy and for firm monitoring to generate the information on which the liquidation decision must be based. This is not to say that we believe that direct incentive effects from inefficient, but informed, termination play no role in practice. On the contrary, we wish to highlight that for this effect to play any role it is necessary that the termination decision be informed, and in that sense our approach is strongly complementary to these papers. The tension between monitoring and liquidation incentives identified in our paper arises naturally once one allows for costly and endogenous monitoring by providers of capital.

A number of theories have considered monitoring incentives by providers of capital (e.g., Winton (1993), Rajan and Winton (1995), Park (2000)). However, in contrast to our work, these papers focus on either equity or debt contracts and explain specific contractual features such as limited liability or debt covenants as a result of monitoring incentives. These theories effectively assume that monitoring is carried out either by equity-holders (Winton (1993)) or by creditors (Rajan and Winton (1995), Koskinen (2000), Park (2000)). An exception is Laux (2001) who endogenises monitoring incentives among different claim-holders, focusing on the implications of monitoring incentives in within-firm hierarchies. By contrast we investigate how securities have to be designed in order to provide the right monitoring incentives and show that monitoring will be carried out either by equity- or by debt-holders, depending on whether the firm's continuation value is high or low compared to its liquidation value.

Moreover, our assumption that a provider of capital cannot commit to monitoring distinguishes our theory from a number of other papers on the topic (e.g., Diamond (1984),

Gale and Hellwig (1985), v.Thadden (1995), Repullo and Suarez (1998)). They assume that a monitor can implement a time-inconsistent monitoring policy. In these papers, as here, monitoring is useful ex ante to mitigate a managerial moral hazard problem, but once the manager has taken his equilibrium action, there is little point incurring the cost of monitoring. Our work provides an important foundation for this assumption, since we show how capital structure can be used to solve the time inconsistency problem associated with monitoring. Most importantly, our paper helps us to resolve the puzzle, mentioned in the introduction, as to why multiple claims are issued despite obvious negative externalities between them.

As mentioned in the introduction, a small number of papers share our goal of rationalising the issuance of multiple securities.[13] Allen and Gale (1988), Gorton and Pennacchi (1990), Boot and Thakor (1993), and Fulghieri and Lukin (2001) show that investor heterogeneity or limited arbitrage can render multiple claims optimal. These papers, however, do not address the governance role of financial contracts. Our model does not rely on investor heterogeneity or limited arbitrage, and we show that the debt and equity claims that the firm issues must be held by different investors to create the proper monitoring incentives. In this respect, our paper is most closely related to the recent work by Axelson, Strömberg and Weisbach (2005); but the investors in their paper are passive - their focus is rather on creating appropriate incentives for the manager of a buy-out fund.

There is a literature on blockholders as active monitors (e.g., Shleifer and Vishny (1986), Burkhart, Gromb and Panunzi (1997)). In these papers, monitoring is interpreted as a general value-enhancing action, but not, as here, directly modelled as information acquisition. This distinction is important, because we show that the incentives to acquire information may run counter to the incentives to act on the information in a way that maximises firm value. These theories do not consider the interaction between equity and debt and do not predict a complementarity between concentrated equity holdings and high gearing ratios (see, however, Mahrt-Smith (2005), discussed in the next section).

8. Discussion and Empirical Implications

The above analysis shows that an aggregate claim on a firm's cash flows may not always have sufficient incentives to monitor the firm's prospects. This is because interim monitoring incentives derive only from the improvement in the quality of the liquidation decision at an interim date. However, monitoring adds further value ex ante, because it mitigates the managerial moral hazard problem. In order to improve monitoring incentives it may sometimes be necessary for the firm to split returns into two (or more) financial claims: something which is commonly observed, but so far has received little explanation. We saw that the analysis splits into two cases depending on whether parameters are such that it is ex ante desirable to implement an inefficiently tough or soft continuation decision. We explore further the empirical implications of these two possibilities below.

[13] Other papers rationalise multiple claims when the entrepreneur is able to choose both the mean and the variance of returns (Cornelli and Yosha 2003, Biais and Casamatta 1999). But these moral hazard problems on which they focus could equally well be solved by issuing a convertible debt claim rather than debt plus equity (that is, there is no requirement that the debt and equity claims be held by different investors).

8.1 *Tough policy*

Our theory argues that for firms for which continuation is expected to be profitable there can be a soft budget constraint which reduces potential monitors' incentives to collect information. By contrast, when a firm increases its leverage from a low level to levels which would put creditors in control at an interim date in the absence of the arrival of good news, this will result in increased incentives for shareholders to collect information about the firm, and thence improved incentives for the firm's management. If monitors' information is subsequently reflected in firm stock prices through informed trading by the monitor, then the theory predicts that these more highly levered firms' stock prices should be relatively informative about firm performance.[14] This problem applies particularly to firms which have a lot of tangible assets (i.e., $L - R_l$ is small, assets do not lose value dramatically over time).

We are not aware of any direct tests of the proposition that a firm's leverage is directly related to the informativeness of its stock price. However, unlike previous work, in highlighting the tension between the monitoring and control functions, our paper does provide a basis for understanding the relationship between firms' capital structure and ownership structure decisions. In particular, a firm that allocates control to a (tough) creditor in order to improve the equity-holders' monitoring incentive needs to ensure that the equity stake is in the hands of agent(s) that do not face excessive free-rider problems in their monitoring decision. Hence, our theory predicts that companies with a high debt burden (and therefore effective creditor control) should have more concentrated equity ownership.

Creditors may exercise significant control over firms, even well before control rights are transferred. Stronger creditor control can be achieved by issuing short term debt at levels above short term cash flows, and sufficiently high that the firm may find it difficult to roll over or refinance the debt unless it can be demonstrated that the firm's prospects are rosy.[15] Coval et.al. (2002) show that in practice it can be difficult for solvent firms to roll over short term debt. Similarly, firms in financial distress are often subject to significant creditor control (see Franks and Mayer (2005)). According to our theory, it is important that such firms have concentrated equity ownership in order to ensure that sufficient information about managerial performance is generated, otherwise (in the absence of other tax issues or agency problems) the high-leverage will be counter-productive. Franks, Mayer and Renneboog (2001) provide evidence consistent with our prediction. They study firms in financial distress and find a positive relationship between equity ownership concentration and high gearing ratios. We are not aware of any empirical studies that investigate the relationship between the proportion of a firm's short-term debt and equity ownership concentration.

