The Good Cop and the Bad Cop: Complementarities between Debt and Equity in Disciplining Management

Alexander Gümbel
Saïd Business School
University of Oxford
22 February, 2002

Lucy White
Nuffield College
University of Oxford

*This paper is a revised version of chapter 4 of the PhD thesis of the second author. We thank Matthias Dewatripont, Denis Gromb, Thomas Mariotti and Jean Tirole for helpful comments at an early stage of this paper. We would also like to thank seminar participants at SOAS. We are responsible for any errors and omissions therein.

Correspondence address: Alexander Guembel, Lincoln College, Oxford, OX1 3DR, U.K. Tel: (+44) 1865 279 782. Fax: (+44) 1865 279 802.
email address: alexander.guembel@sbs.ox.ac.uk
The Good Cop and the Bad Cop:
Complementarities between Debt and Equity in Disciplining Management

Abstract

In this paper we examine how the quantity of information generated about firm prospects can be improved by splitting a firm’s cash flow into a ‘safe’ claim (debt) and a ‘risky’ claim (equity). The former, being relatively insensitive to upside risk, provides a commitment to shut down the firm in the absence of good news. This commitment provides the latter a greater incentive to collect information than the aggregate claimant would have. Thus debt and equity are shown to be complementary instruments in firm finance. Moreover, we investigate the role of stock markets in transmitting information from equity to debt holders. This provides a novel argument as to why information contained in stock prices affects the real value of a corporation. It also allows us to make empirical predictions regarding the relation between shareholder dispersion, market liquidity and capital structure.

Keywords: Debt, Equity, Hard Budget Constraint, Information Production.

JEL Classification: D82, G3

1. Introduction

Corporate finance theory has long recognized the role of capital structure in affecting managerial incentives (e.g. Jensen and Meckling, 1976). Over the years this approach to capital structure has evolved to take into account not only incentives for managers resulting from their claim on the firm, but also the incentives of providers of capital in
affecting a firm’s prospects. The incomplete contracts approach, for example, recognizes
that providers of capital have differing incentives regarding the choice of project risk and
that this choice should optimally be allocated contingent on past firm performance (Hart
and Moore, 1989, Aghion and Bolton, 1992, Dewatripont and Tirole, 1994). In these
papers debt performs the role of being a tough claim that allows the firm to be shut
down in bad states of the world.

One important feature that much of this literature shares is that providers of capi-
tal are largely portrayed as being passive agents when it comes to information on which
their decisions are based. Either information is contained in publicly observable variables
(such as past cash flows) or arrives as a signal about future prospects at no cost. Clearly,
information production about firm prospects is an extremely important and costly ac-
tivity, as witnessed by the resources allocated to financial analysis by investment banks,
rating agencies etc. This paper focuses on the incentives of providers of capital to engage
in information production about the future prospects of their firm. The main point we
make in this paper is easily summarized: we show that debt and equity are comple-
mentary instruments in firm finance. When it is sometimes necessary for a provider of
capital to take a ‘tough’ decision, such as firm shut-down, a claimant needs to have a
‘flat(ish)’ payoff structure like debt, in order to be willing to take this action. Such a
claimant, however, will have little incentive to produce information. Hence, the payoff
sensitive equity claim provides an incentive to monitor the firm and provide the precise
information subsequently used by the creditor.

In our set-up managers are subject to a moral hazard problem and ultimately care only
about remaining in the job; they derive no utility from monetary incentives. Precisely
because managers derive utility from incumbency, they must be motivated to work by the
threat that the firm may be shut down. This means that someone must be given a senior
claim with incentives to shut the firm down, even though it may be a going concern. This
must be a flat(tish) “debt” claim in order that the claimant is not sensitive to the extra
profits that could be gained by continuing (Dewatripont and Tirole, 1994). But almost
by definition, such a claimant does not have the correct incentives to collect information
about how large the profits to be gained from continuing are, i.e. about whether the
Thus we also require a claimant whose claim is sensitive to future returns, and who therefore has an incentive to collect information about these. Otherwise, although the debt-holder’s decisions will be ‘tough’, they will also be random; not based on accurate performance measures, and so will do nothing to motivate the manager. The monitoring claim must clearly be equity-like, i.e. profit-sensitive, though its exact form will depend on what it is possible to make the contract of this ‘monitor’ contingent on. Thus debt and equity are complementary instruments in firm finance. If the manager has worked, the value of the monitor’s claim will be high, and the monitor will be very keen for the firm to continue. The claimant charged with the continuation decision will use the information thus revealed in making his decision. Therefore the manager will care very much about what the value of the equity claim is - more than he cares about fundamental profits - because it is this that determines whether the firm will continue operating.

We moreover explore the role of prices in a financial market in which the equity claim is traded in transmitting information from equity holders to debt holders who may act on this information. A number of papers have attempted to explain why information contained in stock prices may be useful (Diamond, 1967, Hirshleifer, 1971, Leland, 1992, Holmstrom and Tirole, 1993). In this paper we provide a new theory that may help explain why firms and managers care about their share price: since debt holders do not have the incentives to produce information, their decisions are based on information contained in the stock price. Thus the real value of a firm is affected by its share price.

We model this by introducing a market in which cash-flow rights can be traded with noise traders. We show that the introduction of such a market enhances the monitoring incentives of the aggregate claimant (because gathering information allows him to make trading profits), so there is less need to split claims. Nevertheless, splitting claims can be helpful in further increasing information generation. In this case, one mechanism for the equity-holder to reveal credibly his information to the debt-holder is by buying shares in the firm when he receives positive information. Then the debt-holder bases his closure decision on how high the share price is, so the manager cares about the share price, as described above. We show that in this case, softening the creditor slightly by giving
him risky debt can be optimal, since it generates additional trading profits and hence information generating incentives for the equity holder. We thus predict that dispersed ownership and higher liquidity should be associated with higher gearing ratios.

The role of a liquid stock market has been investigated in the context of shareholder activism (Bhide, 1993, Bolton and von Thadden, 1998, Khan and Winton, 1998, Maug, 1998). These papers focus on the incentives of large blockholders to take costly actions to improve firm performance. Since an active shareholder who takes such a costly action faces a free rider problem from other, passive shareholders, a trade-off between ownership concentration and liquidity exists. Maug (1998) explicitly addresses the issue of trading profits as providing an incentive to take a costly, value enhancing action.

In contrast to these papers we consider the incentives of a shareholder to acquire information, where information per se is not value enhancing. Information may increase firm value, because it allows improved resource allocation. Since the shareholders of a geared firm do not maximize overall firm value, they may have an incentive to affect resource allocation by manipulating the share price and therefore available information. When the liquidity in a stock is high, manipulation becomes more costly. Small shareholders have a lower incentive to manipulate the stock price, because the impact on their existing stake is less important. We would therefore expect to see high liquidity associated with dispersed ownership - a relation borne out by casual evidence when comparing financial systems. The US and UK stock markets are relatively liquid, compared to Germany or Japan. At the same time, German and Japanese firms display a significantly higher degree of ownership concentration.