Interestingly, the combination of high gearing ratios with concentrated equity ownership is also exactly the pattern observed in leveraged buy-outs (LBOs); see Kaplan and Stein (1993). These firms are also very often firms which have substantial tangible assets - in fact, anecdotal evidence suggests that LBOs without significant tangible assets are much less likely to be successful. Existing theories of capital structure have been silent on why companies do not simply re-leverage in order to achieve the managerial incentive (and tax) effects of

[14] An extension of the model where monitors do indeed trade on their information in the stock market is available from the authors on request and appeared in an earlier draft of this paper.

[15] An alternative would be to issue longer term debt with covenants that are easily triggered in the short run.

high gearing ratios. Instead, a leveraging-up is often accompanied by a drastic change in ownership structure, whereby typically a publicly listed company with dispersed ownership is taken private in a highly-leveraged transaction. The end result is often equity ownership concentrated in the hands of a buy-out specialist. Denis (1994), for example, provides evidence that buyout specialists fulfill an important monitoring function that complements the increased leverage in an LBO. Similarly, Cotter and Peck (2001) argue that buyout specialists have a particular role as active monitors in the firms they acquire. Our model can help us to understand the coincidence of these phenomena.

Conversely, we would expect to see below average performance by firms that do have effective creditor control (high gearing) but retain a dispersed equity ownership structure. These firms would not generate active monitors and therefore managers have worse incentives to exert effort, and creditors will liquidate more frequently. Cotter and Peck (2001) show that buyout specialist controlled LBOs have a 15% incidence of subsequent financial distress compared with 80% for those with other outside equity holders. In the majority of the latter cases, the outside investors do not purchase a controlling interest and view their investment as passive. Hence, it appears that the benefits from equity ownership concentration are more significant in the presence of effective creditor control. This finding is consistent with our model.

These predictions distinguish our theory from other theories of debt in which equity occurs only to pick up the slack after the optimal security has been designed (e.g., Dewatripont and Tirole (1994)). In those theories the ownership structure of the remaining equity claim plays no role. An exception is Mahrt-Smith (2005) who shows that debt arises as a complementary security to equity in order to counter-balance potential opportunistic actions by the equity holders. He predicts that equity ownership concentration should be correlated with tightly-held debt, and dispersed equity with publicly-held debt. This leaves open the question why LBOs are financed significantly through public bond issues. Our model can help explain this observation, insofar as dispersed debt ownership renders debt renegotiation more costly, and therefore makes the creditor tougher, complementing strong equity monitoring.

8.2 *Soft policy*

Note that a project that is best liquidated in the absence of information would also be a negative NPV project by our assumption that $I > L$ unless information sometimes allows the project to be liquidated in the bad state. One could think of this project as a negative NPV project that turns positive once one takes into account the option to abandon it in the bad ($\omega = l$) state. The value of the option to abandon is given by $\theta(1-\overline{e})(L-R_l)$, where $\theta \in \{\underline{\theta}, \overline{\theta}\}$. From this it follows that for projects with a very high likelihood of success ($\overline{e}$ is high) the option to abandon adds little value. The types of projects for which the option to abandon is sufficiently valuable to turn around the NPV from negative to positive, must therefore have a relatively small likelihood of success and a sufficiently high payoff R_h in case of success so that the NPV is positive overall.

Start-up firms that invest in a new, high risk technology are typically thought of as having this type of payoff. The chances of success are low, but the returns to a successful start-up company are very high. In contrast to our model, these firms do not have large fixed assets which can be salvaged through liquidation, but since they typically rely on staged finance,

we can reinterpret our model in a way which is consistent with the characteristics of such firms. In particular, consider that liquidation saves the funds which would otherwise be invested in the next stage of firm finance, which can be substantial. Suppose that at the initial date, a capital provider needs to invest $I - L$ in the first stage that starts off a project. Subsequently, an entrepreneur puts effort e into the project, which affects the final project payoff just like before. After this, a monitor can produce an informative signal about the future payoff, again like in the previous treatment. However, in contrast to the previous set-up, suppose that in order to take the project forward a further investment of magnitude L is required. In that case, if the stage 2 investment is undertaken, total investment is I and an analogous condition for value enhancing stage 2 investment is $\overline{R} > L$. If the stage 2 investment is not made, total payoffs, net of the stage 1 investment are $I - L$, just as in the previous treatment, where the firm could be liquidated at the interim date, yielding an overall payoff to the providers of capital equal to $I - L$. Using this reinterpretation we can apply the intuitions from the previous model to analyse the finance of start-up companies by re-labelling the liquidation decision as a stage 2 financing decision.

Our theory can thus make predictions about the allocation of control rights, monitoring and the design of securities in the context of start-up firms. Suppose that, in line with the previous discussion, the project has a negative NPV in the absence of the option to abandon the project at stage 2. This implies that the project should be abandoned at stage 2 if no information has been produced about it. If the firm were to implement this investment strategy (stop unless you have positive information), there would be little incentive to acquire information: since the project is unlikely to have turned out well, the expected reward from identifying the high state are limited. On the other hand, if the firm applies an *overinvestment* policy in the form of going ahead with stage 2 financing unless negative information has become available, the party that has committed to providing the funds for stage 2 has a strong incentive to gather information that the state of the world is bad, $\omega = l$, so as not to have to finance stage 2 of the project. Moreover, the party that does provide stage 2 financing should do so in the form of a senior claim. The residual, junior, claim should rest with the party with control rights over continuation, so that this party has an incentive to invest in the absence of information, implementing the soft continuation policy.

How is such a division of monitoring and control structure implemented in such firms in practice? Start up firms have two main sources of finance: alliances with larger firms and venture capitalists. Guedj (2005) and Guedj and Scharfstein (2005) provide recent evidence on decisions to continue drug development in small bio-tech firms allied with large firms; and inside large pharmaceutical firms. They argue that, in contrast to drug trials inside large firms, the decision to continue development in alliances is governed by detailed contracts. They show that drug trials inside large firms are more likely to be terminated than those in alliances, and that these terminations are largely efficient (ex post value-enhancing). Why then, do alliances write such apparently inefficient contracts? Guedj and Scharfstein's findings are consistent with our theory, which suggests that, given their option like pay-off, bio-tech start-ups are good candidates for implementing the soft liquidation policy even though the tough one may be efficient. To be more specific, within-firm drug trials, although they have efficient ex post continuation, are likely to suffer from poor ex ante incentives for managers precisely because control is not split from monitoring. If the pharmaceutical company claims all the returns on the drug development project; it invests

little in monitoring since the project is unlikely to succeed and as a consequence the managers have low-powered incentives as the continuation decision is less correlated with their efforts. In alliances, however, more control rests with the entrepreneur and outside board members of the start-up firm, who have incentives to continue. In order to stop the project, the pharmaceutical company must come up with hard evidence that the project will fail. Thus it has more incentives to monitor the project and the start-up entrepreneur will have higher-powered incentives. As we have shown, under certain parameter restrictions (in particular, for the set of projects with a low probability but very high revenues from success), such an ex post inefficient split of monitoring from control can be ex ante value-enhancing. Nevertheless, since the (efficient) tough policy is used inside firms whereas the (inefficient) soft policy is used between firms, one should see that projects inside firms are terminated more frequently, and that this termination, taken in isolation, is efficient.

Venture capitalists also finance start up firms and govern the continuation decision partly by contract. Note that venture capitalists frequently hold relatively senior claims, such as preferred shares, rather than common equity. This makes them suitable candidates to perform the monitoring function if the soft continuation policy is used, but, according to our model, makes it difficult for them to commit to continuing as frequently as the soft policy requires. We contend that venture capitalists structure their arrangements with firms to help achieve such a commitment. VC financing typically takes the form of an original contract which stipulates the total amount of capital committed, and how the committed capital is to be distributed over the investment stages. But the commitment that is embodied in such a business plan is limited because of the large number of unforeseen contingencies that may arise and in practice the allocation of control is very important (Kaplan and Strömberg (2003)).[16] Thus the allocation of control in the financed firms becomes very important. In a majority of cases studied by Kaplan and Strömberg (75%), VCs *do not* have board control (and even less so in early financing rounds), the balance of power being held by independents who have been jointly agreed by the venture capitalists and the entrepreneur. If these independent board members are inclined to follow a soft policy (e.g., their compensation is junior to that of the venture capitalist) unless the venture capitalist can convince them that this will lead to a very bad outcome, a picture emerges that looks very much like the one described in our model.[17] In particular our model can help explain why VC contracts with start-up firms are written so as to provide a certain degree of commitment to future investment. According to our theory this may be necessary in order to provide VCs with the incentive to produce information that allows them to abandon the project in the bad state. Without this commitment, VCs might be tempted to abandon projects too easily, which undermines their incentive to produce information about their future prospects.[18]

[16] Stage financing is often contractually contingent on a variety of performance measures or other targets (for example technological specifications of the product). We are, however, concerned with the contingencies that cannot be contracted upon ex ante.

[17] An alternative mechanism would be for the incumbent VC to commit to the provision of continuation finance if a new lead investor with a senior claim can be convinced to provide part of the financing at the interim date. Because of the claim's seniority, the lead investor would always be willing to participate, unless the incumbent VC generates negative information $s = l$.

[18] In practice, the reputation of the VC, and the convention that an incumbent VC will typically agree to join a subsequent round if a new 'lead' VC can be found, are also important.

9. Conclusions

In this paper we have investigated the question of why firms may choose to issue different types of securities to different claim-holders, creating potential conflicts of interest among them. The fundamental idea underlying our analysis is that creating externalities which are costly ex post can nevertheless be beneficial for ex ante incentives. We studied the particular case where a firm faces an important continuation decision at an interim date; and we have shown that it can be beneficial to split the firm's cash flows into payments to one agent who controls the continuation decision and another who attempts to provide information that will be relevant to that decision. We have identified situations where dividing these two functions results in more information gathering than would selling a uniform type of claim to a single claim-holder. Unless firms can issue securities that are negatively correlated with firm value (which seems to be very rare in practice), this is not obvious a priori for the following reason. Incentives to produce information generally depend on the sensitivity of returns to profits, and budget-balance dictates that the maximum sensitivity of returns to profits is given by the aggregate claim. Our paper shows that incentives can be improved by dividing up claims in such a way that gives one claim-holder a (credible) incentive to *destroy* value in the absence of information by choosing an inefficient action.

Our analysis is particularly relevant to firms which are relatively opaque, so that the costly collection of information about firm prospects is likely to be particularly valuable. We identify two different sets of circumstances in which splitting claims improves firm value. In the first, "soft budget constraint" case, continuation is expected to be profitable provided that the manager has worked. The issue that arises in such firms is that, given that the manager has worked, there is little reason to spend resources collecting information before deciding to continue - so the manager may be tempted not to work as information that he has performed badly is unlikely to be gathered at the interim date. In such firms it is useful to divide up claims into a (safe) debt claim with control rights and a (risky) equity claim to increase monitoring effort. The creditor's liquidation decision will be tougher than would be interim efficient, but this is precisely the reason why the equity holder's monitoring incentive is improved: only by generating good news will he be able to prevent liquidation. We believe that this analysis is relevant to mature firms with relatively strong cash flows: levering up such firms may improve incentives for information-gathering and hence managerial incentives.