A number of papers have looked at the role of monitoring incentives for the providers of capital. Rajan and Winton (1995) investigate the role of covenants and collateral in providing monitoring incentives for creditors. Like our paper, Repullo and Suarez (1998) point out that the disciplining role of a termination threat may be limited by the lack of credibility of termination. However, they focus on the role of multiple creditors and show that a combination of informed and uninformed debt optimizes the trade-off between the cost of monitoring and the lack of a termination threat. Von Thadden (1995) examines monitoring in the context of short-term versus long-term debt contracts. Both
of the above papers share a set of assumptions that is in line with much of the existing
literature in this area, for example also the costly state verification models of debt finance
(Tonwsend, 1979, Gale and Hellwig, 1985). They assume that the monitor commits to
a monitoring strategy and that it is publicly observable whether or not monitoring has
taken place. Importantly, monitoring is typically not interim incentive compatible. In
contrast to the above papers, we focus on the problem of interim incentive compatible
monitoring choices. Lastly, Winton (1993) looks at the role of monitoring incentives in
the context of unlimited liability by equity holders.

Also related to our paper is a literature starting with Boot and Thakor (1993) (and
more recently Fulghieri and Lukin, 2001) that emphasizes the role of security design on
monitoring incentives in the context of trade on private information. Like our paper, this
literature identifies equity as the information sensitive instrument and therefore argues
that firm value may be increased by levering a firm with debt, and provide ‘informational
leverage’. This literature requires the existence of frictions in financial markets in the
form of borrowing constraints; an assumption we do not make.

The plan of this paper is as follows. In section 2, we set up the basic model where
information collection generates hard information and show that when all the cash-flow
rights are held by the same claimant, it may be impossible to commit to enough mon-
itoring to motivate the manager to work. In section 3, we show how splitting the cash
flow rights into a safe debt claim and an equity claim can improve upon this situation.
Essentially, the equity holder monitors more than the aggregate claimant would because
he is afraid that in the absence of good information the firm will be shut down. We also
show how this basic result is robust to renegotiation between claimants. In section 4, we
investigate whether the same result can be obtained when the information collected by
the monitor is soft. The role of semi strong form efficient stock markets as a transmitter
of information is investigated. Section 5 suggests extensions of the paper and section 6
summarises results and concludes.
2. The model

There are three dates $t = 0, 1, 2$. There are two possible date 2 values $R_\omega$ of the firm, depending on the realization of a random variable $\omega \in \{l, h\}$, where $R_h > R_l$. At $t = 0$, the manager of the firm chooses effort $e \in \{e, \overline{e}\}$. $\overline{e}$ denotes high effort, which accrues a cost $\gamma$ to the manager, while low effort $e$ comes at zero cost. If effort is high, the probability of the high state is given by $\overline{e}$, and if effort is low, the probability of the high state is $e$. Moreover, the manager receives a private benefit from control given by $b$ in the second period $t = 2$. There is a monitoring technology, which can be used at date 1 to provide a signal $s \in \{l, h, \emptyset\}$ about the future state of the world at date 2. If the monitor exerts costly effort $c(\theta)$, he will learn the true state of the world ($\{l\}$ or $\{h\}$) with probability $\theta$. Otherwise he receives no signal ($\emptyset$) and cannot update his prior. The function $c(\theta)$ is convex and increasing in $\theta$.

The advantage of gaining information at the interim date $t = 1$ is that a controlling stakeholder can then choose an action $C$ (continue operations) or $S$ (stop). 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 realised at date 2, $R_h$ or $R_l$ according to the state of the world, and the manager receives $b$. We assume that the manager’s presence is essential for the continuation of the firm, i.e. the firm cannot be continued without him, for example because he has project specific skills. We denote by $A : \{l, h, \emptyset\} \rightarrow \{C, S\}$ a mapping from the signal realization onto the liquidation decision, i.e. $A(s)$ specifies a signal contingent liquidation strategy. 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.

We are interested in a setting where production is actually worthwhile undertaking if the manager has worked. Thus we assume:

$$\overline{e}R_h + (1 - \overline{e})R_l > I > L. \quad (1)$$

where $I$ is the initial investment required to start up the firm. Note that this also implies that the aggregate claimant would choose to continue the firm rather than liquidate it if
he anticipates that the manager has worked and learns nothing more about firm prospects at $t = 1$. We also suppose that it is not profitable ex ante to finance the firm if it is anticipated that the manager will not work:

$$\max \theta : \mathcal{L}R_h + (1 - \varepsilon)[(1 - \theta)R_l + \theta L] - c(\theta) < I.$$ 

Thus if the firm is to be financed, the manager must be induced to work. We assume further that it is efficient for the manager to work, i.e. $(\mathcal{E} - \varepsilon)(R_h - R_l) > \gamma$. Suppose to simplify things that the manager is not responsive to monetary incentives and hence expected utility consists of the expected private benefit of running the project, minus the cost of effort. (One can see how this assumption might be relaxed without changing the results - see Dewatripont and Tirole 1994). Then the only inducement for the manager to work is the idea that if he does not work, the investor may decide to close the firm down after one period. However, as noted above, because the firm is ex ante profitable, the investor will never close the firm down if he thinks the manager has worked, unless he has received further information that the state is bad. Thus to provide the manager with an incentive to work, the investor must credibly commit to monitoring the interim value of the firm in order that he sometimes learns ahead of time that the outcome will be $R_l$, so he chooses to close the firm. If the investor owns all the cash flow rights to the firm, his incentive to monitor is:

$$\max \theta : V^* = \theta(\mathcal{E}R_h + (1 - \mathcal{E})L) + (1 - \theta)(\mathcal{E}R_h + (1 - \mathcal{E})R_l) - c(\theta),$$

where we have used the fact noted above that if the investor learns nothing he cannot credibly commit to shut the firm when he learns nothing. Notice that if the difference between $L$ and $R_l$ is small, the investor has very little incentive to monitor. Let $\theta^*$ be the solution to the investor’s first order condition, given by:

$$(1 - \mathcal{E})(L - R_l) - c'(\theta) = 0 \quad (2)$$

The manager’s incentive constraint, on the other hand, is given by:

$$\theta \mathcal{E}b + (1 - \theta)b - \gamma \geq \theta \mathcal{E}b + (1 - \theta)b \quad (IC_{manager})$$

So that, as remarked above, the manager works only if there is enough monitoring: $\theta \geq \gamma/(\mathcal{E} - \varepsilon)b$. The interesting case occurs when $\theta^* < \gamma/(\mathcal{E} - \varepsilon)b$, so that the investor
holding all the cash flow rights to the firm cannot commit to obtaining enough information to make the manager work. To simplify things, we make the stronger assumption that: 

$$\theta^{**} < \frac{1}{(1-e)\mu_0} b$$

where $$\theta^{**}(> \theta^*)$$ is defined by: 

$$\theta^{**} = \left(1-e\right)(L-R_l) - c(\theta^{**}) = 0.$$ 

In other words, the monitor would not find it worthwhile to monitor enough even if the manager did not work. This assumption rules out mixed equilibria in which the manager sometimes works. Thus the manager always finds it optimal to exert low effort, in the anticipation that the investor will always want to continue anyway when he is uninformed, which is most of the time. Given the anticipated choice of $$e$$ by the manager, investment in the firm is not profitable, so the enterprise cannot be financed. We now look at how splitting the claim can help improve information production.

3. Debt and equity with hard information

The purpose of this section is to illustrate that splitting the aggregate claim into a debt and equity claim can increase firm value. Doing so allows the providers of capital to pose a credible threat of project termination in the absence of good information. Interestingly, in our model, this threat does not directly motivate the manager, whose incentive compatibility constraint will be as before. (Notice from ($IC_{\text{manager}}$) above that whether the firm is closed or not when the monitor is uninformed does not affect the manager’s incentive to work since this decision is independent of whether he works.) Instead, the threat of closure will motivate the equity claimant to collect more information at the interim date than would be optimal for the aggregate claimant. This more informed decision-making will then provide an incentive to the manager to exert the value-enhancing high effort level $$\bar{e}$$. This effect occurs because the debt holder has a flat claim and is therefore willing to liquidate the firm, when the aggregate claimant might not be. This role of debt has been recognized by Dewatripont and Tirole (1994). The novelty of our analysis is to show that equity plays a complementary role to debt in such a setting, because monitoring is a costly activity. Only someone with an information sensitive claim, such as equity, has an incentive to undertake costly monitoring. Moreover, the debt-holder’s threat of liquidation motivates the equity-holder to acquire more information than the
aggregate claimant would choose to do.

Suppose that the monitor’s information is hard information by which we mean the following. If an agent claims a particular piece of information, this information is verifiable by other parties. However, an agent does not have to claim to have any information, i.e. he can conceal information from others. This assumption will be relaxed in the next section where we investigate the case of soft (non-verifiable) information. Suppose also, that the firm is financed with debt of principal value $D$ and equity (which has rights to any surplus income after paying the debt-holder).

Moreover, suppose the debt holder has control rights, i.e. the right to choose action $A$ at date $t = 1$ after observing signal $s$, which is collected by the equity holder.\footnote{In contrast to Dewatripont and Tirole (1994) the allocation of control rights in our setting is not contingent on the realisation of a random variable, but rests with the debt-holder instead. This is due to our assumption that our date 1 signal is non-verifiable. If the signal were verifiable, the same outcome could be achieved by allocating control to the equity holder when the signal is good and to the debt-holder otherwise. But this is essentially no different from what is done here. Note that even with a verifiable signal, cash-flow rights would still have to be divided to achieve the high monitoring outcome.} This could be because the creditor can decide not to roll over short-term debt after date $t = 1$. Effectively, this gives him uncontingent control over the liquidation decision at $t = 1$. (For the moment we do not allow the equity-holder to provide additional capital at $t = 1$, i.e. refinance the firm. We will look at this possibility later when we consider renegotiation between the two claim-holders at $t = 1$.) The debt-holder takes the liquidation decision based on (hard) information available from the equity-holder’s report of the outcome of his monitoring activity. Remember that the equity-holder cannot lie about the signal which he receives, but he can conceal a bad signal $l$ by reporting instead that he received no signal, $\emptyset$, “Don’t know”. The equity claim will be designed so as to provide an \textit{ex ante} incentive to monitor, while the debt claim will be designed to provide an incentive to take the \textit{ex ante} efficient continuation decision at the interim stage. We now prove the following proposition.

\textbf{Proposition 1} \textit{Supposing that the manager works, splitting the claim into safe debt $D = L$ and equity results in more monitoring than under the aggregate claim.}
Proof. The debt holder trivially wishes to continue operations after receiving good news and to stop after receiving bad news; in the light of the above discussion, his claim must be designed such that he prefers to stop when no signal is received. Note that there is no way to get the equity holder to report bad news since he can conceal information; so from the debt holder’s point of view, these two possibilities are indistinguishable.\(^2\)

Anticipating that the manager has worked, the debt holder wishes to stop operations when the equity holder reports “don’t know” (which may in fact be either bad news or don’t know) if:

\[
q(\theta) \min\{D, R_h\} + (1 - q(\theta)) \min\{D, R_l\} \leq \min\{D, L\},
\]

(3)

where \(q(\theta) \equiv \text{prob}(\omega = h|s = h) = \frac{(1-\theta)c}{1-\theta} \). Note, that inequality (3) is weakly satisfied for all levels of riskless debt: \(D \leq R_l\). For risky debt, the debt holder strictly prefers to stop as long as \(L > D \geq R_l\), regardless of signal quality. For \(L \leq D \leq R_h\), the debt-holder will be content to stop if and only if \(q^h(\theta) \leq \frac{L-R_l}{D-R_l} \equiv \phi\). In other words, he will be willing to stop if the probability that the monitor is informed is high enough, \(\theta > \frac{\phi}{\epsilon-\phi} \), or if his claim is steep enough. Supposing that these conditions are satisfied, the equity-holder’s incentive to monitor is:

\[
\max \theta : V^{\text{equity}} = c\theta(R_h - D) + (1 - \theta) \max\{L - D, 0\} - c(\theta)
\]

Yielding first order condition:

\[
\overline{c}(R_h - D) - \min\{L - D, 0\} - c'(\theta^{\text{equity}}) = 0
\]

It is easy to see that safe debt \(D\) equal to the firm’s liquidation value \(L\) maximises the equity-holder’s incentives to monitor. Moreover, in this case, the debt-holder’s incentive to monitor is zero, so there will be no duplication of monitoring. In this case we have:

\[
\overline{c}(R_h - L) = c'(\theta^{\text{equity}}),
\]

which (from above) implies more monitoring than the aggregate claim if \(\overline{c}(R_h - L) > (1-\overline{c})(L - R_l)\), which is true since \(L < \overline{c}R_h + (1-\overline{c})R_l\). Under this continuation policy, it turns out that the manager’s IC looks the same as before, and he can be induced to work if \(\theta^{\text{equity}} > \frac{\gamma}{\overline{c} - \gamma} \).

\(^2\)In fact, the equity-holder is indifferent about reporting bad news in this simple model with perfectly informative signals, so in this special case one could also assume that he truthfully reports bad news. Which assumption is made will not be important for our results here.
Corollary 1 Splitting financial claims into safe debt and equity will increase the manager’s effort relative to the aggregate claim if: \[ c^{-1}[\overline{e}(R_h - L)] > \frac{\gamma}{(\overline{e} - \underline{e})(R_h - L + b)} > c^{\prime - 1}[(1 - \underline{e})(L - R_l)]. \] Thus splitting the aggregate claim into debt and equity can achieve the high effort level when this is not attainable with ungeared equity.

It is less clear that splitting the claim will actually increase firm value, however, for two reasons. Firstly, since the firm is shut down more often under split claims, it is not clear whether it is still efficient for the manager to work under this more stringent closure policy. However, it is straightforward to realize that if monitoring is sufficient to induce the manager to work, it must be socially valuable for him to do so since he does not internalize all the benefits from his working. (Formally, managerial effort is socially efficient given the closure rule if \[ \theta^{*\text{equity}} > \frac{\gamma}{(\overline{e} - \underline{e})(R_h - L + b)}. \] Secondly, under the new closure policy, the investors have to commit to an inefficient shutdown rule: they shut the firm down when they do not observe a signal, which reduces firm value if the manager has worked. However, it turns out that under the assumptions made above, it is indeed the case that splitting claims improves value.