The other set of firms to which our analysis is relevant are those at the other end of the spectrum, where it is considered to be unlikely that continuation has positive expected value, but ex ante investment is nevertheless worthwhile, once one accounts for the value of the option to abandon. This category includes start-up firms. There is mounting evidence that start ups are often continued inefficiently (Guedj 2005, Guedj and Scharfstein 2005). This is because venture capitalists or alliance partners have made implicit or explicit commitments to fund the firm unless prospects are very poor. One interpretation of this evidence is that such excessive continuation of negative NPV projects provides incentives to managers; we have shown that one way in which it does this is that it provides strong incentives for senior claimants such as VCs to monitor the firm's prospects in order to improve the correlation between the closure decision and the lack of managerial effort.

The mechanism at work in our model allows us to highlight a fundamental trade-off which is probably of wider importance than the simple application given here. The difficulty

with motivating monitors, as opposed to other agents, is that it is often the case that if all other decisions are taken optimally and agents act according to plan, then there is typically little benefit to monitoring, and hence, unless there is a budget breaker willing to subsidise this activity, little reason to monitor. If it is possible, however, to delegate the information contingent action to a third party with incentives to take an inefficient action, then monitoring incentives can be improved. Thus *there is a natural division of labor between those who collect information and those who act on it*, and the sum of the parts may be greater than the whole. Non-financial examples might include the desirability of separating the function of teaching from that of examining students; the separation of judging criminals (the judiciary) from that of apprehending them (the police); the separation of lobby groups who collect information from politicians who act upon it.

Appendix A

Renegotiation with other parties at the bargaining table and managerial incentive pay In the analysis of section 6 we made two assumptions to simplify the argument. The first of these was that the manager did not earn an incentive wage and the second, related, assumption, was that only the controlling party and the monitor were involved in the renegotiation. It should be clear that the same kind of argument can be made without these assumptions, but one would need to make assumptions about how the gains from renegotiation are to be divided and which of the various parties which benefit from renegotiation are present at the bargaining table. If the monitor is not the only party to receive a monetary benefit from continuation (for example, there are other outside equity-holders and/or the manager earns an incentive wage), and yet only the monitor is involved in the renegotiation with the controlling party, then efficient renegotiation becomes more difficult. In particular, even though continuation is efficient, the monitor himself may not gain enough surplus from continuation to compensate the controlling party for his loss from continuation, since some of the surplus from continuation will go to the manager (in the form of a bonus wage) and to any other equity-holders. Specifically, the monitor gains $\overline{e}m_h$ from continuation, where m_h is at least $\frac{c}{\overline{e}\Delta\theta}$ and so the surplus available for continuation is $\overline{e}(\frac{c}{\Delta\theta}+d)-(1-\overline{e})(L-R_l)$, which, if d is small, can be negative even though the total surplus from continuation $\overline{e}(R_h)-(1-\overline{e})(L-R_l)$ is positive. The difficulty is that other parties who gain from continuation (e.g. the manager and any other equity-holders) may not be present at the bargaining table to make concessions. Thus having dispersed equity-holders could, for example, make renegotiation more difficult, and thus provide better incentives for a monitoring blockholder.

The case where the manager earns an incentive wage and is present at the renegotiation table with the monitor and the controller is more complex, because if the manager anticipates making wage concessions in the event of a lack of information, this will affect his incentives ex ante. In fact, for the reasons indicated above, if possible, it will be optimal to design the renegotiation such that the manager is not able to make concessions on his wage, as the fact that he is unable to control the information flow means that making his wage contingent on it will simply serve to blunt his incentives; whereas maximizing the concessions which must come from the monitor improves the latter's incentives.[19] It is straightforward to see that

[19]This provides an interesting argument for why managers' bonuses should not be renegotiated when a firm is in financial distress.

one could set out the ex ante incentive constraints for the monitor and the manager when both anticipate being present at the bargaining table ex post and show again that splitting claims will improve information collection as long as the monitor is forced to make a large enough concession to the controller.

Inside monitoring In this section we consider the case where the manager can also be the monitor. The optimal wage contracts are then given as follows.

Proposition 3 *Suppose the manager is also the monitor and the liquidation policy is* $A(\varnothing) = C$*. The wage contract that results in the lowest expected payment to the manager and that induces* $\overline{e}$ *and* $\overline{\theta}$ *satisfies*

$$w_h^{C,m} = \frac{\gamma}{\Delta e} + \overline{\theta}\frac{c}{(1-\overline{e})\,\Delta\theta}, \tag{28}$$

$$w_L^{C,m} = b + \frac{c}{(1-\overline{e})\,\Delta\theta}, \tag{29}$$

$$w_l^{C,m} = 0. \tag{30}$$

When the manager is the monitor and the liquidation policy is $A(\varnothing) = S$ *the wage contract that results in the lowest expected payment to the manager and that induces* $\overline{e}$ *and* $\overline{\theta}$ *satisfies*

$$w_h^{S,m} = \max\{\frac{\gamma}{\overline{\theta}\Delta e} - b, \frac{c}{\overline{e}\Delta\theta} - b, \frac{\gamma + c}{\overline{\theta}\Delta e + \underline{e}\Delta\theta} - b, 0\}, \tag{31}$$

$$w_L^{S,m} = w_l^S(\theta) = 0.$$

A simple comparison between (28), (29) and (14) shows that the wage contract under the soft liquidation policy is more expensive when the manager is also the monitor compared to when an outsider performs the monitoring function. Firstly, if the manager is the monitor he needs to be given a positive payment when the firm is liquidated ($w_L > 0$), compared to a zero wage when an outsider monitors. This is because monitoring incentives under the soft continuation policy are provided by the difference in payoff when the firm is worth L compared to R_l. Rewarding the manager, however, when the firm is liquidated, reduces his incentive to exert effort ex ante. In order to restore effort incentives, the manager's payoff in state R_h must increase even further. This increases the agency rent to the manager. Further, unlike the other investors, the manager does not have cash to compensate the initial owner for this increase in agency rent ex ante. It is therefore never optimal to make the manager also the monitor when a soft liquidation policy is applied. In other words, when the default is that the firm will continue in the absence of bad news, it is never appropriate to try to design a compensation scheme to induce the manager to collect such bad news. It is always cheaper to have outsiders monitor the firm and suggest that it should be liquidated.