Proposition 2 Given \[ c^{-1}[\overline{e}(R_h - L)] > \frac{\gamma}{(\overline{e} - \underline{e})(R_h - L + b)} > c^{\prime - 1}[(1 - \underline{e})(L - R_l)], \] splitting the claim increases firm value.

Proof. Firm value under split claims is: \[ V^{\text{split}} = \theta^{*\text{equity}}\overline{e}(R_h + b) + (1 - \overline{e})\theta^{**}(R_l + b) - c(\theta^{**}) \]

\[ = \{\theta^{**}\overline{e}(R_h + b) + (1 - \overline{e}\theta^{**})L - c(\theta^{**})\} \]

\[ + (1 - \theta^{**})[\underline{e}(R_h + b) + (1 - \underline{e})(R_l + b) - L]. \]

By the assumption that the firm has negative social value if the manager does not work, the term in square brackets is negative, implying that the best thing in this case would be to shut down the firm when the null signal is received. Thus the value of the firm under the optimal shutdown policy with the aggregate claim, \[ V^{agg} \] is simply equal to the term in curly brackets. Moreover, \[ \theta^{*\text{equity}} = \arg \max \theta \overline{e}(R_h - L) - c(\theta) \]
\[
= \arg\max \theta \epsilon(R_h) + (1 - \epsilon(1 - \theta))L - c(\theta),
\]
and by assumption \( \theta^*_{equity} > \theta^* \) (since the former induces more effort than the latter). Therefore \( \theta^*_{equity} \epsilon(R_h + b) + (1 - \epsilon(1 - \theta^*_{equity}))L - c(\theta^*_{equity}) - \gamma \)
\[
> \theta^* \epsilon(R_h + b) + (1 - \epsilon(1 - \theta^*))L - c(\theta^*) - \gamma
\]
\[
> \theta^* \epsilon(R_h + b) + (1 - \epsilon(1 - \theta^*))L - c(\theta^*).
\]

The last inequality being due to fact remarked upon above that it still is efficient for the manager to exert effort under the more stringent closure rule. Thus the value of the first term in curly brackets, \( V^{agg} \), is also less than \( V^{split} \) and we are done. \( \Box \)

Two observations are noteworthy at this stage. Firstly, though we have focussed here on the case of ‘safe debt’ \( D = L \) for simplicity, any \( D \leq L \) could work equally well, provided the creditor sticks to the ex ante efficient liquidation rule of \( A(\theta) = S \). (When debt is truly riskless \( D \leq R_l \), the creditor is always indifferent between continuing and liquidating the firm. When this is the case one would have to suppose the creditor nevertheless takes the ex ante efficient liquidation decision for truly riskless debt to perform as well, which may not be realistic.\(^3\)) This being the case, the equity-holder would have exactly the same monitoring incentives as before (he sets \( c'(\theta) = \epsilon(R_h - D) - \epsilon(L - D) = \epsilon(R_h - L) \)). In other words, regardless of the level of riskless debt \( D \leq L \), gearing \( per se \) does not affect monitoring, it is the induced change in the closure rule that affects monitoring.\(^4\)

Secondly, for risky debt \( D > L \), the creditor is not always willing to liquidate the firm after a null report from the monitor: he has too much at stake in the profitability of the enterprise. He will be willing to liquidate if \( D \leq \frac{L - (1 - \epsilon)L}{\epsilon} \). As observed by Dewatripont and Tirole (1994), it is always easier to induce a stakeholder with a ‘flattish’ claim such as risky debt to take the ‘tough’ action of liquidation. Moreover setting \( D > L \) directly takes away some of the monitoring incentive from the equity holder, so risky debt is

\(^3\)Strictly speaking even a debt level of \( D = 0 \) would work. All that is needed for the proposition to go through is an ‘arbitrator’ to whom the continuation decision is credibly delegated. In practice, however, it does not seem very realistic to delegate to someone who has no stake in the enterprise.

\(^4\)In this respect our analysis differs crucially from Boot and Thakor (1993): as long as debt is riskless, monitoring incentives are unaffected by the introduction of debt in our setting, because the slope of the equity payoff remains the same.
never optimal in this simple setting. Note that even if debt must for some reason be risky, firm value might be increased by splitting the claim, although the second best cannot be achieved.

A. Renegotiation

Given our assumptions it seems clear that whenever the monitor receives no information from monitoring in the proposed high effort equilibrium, the debt and equity holder can collectively gain from renegotiating to the choice of action \( C \) from the debt-holder’s chosen action \( S \).\(^5\) For example, if the equity holder holds any wealth, then he has an incentive to try to buy the debt claim (refinance the firm if short-term debt is not rolled over) from the debt-holder. Thus the equilibrium derived above will not be renegotiation-proof. We model the renegotiation game as follows. After the equity holder makes his report at \( t = 1 \), with probability \( \alpha \), the equity-holder will have 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. Finally, whoever is holding the debt after this round of bargaining chooses an action \( C \) or \( S \), returns are realised, 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 \( C \). For simplicity we will treat only the case when the debt-holder’s debt is safe at \( t = 1 \), i.e. \( D = L \). It should be clear how the logic of the other cases will be similar.

Note first that if the equity holder makes the report ‘\( h \)’ whoever is holding the debt after renegotiation will be willing to continue since \( R_h > L \), so there is no risk to continuing. Therefore there is no inefficiency associated with the claim structure and no particular need for renegotiation. We can thus assume without loss of generality that the bargaining offers made are null offers, i.e. no claims or money will change hands. On the other hand, when the equity-holder reports ‘\( \emptyset \)’, then without renegotiation, the

\(^5\)We assume that the manager does not take part in this renegotiation (even though he too gains from continuation) because he has no wealth and his private benefit is inalienable. However, based on Dewatripont and Tirole 1994, it is easy to see how our results would extend to the more general case.
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. $L$. However, if the debt-holder makes an offer to the equity-holder, he knows that the latter stands to gain $\bar{c}(R_h - L) + (1 - e)R_t$ from continuation holding the debt plus equity, and so he can extract this by demanding this in exchange for giving up his debt. Thus the equity-holder’s total payoff is given by:

$$\max \theta : \bar{c}[\theta (R_h - L) + (1 - \theta)(\alpha (R_h - L) + (1 - \alpha)0)]$$

$$+(1 - \bar{c})(1 - \theta)\alpha(R_t - L) - c(\theta)$$

with first order condition: $\bar{c}(1 - \alpha) (R_h - L) + \alpha(R_t - L)(1 - \bar{c}) - c'(\theta) = 0$. By comparison with equation (2), this will represent strictly (weakly) more monitoring than the aggregate claim whenever $\alpha < (\leq)1$. Thus our result 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 internalises all the benefits of his monitoring and thus acts exactly like the aggregate claimant.