The potential advantage from allocating the monitoring function to the manager becomes apparent under the tough liquidation policy. It derives from the fact that the manager is motivated by his private benefits to produce positive information about the future state of the world. When private benefits are high, the manager may be willing to incur the monitoring cost with little or no additional monetary reward. This makes it cheaper to get the manager to act as monitor than to delegate the task to an outsider. On the other hand,

the manager's incentive compatibility constraint is complicated by the fact that he can now deviate simultaneously to low effort *and* to no monitoring. If this incentive compatibility constraint is harder to satisfy than the original incentive compatibility constraint, then the wage payment necessary to induce the manager-monitor to exert effort and to monitor may be so high as to render it more desirable to allocate the monitoring task to an outsider.

Proposition 4 *When* $\frac{\gamma}{\underline{\theta}\Delta e} < \frac{c}{\bar{e}\Delta\theta}$ *it is never optimal to rely on the manager to act as monitor.*

When the effort incentive problem is relatively easy to resolve compared to the monitoring incentive problem under the tough liquidation policy ($\frac{\gamma}{\Delta e}$ is small compared to $\frac{c}{\bar{e}\Delta\theta}$) then it is cheaper to allocate the monitoring function to an outsider rather than to the manager. This is effectively because the manager can extract an agency rent, while the outside monitor cannot. This is because the outside monitor has to pay in order to acquire the stake that then provides him with the incentives to monitor. Hence, the agency rent extracted by the monitor is priced into the contract ex ante. This is not the case for the manager, because his limited wealth renders bidding for employment impossible.

The importance of this proposition lies in the fact that it shows a positive role for *outside* equity,[20] and hence confirms that under some circumstances the firm must issue multiple outside claims. Under the tough policy, outside equity collects information in a more cost effective way than inside equity. Under the soft policy, outside equity may also act as monitor if the upside from continuation is sufficiently large (the upper right quadrant of figure 3); otherwise the monitoring function should be allocated to a more senior claimant whilst outside equity is charged with making the continuation decision.

The proposition also provides an interesting slant on the leveraged buyout and venture capital examples discussed above. The highly successful LBOs and MBOs of the 1980s were mostly undertaken on highly profitable firms. Our model suggests that levering up the firm can be helpful in terms of improving managerial incentives under these circumstances; and that under these circumstances it is possible that either the manager or and outside shareholder can act as the monitor, providing positive information to the banks who would otherwise foreclose the debt. It also helps us to understand why the more recent trend of undertaking MBOs and LBOs on firms which were unprofitable has been less successful, since our theory suggests that in these firms it may be more appropriate to employ a soft policy, with (concentrated) debt holders - not managers or equity holders - acting as monitors. Similarly, notice that it is initially not obvious why investors' stakes in start-up firms are typically so concentrated since the entrepreneurs running these firms have such high-powered incentives that it is not clear that moral hazard or adverse selection is a real issue. Our theory helps us to understand this since we have shown that in firms that are unprofitable apart

[20] The fact that nearly all firms issue outside equity is not well explained by most traditional theories of capital structure. They would predict that for incentive, selection and tax reasons, firms should rather issue debt-like claims to outsiders and with insiders retaining the equity. What is the function of outside equity? If outside equity is present only as a passive provider of funds (the last resort in the pecking order), why is so much attention lavished on firms' leverage ratios (and why is low leverage seen as desirable, whereas the pecking order would suggest that firms should rather issue a lot of debt)? In our theory, when the manager is not the monitor, the balance of outside equity and debt matters because these two claims must work in tandem to make appropriate monitoring and control decisions.

from the option to abandon, the manager (entrepreneur) cannot credibly act as a monitor. Monitoring will be carried out more effectively by an outside claimant holding a senior claim such as a venture capitalist.

Appendix B

Proof of Lemma 1 The manager's incentive compatibility constraint (7) under the soft liquidation policy $A(\varnothing) = C$ is given by

$$\begin{aligned}&\overline{e}(w_h + b) + (1 - \overline{e})(\theta w_L + (1 - \theta)(w_l + b)) - \gamma \\ &\geq \underline{e}(w_h + b) + (1 - \underline{e})(\theta w_L + (1 - \theta)(w_l + b)).\end{aligned}$$

This can be rewritten as

$$\Delta e \left(w_h + \theta b - \theta w_L - (1 - \theta) w_l\right) \geq \gamma.$$

Expected incentive compatible wage payments are minimized by setting $w_L = w_l = 0$. Solving the binding incentive compatibility constraint for w_h yields (14).

Under the tough liquidation policy $A(\varnothing) = S$, the incentive compatibility constraint becomes

$$\begin{aligned}&\overline{e}\theta(w_h + b) + (1 - \overline{e}\theta) w_L - \gamma \\ &\geq \underline{e}\theta(w_h + b) + (1 - \underline{e}\theta) w_L.\end{aligned}$$

Or

$$\Delta e \theta \left(w_h + b - w_L\right) \geq \gamma.$$

Again, setting $w_L = w_l = 0$ minimizes expected wage payments and yields w_h given in (15).

Proof of Lemma 2 Under the soft liquidation policy, the monitor's incentive compatibility constraint (9) can be written as

$$\begin{aligned}&e m_h + (1 - e)\left(\overline{\theta} m_L + \left(1 - \overline{\theta}\right) m_l\right) - c \\ &\geq e m_h + (1 - e)\left(\underline{\theta} m_L + (1 - \underline{\theta}) m_l\right).\end{aligned}$$

This can be rewritten as

$$(1 - e)\left(m_L^C(e) - m_l^C(e)\right) \geq \frac{c}{\Delta\theta}, \tag{32}$$

and $m_h^C(\theta) - m_L^C(\theta) \geq 0$ follows from (5).