4. Soft information and trade

So far it has been assumed that the equity holder’s (the monitor’s) information is publicly available. The following section deals instead with the case where the monitor’s signal is non-verifiable (soft) information. If the firm is held by an aggregate claimant (unlevered equity) this will make no difference to the analysis of the previous section. However, if the claim is split into debt and equity, a mechanism is required to transmit information from the equity holder (monitor) to the creditor who acts on the information. A simple mechanism would be to require the equity holder to ‘put his money where his mouth is’. This could take the form of a contract, requiring the equity holder to make a payment if he announces ‘good news’, and the bad outcome $R_t$ occurs. This is quite similar to buying more shares in the own firm if the signal $s = h$ is received.

In general, however, buying shares in the market may supply an additional incentive to monitor, due to profits that may result from trade on private information (Maug, 1998).
This is important for two reasons. Firstly, the equity holder’s incentive to monitor is increased by partially revealing prices, because they provide a trading profit. Secondly, when prices are partially revealing, the continuation decision is based on a noisy version of the equity holder’s private information, which increases the likelihood of taking the wrong continuation decision.

This section develops a simple trading model with semi strong form efficient prices. This is done, first in the context of an aggregate claimant (unlevered equity) who is allowed to trade. This will illustrate the mechanics of the trading model, and confirm the intuition that liquid markets increase monitoring effort. We then show that splitting the claim can increase firm value, even if information is soft, and examine the role of trade in this context.

The type of information that we have in mind in this setting is not insider information (to which trading restrictions apply in most countries). That is, we are not thinking of superior information that an insider may receive costlessly by virtue of the fact of holding a particular post in relation to the firm. Instead we have in mind information that can be arrived at by analyzing publicly available information, e.g. by engaging in an in-depth market analysis etc. While it is costly to carry out such an analysis, in principle anyone can decide to expend the corresponding effort.

A. Trade in unlevered equity

Suppose now that the equity is traded. In the spirit of Kyle (1985) we assume that trade is executed by a risk neutral market maker to whom orders are submitted. He then sets a price and meets order flow imbalances out of his inventory. The price is determined by the condition that the market maker breaks even in expectation, given the information contained in order flow. In addition to demand \( u \) by the (potentially) informed equity holder, there is noise trader demand \( \tilde{n} \in \{-n, 0, n\} \), where \( \text{prob}(\tilde{n} = 0) = 1 - \eta \), and \( \text{prob}(\tilde{n} = -n) = \text{prob}(\tilde{n} = n) = \eta/2 \). The unit of \( n \) is the percentage of total equity.

\( ^6 \)There is a growing literature that deals with the question of the desirability of insider trading, for example Leland (1992), Khanna, Slezak, and Bradley (1994) and Bhattacharya and Nicodano (2001).
outstanding, although one could equally well measure it in numbers of shares.

It is assumed that the market maker can observe a pair of orders \( Q = \{ \tilde{n}, u \} \), but is unable to distinguish the originator of an order. This is a deviation from the standard set-up as in Kyle (1985), where market makers can observe total order flow and has been used for example in Biais and Germain (2002). Whenever order flow \( Q \) reveals the equity holder’s order, the market maker will set the price in equilibrium so that it is equal to the expectation of firm value, conditional on the signal realization. Hence, the equity holder can make a trading profit only if he succeeds in concealing his order from the market maker. In order to hide his order, the informed trader must choose orders of size \( n \).

Consider the following equilibrium order flows by the equity holder: \( u(s = h) = n \), \( u(s = l) = -n \), and \( u(s = \emptyset) = 0 \). In the case where the aggregate claimant can trade in the equity of his firm, the liquidation decision depends on the quality of information in the same way as discussed above. The fact that information is private does not affect liquidation incentives, because the monitor is also the party in control. The fact that information is private, however, does affect monitoring incentives, because private information has value in the stock market. If the equity holder follows the information contingent trading strategy outlined above, the following order flows can occur in equilibrium.

\[
Q = \{ n, n \} \quad \{ -n, -n \} : \text{the equity holder received a good signal } s = h \text{ (bad signal } s = l) \text{ and submitted a buy order } u = n \text{ (sell order } u = -n) \text{. The noise trader also submitted a buy (sell) order. Trade is fully revealing and } p(n, n) = E[V | s = h, A = C] \quad p(-n, -n) = E[V | s = l, A = S] \text{. The equity holder does not make a profit in this state.}
\]

\[ Q = \{ n, 0 \} \quad \{ -n, 0 \} : \text{either the equity holder submitted a buy (sell) order and the noise trade did not submit an order, or the equity holder did not submit an order and the noise trader submitted a buy (sell) order. The equilibrium price } p(n, 0) < E[V | s = h, A = C] \quad (p(-n, 0) > E[V | s = l, A = S]) \text{ and therefore the equity holder can make a profit from submitting a buy (sell) order after receiving good (bad) information. This}
\]

Note that the equity holder does not have an incentive to trade in the absence of information. If he were to trade he would move the price against himself with positive probability and thus incur a trading loss. Since he does not stand to gain from a price movement per se, he will therefore not trade at all.
occurs with probability $\theta q(1-\eta) (\theta(1-q)(1-\eta))$. Note that the probability of a profitable state increases with $\theta$.

$Q = \{-n,n\}$: this state can occur in two different ways. (i) The equity holder submits a buy and the noise trader a sell order, or (ii) the equity holder submits a sell and the noise trader a buy order. Again, we have that the equilibrium price $E[V|s = l, A = S] < p(-n,n) < E[V|s = h, A = C]$, and hence it is profitable to submit a buy (sell) order after receiving good (bad) news. This profitable state occurs with probability $\theta q\eta/2 (\theta(1-q)\eta/2)$, which is increasing in $\theta$.

$Q = \{0,0\}$: Neither noise trader nor equity holder submit an order.

This enables us to show the following result.

**Lemma 1** Monitoring effort $\theta^{*}_{\text{trade}}$ when trade in equity is possible is higher than in the absence of trade, i.e. $\theta^{*}_{\text{trade}} > \theta^{*}$, which may increase firm value.

**Proof.** The firm owner maximizes

$$\max_{\theta} E[V^{*}_{\text{trade}}] + E[\pi] - c(\theta).$$

Solving the first-order condition yields a choice of monitoring effort given by:

$$c'(\theta^{*}_{\text{trade}}) = \frac{\partial E[V^{*}_{\text{trade}}]}{\partial \theta} + \frac{\partial E[\pi]}{\partial \theta}$$

As mentioned above, the actual continuation decision is unaffected by trade, which implies that firm value as a function of monitoring effort is the same as in the no-trade case: $E[V^{*}_{\text{trade}}] = E[V^{*}]$. It follows from the prices and order flows above that increasing monitoring effort $\theta$ increases the probability of a state in which trade occurs (but prices are not fully revealing). Therefore, $\frac{\partial E[\pi]}{\partial \theta} > 0$. Since $c(\theta)$ is a convex function, it follows that $\theta^{*}_{\text{trade}} > \theta^{*}$. Note that it is not required that equilibrium trading profits are an increasing function of $\theta$, since those will depend on equilibrium prices, which are more revealing for higher equilibrium values of $\theta$. I.e. it *may* be the case that the equity holder wants to commit to a lower $\theta$ in order to increase equilibrium trading profits. However, all that is required here is that trading profits are an increasing function of $\theta$, *given* the pricing
function of the market maker. We can therefore remain agnostic as to how equilibrium trading profits depend on $\theta$.

If $\theta_{\text{trade}}^* > \frac{\gamma}{b(e-e')} > \theta^*$ then firm value increases because monitoring by the aggregate claimant is now sufficiently high to ensure that the manager exerts a high level of effort. Even if $\theta^* > \frac{\gamma}{b(e-e')}$, firm value may increase once trade is allowed, because the probability of shutting down the firm in bad states is increased. ■

B. Split claim

Let us now consider the case where the aggregate (unlevered) equity claim is split into a debt and equity portion. As before, control rests with the debt holder who acts on information that the equity holder produces by engaging in monitoring activities. In contrast to the previous treatment, it is now assumed that this information is soft. Therefore, equity holders who have received a good signal cannot simply report this to the debt-holder, because equity holders who have learned nothing from monitoring ($s = \emptyset$) have an incentive to also report '$h$'. Instead, equity holders must indirectly reveal part of their information through their trades and debt holders make their liquidation decision contingent on the observed stock price. The distribution of noise trade is assumed to be the same as before.

For the sake of generality suppose that the monitoring equity holder may not own 100% of the equity of a firm. Instead he owns a fraction $\beta \in (0,1]$ of all shares. Suppose also that only this one equity holder engages in monitoring. One way to justify this assumption is to say that equity is widely held and that $\beta$ constitutes the largest block of shares. In this case smaller shareholders may have no incentive to acquire information. Suppose for example that equity holder 1 has a larger stake than equity holder 2. Suppose also that for a monitoring effort $\theta_i > \theta_j$ signals are correlated in the following way: $\text{prob}(s_i \neq \emptyset|s_j \neq \emptyset) = 1$ and $\text{prob}(s_j \neq \emptyset|s_i \neq \emptyset) < 1$, i.e. the higher effort monitor $i$ always receives a signal when monitor $j$ does, but not vice versa. The smaller equity holder has a lower incentive to monitor, even if the per share value of monitoring were equal for either monitor and therefore he would only ever receive a signal when the
larger equity holder receives a signal also. His signal is therefore useless in affecting the continuation decision. In addition if the larger equity holder also trades on his information by submitting orders of size \( n \), the smaller equity holder cannot make a trading profit and therefore has no incentive to acquire information.

The following proposition describes a mechanism by which the equity holder can credibly communicate the information \( s = h \) to the creditor.

**Proposition 3** Let \( \theta_{\text{trade,rev}}^{\text{equity}} \) be the solution to

\[
\beta \bar{c}(R_h - L) - c'(\theta) = 0, \tag{5}
\]

and suppose \( \theta_{\text{trade,rev}}^{\text{equity}} \geq \gamma / (\bar{c} - \underline{c})b \). For \( D = L \) it is then an equilibrium for the equity holder to submit a buy order \( u^{\text{rev}} \geq \beta \frac{\bar{c}}{c'} \) after receiving \( s = h \) and not to submit any order otherwise. Equity prices are given by \( p(\bar{n}, u^{\text{rev}}) = R_h - L \), and \( p(\bar{n}, 0) = 0 \), and the debt holder’s continuation decision is \( A(p = R_h - L) = C \), and \( A(p = 0) = S \).

**Proof.** In this equilibrium the equity holder chooses a buy order \( u^{\text{rev}} \neq n \), which fully reveals the equity holder’s position. Therefore, in equilibrium the order flow is fully revealing of the state \( s = h \), and \( q(p) \equiv \text{prob}(\omega = h|p) = 1 \) in this case. The debt holder is willing to continue the firm if \( q(p) \) satisfies the following condition: \( q(p)D + (1 - q(p))R_l \geq \min\{D, L\} \). Hence, for \( R_l < D \leq L \), the debt holder strictly prefers shut-down unless \( q(p) = 1 \). The debt holder is thus willing to continue the firm after \( Q = \{\bar{n}, u^{\text{rev}}\} \) and the value of total equity is \( R_h - L \). In all other states the firm is shut down and the value of equity is zero. The expected value of the monitor’s stake is given by

\[
E[V^{\text{equity}}] = \beta E[V_{\text{trade,rev}}^{\text{equity}}] = \beta \bar{c}(R_h - L).
\]

The order size \( u^{\text{rev}} \) is determined by the condition that the equity holder not have an incentive to buy in the absence of information (he would never want to buy after receiving bad news, because the value of the firm from continuing is lower in this case than from liquidating it). The expected payoff to the equity holder under the deviation strategy \( u(s = \emptyset) = u^{\text{rev}} \) is given by

\[
E[V^{\text{equity}}] = \beta [\bar{c}(R_h - L) + (1 - \theta)\bar{c}(R_h - L)] + u(1 - \theta)\bar{c}(R_h - L) - p(\bar{n}, u^{\text{rev}})].
\]

Setting \( E[V^{\text{equity}}] \geq E[\hat{V}^{\text{equity}}] \) yields a minimum level of \( u^{\text{rev}} \) given in the proposition. ■
**Corollary 2** Splitting the claim when information is soft and equity can be traded may increase firm value.

This follows directly from proposition 2, where we can see that for $\beta = 1$, $\theta_{\text{trade, rev}} = \theta_{\text{equity}}$.

The above illustrates that when information is soft a mechanism exists that implements the same solution as when information is hard. The fact that the mechanism was implemented using a market on which additional equity could be purchased after receiving good news plays no particular role here. Alternatively one could assume that the monitoring equity holder places an amount $u_{\text{rev}} (R_h - L)$ in an account after claiming to receive good news and that access to this account is contingent on a high realized firm value. However, as has been demonstrated above, non-degenerate trading that allows the privately informed party to make a trading profit, may increase monitoring effort. The question is therefore whether another equilibrium may exist that yields higher monitoring effort by the equity holder than the degenerate trading equilibrium.

Note that when information is private and the debt holder acts on information contained in (noisy) prices, additional considerations need to be taken into account. Firstly, the debt holder’s action requires continuation in some states of the world in which the posterior probability of $\omega = h$ is smaller than one: $q(p) < 1$. Otherwise it is impossible for the equity holder to ever make a trading profit: if the firm is liquidated whenever $q(p) < 1$, a profit from short selling cannot be made, because the value of the firm ceases to be uncertain. When $q(p) = 1$, by definition, the price is fully revealing, which means that no trading profit can be made from buying additional equity. From (3) it can be seen that continuation after $q(p) < 1$ can only be achieved through risky debt $D > L$.

Secondly, there is a drawback from making information available via noisy prices in the form of poorer quality continuation decisions. This reduces the equity holder’s monitoring incentive and makes it harder to satisfy the managerial incentive compatibility constraint, because the link between effort, monitoring and firm continuation or shutdown becomes less direct.
Proposition 4  For block size $\beta$ sufficiently small relative to liquidity $n$, financing the firm with risky debt $D > L$ increases firm value for a non-empty set of parameter values. For larger block sizes relative to liquidity, ‘riskless’ debt $D = L$ dominates.

Proof. Suppose $\theta_{\text{equity}}^{\text{trade,rev}}$ given by the solution to (5) is smaller than $\frac{1}{(\beta - \frac{1}{2})}$, i.e. the equity holder’s monitoring effort is too small to satisfy the manager’s incentive compatibility constraint. Firm value in that case is zero, because the investment project will not be undertaken. Risky debt then increases firm value if it renders high managerial effort choice an equilibrium outcome. In the following we show that this may be the case.