Under the tough policy (9) is given by

$$\begin{aligned}&e\overline{\theta} m_h + \left(1 - e\overline{\theta}\right) m_L - c \\ &\geq e\underline{\theta} m_h + \left(1 - e\underline{\theta}\right) m_L\end{aligned}$$

This is the same as

$$e\left(m_h^S(e) - m_L^S(e)\right) \geq \frac{c}{\Delta\theta}. \tag{33}$$

Again, $m_L^C(\theta) - m_l^C(\theta) \geq 0$ follows from (5).

Proof of Proposition 1 Consider payments that satisfy the monitor's incentive compatibility constraints region by region.

Region (i)

Suppose the soft liquidation policy is implemented and payments to the monitor are therefore given by (16): $m_L - m_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$. Moreover, monotonicity of payments requires that $L - m_L \geq R_l - m_l$. This together with (16) implies $L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$. When the monitor and the party with control rights are different agents, the soft policy can be implement by making payments $a_h \geq 0$, $a_L = a_l = 0$, where $a_h > 0$ only if continuation destroys value. The latter point follows from our assumption that in case of indifference the interim value enhancing policy is implemented. When continuation destroys value, a strictly positive payment needs to be given to the controlling stakeholder to induce continuation. When the monitor also takes the continuation decision, the soft policy can be implemented if

$$\overline{e}\,(m_h - m_L) \geq (1-\overline{e})\,(m_L - m_l)\left(\geq \frac{c}{\Delta\theta}\right).$$

Setting $m_h - m_L$ to its maximum $R_h - w_h^C(\theta) - L$ implies that $A(\varnothing) = C$ is incentive compatible for the monitor if

$$\overline{e}\left(R_h - w_h^C(\theta) - L\right) \geq \frac{c}{\Delta\theta}.$$

Since $w_h^C(\theta) \leq w_h^S(\theta)$ monitoring can then be incentive compatible under the soft policy if the monitor is also the controlling stakeholder in region (i).

Suppose now that the tough liquidation policy is implemented. Then payments $m_h - m_L$ can be given so as to satisfy (17) if $R_h - w_h^S(\theta) - L \geq \frac{c}{\overline{e}\Delta\theta}$. If the monitor is also in control of the continuation decision he is willing to choose the tough policy if

$$(1-\overline{e})\,(m_L - m_l) \geq \overline{e}\,(m_h - m_L) \geq \frac{c}{\Delta\theta}.$$

Setting $m_L - m_l$ to its maximum value of $L - R_l$ yields that the monitor's claims can be structured such that he is willing to implement the tough policy if $L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$, which is exactly the limit of region (i). As before, if control is given to a different stakeholder than the monitor, it is trivial implement the tough liquidation policy by setting $a_h = \varepsilon$, $a_L \in [\overline{e}\varepsilon, \varepsilon]$ and $a_l = 0$, where $\varepsilon > 0$ is required if the tough policy destroys value.

Note that trivially, when parameters are on the border of region (i), there are no cash flows available in some states for distribution to a controlling party. In that case control cannot be split from the monitor if a value destroying liquidation policy is supposed to obtain.

Region (ii)

If the soft policy is implemented, monitoring can only be made incentive compatible if $L - R_l \geq \frac{c}{(1-\overline{e})\Delta\theta}$. It follows directly that in region (ii) $\overline{\theta}$ cannot be incentive compatible if the soft policy is implemented. Suppose the monitor's payments are structured such that he has an incentive to monitor and has and incentive to implement the tough policy. This requires

$$\frac{c}{\Delta\theta} \leq \overline{e}\,(m_h - m_L) \leq (1-\overline{e})\,(m_L - m_l).$$

Since the maximum of $m_L - m_l$ is just $L - R_l$, this yields a contradiction with the restriction of region (ii) that $L - R_l < \frac{c}{(1-\overline{e})\Delta\theta}$. Hence, whenever the monitor would choose $\overline{\theta}$ he would also choose to continue the firm, rather than liquidating it.

When the monitor does not have control rights, his incentive compatibility constraint can be satisfied by setting $m_L = m_l = 0$, and $m_h = \frac{c}{\overline{e}\Delta\theta}$. Moreover, the party with control rights is willing to liquidate the firm in the absence of information when $a_h = \varepsilon$, $a_L \in [\overline{e}\varepsilon, \varepsilon]$ and $a_l = 0$. If all the remaining cash goes to a residual claimant, monotonicity of his claim requires

$$R_h - w_h^S\left(\overline{\theta}\right) - \frac{c}{\overline{e}\Delta\theta} - \varepsilon \geq L - \overline{e}\varepsilon \geq R_l. \tag{34}$$

If we set $\varepsilon = 0$ the controlling stakeholder chooses $A = S$ if that action enhances value. In that case (34) is satisfied in region (ii). If $A = S$ destroys value, we need to choose a small $\varepsilon > 0$. From the strict inequalities in region (ii) it follows that there exists a small ε such that (34) holds, and therefore claims can clearly be structured so that monitoring and implementation of the tough policy are incentive compatible for two different parties.

Region (iii)

If the tough policy is implemented, monitoring can only be made incentive compatible if $R_h - L - w_h^S(\theta) \geq \frac{c}{\overline{e}\Delta\theta}$. It follows directly that in region (iii) $\overline{\theta}$ cannot be incentive compatible if the tough policy is implemented. If the monitor takes the liquidation decision, he is willing to monitor and implement the soft policy if

$$\overline{e}\left(m_h - m_L\right) \geq \left(1 - \overline{e}\right)\left(m_L - m_l\right) \geq \frac{c}{\Delta\theta}.$$

This is possible if $\overline{e}\left(R_h - w_h^C(\theta) - L\right) \geq \frac{c}{\Delta\theta}$. Hence, in the region $\frac{c}{\overline{e}\Delta\theta} + w_h^C(\theta) \leq R_h - L \leq \frac{c}{\overline{e}\Delta\theta} + w_h^S(\theta)$ the soft policy can render monitoring incentive compatible and it can be implemented by allocating control to the monitor. If $\overline{e}\left(R_h - w_h^C(\theta) - L\right) < \frac{c}{\Delta\theta}$ monitoring incentive compatibility implies that the monitor would choose the tough liquidation policy if he had control rights. In this region the soft policy can be implemented by setting the controlling stakeholder's payoffs to $a_h = \varepsilon$, $a_L = a_l = 0$. Moreover, in the high state there must be sufficient cash available to pay the manager, and hence we require $R_h - L \geq w_h^C(\theta)$, which needs to hold with strict inequality if $\varepsilon > 0$ is needed.

Region (iv)

It follows directly from the arguments provided for region (ii) and (iii) that in region (iv) monitoring cannot be rendered incentive compatible under either liquidation policy.

Proof of Lemma 3 Incentive compatibility for the monitor is satisfied for $m_l = m_L = 0$, and $m_h \geq \frac{c}{\overline{e}\Delta\theta}$. This corresponds to the equity payoff of a geared firm. Moreover, the controlling party (the debt holder) receives payoffs $a_l = R_l$, $a_L = L$, and $a_h = L + d$. In order to ensure that the debt holder chooses $A(\varnothing) = S$, d must be no bigger than $\frac{1-\overline{e}}{\overline{e}}(L - R_l)$ (see (18)). In order to ensure that the remaining payoff in the high state is sufficient to satisfy the monitor's incentive compatibility constraint, we have to set $R_h - w_h^S(\overline{\theta}) - L - d \geq \frac{c}{\overline{e}\Delta\theta}$, which yields the second constraint on d.

Proof of Lemma 4 We first need to verify that if the monitor has a senior claim with face value L, his payoff satisfies the incentive compatibility constraints (16). A senior claim with

face value L, is worth $m_L = L$ in liquidation but only $m_l = R_l$ when the firm continues in the bad state. The payoff to the monitor when the firm is continued in the high state is $m_h = m_L$. This contract clearly satisfies (16). The equity-holder is the residual claimant and receives $a_h = R_h - w_h^C(\overline{\theta}) - L, a_L = 0, a_l = 0$, which satisfies (18). Note further that it is in fact irrelevant whether the monitor or some senior claimant holds the safe part of the monitor's claim, i.e., the same monitoring and control policy could be implemented by selling a riskless claim with face value R_l to a senior claimant, allocating subordinated debt or preferred shares to the monitor, and leaving control in the hands of the most junior claimant (equity).

Proof of Proposition 2 Note that the firm value depends on whether the monitoring and the control functions are carried out by the same or by two different stakeholders, but it does not depend on whether one of these stakeholders is the initial owner, or an outsider. This is because the initial owner has all the bargaining power when offering the monitoring and control contracts. He will therefore optimally set a price $P_{\mathbf{m}}$ for the monitoring contract such that (11) is binding: $P_{\mathbf{m}} = E\left(m_\varphi|\theta^*\right) - f\left(\theta^*\right)$. Moreover, the same is true for the controlling stakeholder, so that $P_{\mathbf{a}} = E\left(a_\varphi\right)$. The initial owner then has to put up the remaining capital $K = I - P_{\mathbf{m}} - P_{\mathbf{a}}$ and receives the value of the firm minus the payments to the monitor, the controlling stakeholder and the manager: $E(CF_\varphi - m_\varphi - a_\varphi - w_\varphi) - K$. The initial owner's objective function (13) can then be written as $E(CF_\varphi - w_\varphi) - I - f\left(\theta^*\right)$. This is the same expected value as if the initial investor awarded the monitoring or control contract (but not both) to himself. Hence, in the following we can disregard the identity of the parties who hold the contracts and can restrict attention to whether $\lambda = 0$ or $\lambda = 1$..

Consider the initial owner's objective as a function of the monitoring level under the soft and the tough liquidation policies. If the soft policy applies, his objective function is given by

$$V^C\left(\theta\right) \equiv \overline{e}\left(R_h - w_h^C\left(\theta\right)\right) + (1-\overline{e})(\theta L + (1-\theta)R_l) - f(\theta) - I. \tag{35}$$

Under the tough policy it is given by

$$V^S\left(\theta\right) \equiv \overline{e}\theta(R_h - w_h^S(\theta)) + (1-\overline{e}\theta)L - f(\theta) - I. \tag{36}$$

From (14) and (15) follows that expected wage payments are the same under either policy, if the level of monitoring is the same. Hence, from a direct comparison between (35) and (36), we conclude that the soft policy is preferred over the tough policy at the same level of monitoring, if (21) holds.

Moreover,

$$\begin{gathered} V^C\left(\overline{\theta}\right) \geq V^C\left(\underline{\theta}\right) \\ \Leftrightarrow \\ \left(1-\overline{e}\right)\Delta\theta\left(L - R_l\right) \geq c - \overline{e}\left(w_h^C\left(\underline{\theta}\right) - w_h^C\left(\overline{\theta}\right)\right), \end{gathered}$$

which always holds in region (i). Moreover,

$$\begin{gathered} V^S\left(\overline{\theta}\right) \geq V^S\left(\underline{\theta}\right) \\ \Leftrightarrow \\ \overline{e}\Delta\theta\left(R_h - L\right) \geq c - \overline{e}\left(\underline{\theta} w_h^S\left(\underline{\theta}\right) - \overline{\theta} w_h^S\left(\overline{\theta}\right)\right), \end{gathered}$$

which always holds in region (i). Hence, the initial owner chooses contracts so that the soft policy will be implemented if and only if $V^C\left(\overline{\theta}\right) \geq V^S\left(\overline{\theta}\right)$.