Consider now the following equilibrium in which profitable trading occurs and the debt holder continues the firm at a belief $q < 1$. Suppose the equity holder employs the same trading strategy as before, i.e. $u(s = h) = n$, $u(s = l) = -n$, and $u(s = \emptyset) = 0$.

The posterior $q(n, 0)$ is given by

$$q(n, 0) = \frac{e^{\theta(1 - \eta) + (1 - \theta)^{n/2}}}{e^{\theta(1 - \eta) + (1 - \theta)^{n/2}}}$$

(6)

It follows that $q(n, 0) > q(n, -n) \iff 1 > \tau$. Therefore, debt can be designed such that the debt holder has an incentive to continue the firm after $Q = \{n, 0\}$, but wishes to shut it down after $Q = \{n, -n\}$, i.e. the continuation strategy as outlined in the table maximizes the value of debt given $D$ sufficiently low (see below for the design of debt).

| $s$ | $u$ | $\tilde{n}$ | $Q$ | $A$ | $p(Q)$ | $E[V_{\text{equity}}|s, A]$ | prob |
|-----|-----|-------------|-----|-----|--------|----------------|-------|
| $h$  | $n$ | $n$ | $n, n$ | $C$ | $R_h - D$ | $R_h - D$ | $\theta \tau_e^{n/2}$ |
| $h$  | $n$ | $0$ | $n, 0$ | $C$ | $q(n, 0)(R_h - D)$ | $R_h - D$ | $\theta \tau_e^{1 - \eta}$ |
| $h$  | $n$ | $-n$ | $n, -n$ | $S$ | $0$ | $0$ | $\theta \tau_e^{n/2}$ |
| $\emptyset$ | $0$ | $n$ | $n, 0$ | $C$ | $q(n, 0)(R_h - D)$ | $\tau_e(R_h - D)$ | $(1 - \theta)^{n/2}$ |
| $\emptyset$ | $0$ | $0$ | $0, 0$ | $S$ | $0$ | $0$ | $(1 - \theta)(1 - \eta)$ |
| $\emptyset$ | $0$ | $-n$ | $-n, 0$ | $S$ | $0$ | $0$ | $(1 - \theta)^{n/2}$ |
| $l$  | $-n$ | $n$ | $n, -n$ | $S$ | $0$ | $0$ | $\theta (1 - \tau_e)^{n/2}$ |
| $l$  | $-n$ | $0$ | $-n, 0$ | $S$ | $0$ | $0$ | $\theta (1 - \tau_e)(1 - \eta)$ |
| $l$  | $-n$ | $-n$ | $-n, -n$ | $S$ | $0$ | $0$ | $\theta (1 - \tau_e)^{n/2}$ |

Table 1 shows signal contingent trading strategy, resulting order flows and the continuation decision depending on order flow. Resulting firm value and associated probabilities are also
The expected payoff to the monitoring equity holder is given by $E[V] = \beta E[V_{\text{trade}}] + E[r_{\text{trade}}] - c(\theta)$, where

$$E[V_{\text{trade}}] = \frac{\theta}{\beta} \left( 1 - \eta + \frac{\eta}{2} + (1 - \theta) \frac{\eta}{2} \right) (R_h - D)$$

$$E[r_{\text{trade}}] = n\theta \bar{e} (1 - \eta)(R_h - D - p(n)).$$

Taking the first order condition gives $\theta_{\text{trade}}$ as the solution to

$$c'(\theta) = \bar{e}(1 - \eta)(R_h - D) \left[ \beta + n(1 - q(n, 0)) \right]$$

Several features of this equilibrium are noteworthy. Firstly, in order to effect continuation by the debt holder after $Q = \{n, 0\}$, it is necessary to set $D > L$. This follows from the fact that $q(n, 0) < 1$. In particular, the minimum amount of debt can be calculated using (3): $D_{\text{min}} = \frac{1}{q(n, 0)} (L - R_l) + R_l$. Since $q(n, 0) > \bar{e}$ it is easier to induce continuation after $q(n, 0)$ than it is to do so after $\bar{e}$. By assumption the aggregate claimant continues after a belief $\bar{e}$. Therefore, $D_{\text{min}} < R_h$, i.e. there always exists a gearing ratio that can implement the proposed continuation strategy in equilibrium.

Secondly, note that $\frac{\partial E[V_{\text{trade}}]}{\partial \theta} = (1 - \eta) \frac{R_h - D}{R_h - L} \cdot \frac{\partial E[V_{\text{trade}, \text{rev}}]}{\partial \theta} < \frac{\partial E[V_{\text{trade}, \text{rev}}]}{\partial \theta}$ for $\eta < 1, D > L$, i.e. the monitoring incentive due to increasing the value of the equity holder’s existing stake is reduced, because (i) of noisy prices and, (ii) because by making the debt claim more risky, the equity claim becomes less risky and therefore less sensitive to monitoring effort. Monitoring effort is higher in the non-degenerate trading equilibrium ($\theta_{\text{trade}} > \theta_{\text{trade, rev}}$), when

$$\bar{e}(1 - \eta)(R_h - D_{\text{min}}) \left[ \beta + n(1 - q(n, 0)) \right] > \beta \bar{e}(R_h - L)$$

Note that an increase in $n$ increases $\theta_{\text{trade}}$ as a first order effect. An increase in $\theta$ has two second order effects. Firstly, from (6) it can be seen that it increases $q(n, 0)$, i.e. equilibrium equity prices become more revealing and reduce trading profits per unit traded. Secondly, an increase in $q(n, 0)$ reduces $D_{\text{min}}$ which makes the equity claim steeper and increases monitoring incentives. Similarly, an increase in $\beta$ moves the monitoring incentive in the same direction. It is thus possible to reduce $\beta$ and increase $n$ in such a
way as to leave $\theta_{\text{trade}}^{\text{equity}}$ unchanged, i.e. the effects just offset each other. Such a change has an unambiguously decreasing effect on $\theta_{\text{trade, rev}}^{\text{equity}}$. It is thus possible to find values of $\beta$ and $n$ such that (8) is satisfied.

Thirdly, the manager’s incentive compatibility constraint changes to

$$\tau \left[ \theta \left( 1 - \eta + \frac{n}{2} \right) + (1 - \theta) \frac{n}{2} \right] b - \gamma \geq \xi \left[ \theta \left( 1 - \eta + \frac{n}{2} \right) + (1 - \theta) \frac{n}{2} \right] b.$$  

When the continuation decision is based on noisy prices, it becomes harder to satisfy the manager’s incentive compatibility constraint:

$$\theta \geq \theta_{\text{IC}}^{\text{trade}} = \frac{\gamma}{b (\tau - \xi) \left( 1 - \frac{\eta}{2} \right)}.$$  

Since $\theta_{\text{trade}}^{\text{equity}} - \theta_{\text{trade, rev}}^{\text{equity}}$ is an increasing function of $n$, we can choose $n$ and $\beta$ such that $\theta_{\text{trade}}^{\text{equity}} > \theta_{\text{IC}}^{\text{trade}} > \theta_{\text{IC}}^{\text{trade}} > \theta_{\text{trade, rev}}^{\text{equity}}$.

Finally, it needs to be verified that this equilibrium is implementable, i.e. that the equity holder does not want to deviate from this trading equilibrium. In particular, the equity holder may want to ensure firm continuation after receiving no signal: $u(s = 0) = n$. Such a deviation leads to an increased probability of firm continuation and therefore increases the value of the equity holder’s stake. At the same time, it imposes a trading loss on the equity holder. The payoff from deviating to $u(s = 0) = n$, is given by

$$E[V^{u(s = 0) = n}] = (R_h - D) \beta \tau \left[ 1 - \eta + \frac{n}{2} \right]$$

$$+ (R_h - D) \left[ \theta^\epsilon(1 - \eta)(1 - q(n, 0)) \right]$$

$$- (R_h - D) \left[ (1 - \theta) \frac{n}{2} \left( 1 - \tau \right) + (1 - \eta)(q(n, 0) - \tau) \right].$$  

This yields the following incentive compatibility constraint:

$$n \left[ (1 - \tau) \frac{n}{2} + (1 - \eta)(q(n, 0) - \tau) \right] \geq \beta \tau (1 - \eta).$$  

Again, since we choose $n$ to be large relative to $\beta$ there is a set of parameter values for which the condition (11) is consistent with this trading equilibrium.

Moreover, after receiving $s = l$, the equity holder is indifferent between submitting $u = 0$ and $u = -n$. In either case he does not derive a trading profit, and in either case the value of the equity stake is zero. However, $u(s = l) = 0$ cannot be an equilibrium,
because in that case demand \( Q = \{ n, -n \} \) would be fully revealing of \( u = n \), which would provide an incentive to deviate from \( u(s = l) = 0 \) to \( u(s = l) = -n \).

To summarize, when equity holding is relatively concentrated (\( \beta \) high) the incentive to monitor is mainly provided by the desire to increase the value of the existing stake. In this case also, the incentive to manipulate stock prices in the absence of good news is high, which requires a particularly tough debt holder (‘riskless’ debt) who is only willing to continue the firm when the equity holder fully reveals his information. For more dispersed ownership (\( \beta \) small), the direct incentive to monitor falls. However, by designing debt to be risky, the creditor becomes less tough, and is willing to continue the firm even if stock prices only partially reveal information. This allows the monitoring equity holder to make a trading profit and thus provides an additional monitoring incentive. We would therefore associate dispersed ownership with higher gearing ratios than more concentrated ownership. By the same token, for a given level of ownership dispersion, we would expect to find higher gearing ratios with increased liquidity.

5. Extensions

In future work, we would like to extend this model to consider wage contracts for managers who care about monetary incentives as well as obtaining private benefits from continuation. If the manager can be motivated by monetary rewards, and is informed about the state of the world it is conceivable that he could be induced to report truthfully to the decision-maker. However, we conjecture that if private benefits of control are large enough, it will still be cheaper to hire an equity-holder manager, since the private benefits represent an additional bias in favour of reporting favourable information that the equity holder does not have. This means that it will be more expensive to illicit the truth from the manager (especially if he is cash-constrained). We could then allow renegotiation to take place between all three parties. We should also investigate renegotiation when trade is allowed and information is soft.

Another issue which should be investigated is the possibility of simultaneous information acquisition by several parties. For the moment, we have implicitly assumed that
only one agent can hold the monitoring technology, so that even when the debt-holder holds risky debt, he does not monitor. If the debt-holder may also monitor in this case, this may sap the initiative of the equity-holder in monitoring, as in Aghion and Tirole (1997).

6. Conclusion

In this paper we have explored the way in which splitting claims on a firm’s cash flow can be used to increase the quantity of information generated about the firm’s future prospects, and thence enhance managerial incentives. Unless one allows firms to issue securities that are negatively correlated with their own value (which seem to be very rare in practice), it is not obvious a priori how splitting claims can generate more information. Incentives to produce information 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. (In other words, dividing up returns according to the state of the world cannot make anyone’s profit increase faster with the state of the world than does aggregate profit unless someone else’s return is decreasing in the state of the world). We show that incentives can be increased by dividing up claims in such a way that gives one claim-holder a (credible) incentive to destroy value in the absence of information production.

In particular, we have shown that dividing up claims on a firm’s cash flow into a (safe) debt claim and a (risky) equity claim can increase monitoring effort, which will sometimes be beneficial to a firm if it induces the manager to exert more effort. The mechanism through which this occurs is the following. Because the debt-holder’s claim is insensitive to high profits, the debt-holder has an inherent bias towards shutdown, which allows him to redeem all his debt with certainty. He will be reluctant to continue unless he receives information which persuades him that the chances of his not being able to redeem all of his debt from the firm at a later date are minimal. Shutting down the firm early destroys value, but the debt-holder is indifferent to this since the cost of early shutdown falls on the equity-holder. This destruction of value, however, gives the
equity-holder a disproportionate incentive to collect information, since if he does not do so, the firm will certainly be shut down. This contrasts with the case where all cash flows are due to an aggregate claim, where continuation would be optimal even in the absence of information, so there is very little incentive to collect information. We showed that this analysis was robust to renegotiation between claim-holders.

We also showed how this analysis can be extended to the case of soft information, where the monitor cannot simply report good outcomes to the decision maker (except in the case of the aggregate claim, where these are one and the same). Instead, he must ‘post a bond’ when he reports that the outcome will be good, which will be redeemed only if the outcome is indeed good. This is equivalent to the equity-holder buying shares in the market place when firm prospects are good. The debt-holder will then look at the firm’s stock price in order to determine whether to close the firm or not. This yields the prediction that the manager cares strongly about the firm’s share price, even though he cares only about continuation of the firm and not at all about a monetary reward. This is because the share price contains information which the debt-holder can use to make his decision, because the debt-holder himself has no incentive to collect costly information.

We show further that if the amount of liquidity trade in the stock is large relative to the size of the equity holder’s blockholding, then it can be optimal to make continuation decisions based on a noisy stock price. To achieve this, one must soften the decision maker somewhat by financing the firm using risky debt (rather than safe debt, which is always optimal in the hard information case). The debt holder will then choose to continue as long as the stock price is high enough. The presence of noise trade means that sometimes the firm will be continued when its value is low (but the noise traders have bought), so it is not obvious that this is value-enhancing. Further, it directly reduces the monitor’s (and hence the manager’s) incentives, since his information is transmitted only with random error (from the noise-trader trades) to the debt-holder. However, the fact that the firm is sometimes continued when the price is less than fully revealing allows the equity-holder to make a trading profit on his information, giving him more incentive to collect it; and this effect can sometimes dominate.

In writing this paper we highlight a fundamental trade-off which is probably of wider
importance than the simple application given here. *Decision makers with good incentives to take tough decisions necessarily have poor incentives to collect information*, because the first requires outcome-insensitive claims whereas the latter requires outcome-sensitive claims. Thus there is a natural division of labour between those who collect information and those who act on it, and sum of the parts may be more than the whole in this case.

References