Consider now region (ii). Since $\overline{\theta}$ is incompatible with the soft policy, the equilibrium regime is now determined by $\max\left\{V^C\left(\underline{\theta}\right), V^S\left(\overline{\theta}\right), V^S\left(\underline{\theta}\right)\right\}$ and the constraint that $V \geq 0$. Clearly, in region (ii) $V^C\left(\underline{\theta}\right) > V^S\left(\underline{\theta}\right)$. Hence, the tough policy with high monitoring is chosen if and only if $V^S\left(\overline{\theta}\right) \geq V^C\left(\underline{\theta}\right)$ and $V^S\left(\overline{\theta}\right) \geq 0$. Using (35) and (36) yields (22) and (23).

Consider region (iii). Now $\overline{\theta}$ is not feasible under the tough policy and the equilibrium is determined by $\max\left\{V^C\left(\overline{\theta}\right), V^C\left(\underline{\theta}\right), V^S\left(\underline{\theta}\right)\right\}$ and $V \geq 0$. When $\overline{R} < L$ then $V^C\left(\underline{\theta}\right) < V^S\left(\underline{\theta}\right)$. Hence, the soft policy is chosen if $V^C\left(\overline{\theta}\right) \geq V^S\left(\underline{\theta}\right)$, which is exactly the constraint (24). The constraint $V^C\left(\overline{\theta}\right) \geq 0$ is then given by (25). If $\overline{R} \geq L$, then $V^C\left(\underline{\theta}\right) \geq V^S\left(\underline{\theta}\right)$. The soft policy and high monitoring is then chosen if $V^C\left(\overline{\theta}\right) \geq V^C\left(\underline{\theta}\right)$, which is the same as

$$\left(1-\overline{e}\right)\Delta\theta\left(L-R_l\right) \geq c - \overline{e}\left(w_h^C\left(\underline{\theta}\right) - w_h^C\left(\overline{\theta}\right)\right). \tag{37}$$

This always holds in region (iii).

Proof of Proposition 3 Consider first the case where the soft liquidation policy is implemented. We then get three incentive compatibility constraints:

$$\begin{aligned}
&\overline{e}\left(w_h+b\right)+\left(1-\overline{e}\right)\left(\overline{\theta}w_L+\left(1-\overline{\theta}\right)\left(w_l+b\right)\right)-c-\gamma \geq \\
&\quad \underline{e}\left(w_h+b\right)+\left(1-\underline{e}\right)\left(\overline{\theta}w_L+\left(1-\overline{\theta}\right)\left(w_l+b\right)\right)-c, && (38)\\
&\quad \overline{e}\left(w_h+b\right)+\left(1-\overline{e}\right)\left(\underline{\theta}w_L+\left(1-\underline{\theta}\right)\left(w_l+b\right)\right)-\gamma, && (39)\\
&\quad \underline{e}\left(w_h+b\right)+\left(1-\underline{e}\right)\left(\underline{\theta}w_L+\left(1-\underline{\theta}\right)\left(w_l+b\right)\right). && (40)
\end{aligned}$$

Simple calculation shows that satisfying (38) and (39) implies that (40) is also satisfied. The contract which pledges most income to the principal sets $w_l = 0, w_L = b + \frac{c}{(1-\overline{e})\Delta\theta}$, and $w_h = \frac{\gamma}{\Delta e} + \overline{\theta}\frac{c}{(1-\overline{e})\Delta\theta}$.

Consider now the tough liquidation policy. Again three incentive compatibility constraints need to be satisfied for the entrepreneur.

$$\begin{aligned}
\overline{e}\overline{\theta}\left(w_h+b\right)+\left(1-\overline{e}\overline{\theta}\right)w_L-\gamma-c \geq & \\
&\overline{e}\underline{\theta}\left(w_h+b\right)+\left(1-\overline{e}\underline{\theta}\right)w_L-\gamma, \\
&\underline{e}\overline{\theta}\left(w_h+b\right)+\left(1-\underline{e}\overline{\theta}\right)w_L-c, \\
&\underline{e}\underline{\theta}\left(w_h+b\right)+\left(1-\underline{e}\underline{\theta}\right)w_L.
\end{aligned}$$

We can thus write the minimum payments to the entrepreneur as $w_l = w_L = 0$, and

$$w_h^E = \max\left\{0, \frac{\gamma}{\overline{\theta}\Delta e} - b, \frac{c}{\overline{e}\Delta\theta} - b, \frac{\gamma+c}{\overline{\theta}\overline{e}-\underline{\theta}\underline{e}} - b\right\}.$$

Proof of Proposition 4 We only need to consider the case when the tough liquidation policy is implemented. The firm value in this case is given by $V^E = \overline{e}\overline{\theta}\left(R_h - w_h^E\right) + \left(1-\overline{e}\overline{\theta}\right)$. Compare this to the case where an outsider monitors who receives payment m_h in the high

state and nothing otherwise. Monitoring incentive compatibility requires $m_h \geq \frac{c}{\overline{e}\Delta\theta}$. The monitor is willing to provide capital up to the amount $I_M = \overline{e}\overline{\theta}m_h - c = c\frac{\underline{\theta}}{\Delta\theta}$. The ex ante firm value is then given by $V^T = \overline{e}\overline{\theta}\left(R_h - m_h - w_h\right) + (1 - \overline{e}\overline{\theta})L + I_M$, which can be written as

$$V^T = \overline{e}\overline{\theta}\left(R_h - w_h^T(\overline{\theta})\right) + (1 - \overline{e}\overline{\theta})L - c.$$

When $w_h^E = \frac{\gamma + c}{\theta\overline{e} - \underline{\theta}\underline{e}} - b$, (that is the case when $\gamma\underline{e}\Delta\theta < c\overline{\theta}\Delta e$) then the firm value is higher when monitoring is delegated to an outsider under the following condition: $\overline{e}\overline{\theta}\left(R_h - w_h^T(\overline{\theta})\right) + (1 - \overline{e}\overline{\theta})L - c > \overline{e}\overline{\theta}\left(R_h - w_h^E\right) + \left(1 - \overline{e}\overline{\theta}\right)L$. This can be rewritten as $\gamma\overline{e}\Delta\theta < c\underline{\theta}\Delta e$.

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