# Regulation of Hedge Funds and Corporate Governance: A New Perspective

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**Abstract**

Hedge funds are key players in capital markets and we analyze the implications of their involvement in the creditors board of financially distressed companies. We look at the effects of the fact that hedge funds are not required to report their exposure in a distressed company's stock prior to their voting in the creditors board. Absent any agency problem, a CFO who wants to maximize shareholder's payoff chooses a restructuring plan based on her beliefs about creditors positions in the company's stock. This uncertainty leads to contingencies where the creditors board inefficiently rejects the restructuring plan. Our model suggest that requiring creditors to report their aggregate exposure to the company's securities might lead to a better voting outcome.

## 1 Introduction

Due to good past returns, hedge funds attracted a large inflow of capital. As traditional strategies could not generate the previous level of returns, hedge funds diversified their strategy set. In particular, over the past five years, hedge funds have become a key player in capital markets, specializing in high-risk loans to the financially distressed, cf. (Durfee 2006).

Hedge funds' involvment in financially distressed markets can potentially lead to a number of well documented problems.[1] First, they might trade using information they obtain while sitting on companies' creditors committees. In 2004, the SEC accused Blue River

[1] Claims made here of hedge fund behavior apply only to a small subset of this vast industry.

Capital LLC of using confidential information to trade in shares of WorldCom, Adelphia, and Globalstar. Second, a hedge fund can potentially use loans as means to an eventual takeover, a tactic known as "loan-to-own". During a bankruptcy, a creditor holding a lien can typically negotiate to swap debt for a stake in the company. If the company retires its existing equity (typically worthless by the time of bankruptcy) the creditors become the new owners. Third, hedge funds may be more aggresive than banks when borrowers run into financial problems. A good example, (Durfee 2006), is Calpine, a large power producer, which filed for Chapter 11 bankruptcy in 2005. Previously, Harbert Distressed Investment Master Fund, a New York hedge fund, sued Calpine for violating its debt covenants.

Quoting, again, (Durfee 2006) "...Chuck Bralver, executive director of Mercer Oliver Wyman, a financial consultancy in New York. He suggests CFOs investigate whether a fund has a position in the company's stock before borrowing...". This raises another issue which is the effect of CFO's uncertainty regarding a hedge funds' position in the company's stock. We suggest a simple framework that allows us to address this. In our model, in case of bankruptcy, the CFO has to suggest a debt restructuring plan. Any uncertainty regarding the hedge fund stock position results in a restructuring plan that is sub-optimal, in the sense that the plan might be rejected by the creditor board. A rejection of the restructuring plan results in liquidation of the company. The sub-optimality results from liquidation, since we assume that it is always socially beneficial to continue the company.

A key ingredient in our model is the assumption that the hedge fund has an unknown position in the company's stock. Such a situation challenges the existing corporate governance mechanisms and might derail companies from reaching a socially desired outcome. We address the governance implication of "credit events", and especially of the voting procedure to debt restructuring decisions. This is a special credit event that leaves room for unregulated debt holders (such as hedge funds) to vote according to opportunistic strategies that are forbidden to other more regulated intermediaries (such as mutual funds and banks). For example, banks in the United States are allowed only to have long positions in the equity of their clients, and this only in case of financial distress.[2] Hedge funds can have short equity positions and hold debt in the same company. If a hedge fund holds a short position on the equity of a firm and also owns debt, she will vote according to his aggregate exposure to the company's securities. This might lead to the rejection of an "overall" beneficial plan.

We provide a new theoretical framework that is inspired by current hedge funds' strategies, particularly capital structure arbitrage. We approach this strategy by combining the classical corporate governance framework with one inspired by popular press accounts of hedge funds' activities. The corporate governance literature is extensive and it is thoroughly reviewed in (Becht, et al. 2002). Traditionally, theoretical research in corporate governance has taken an agency perspective, as in (Hart 1995). On the empirical side, (Yu 2005) and (Agarwal & Naik 2000) address the profitability of capital structure arbitrage. Our work is also inspired by current hedge funds' strategies, as depicted in the press. Good examples of financial press articles addressing hedge funds' capital structure strategy are (Currie & Morris 2002) and (Durfee 2006). More details about companies in default and debt restructuring can be found in (White 1994) and in (Chatterjee, et al. 1996).

The rest of the paper is structured as follows. In Section 2 we present the model and make preliminary observations. Then in Section 3 we study the efficiency of majority voting under the assumption that the manager knows the full distribution of credit and equity. Specifically, in subsection 3.1 we do this under the restriction that no creditor holds equity, in subsection 3.2 we allow for equity holdings but only long positions and in subsection 3.3 we allow for any equity position for creditors. We depart from the full knowledge assumption is Section 4 where we focus on two special cases, one in which there is a prevalent creditor, in subsection 4.1, and one in which there are many "small" and symmetric creditors, in subsection 4.2. Finally, in Section 5 we draw conclusions and provide directions for future research.

[2] The main rationale for allowing banks to be long in both debt and equity for the same company is to have its incentives aligned to those of its debtors.

## 2 Model

The manager of a company wants to finance a project whose budget is $B$. The manager is benevolent and has no own wealth so the project will be financed solely from creditors (debt) and shareholders (equity). At date 0 the decision to finance or not is taken. Given that the project is financed it yields cash flows $y_1$, $y_2$ in periods 1 and 2 respectively. The cash flows $y_1$, $y_2$ are i.i.d. continuous random variables with atom-less, continuous cumulative (probability) distribution function $F$ $(f)$ and support $[\underline{y}, \bar{y}]$, where $\bar{y} > \underline{y} > 0$. The realization of $y_1$, $y_2$ is observable at the corresponding period. At period 2 the project is terminated and the liquidation value of its assets at that point is $l_2 \equiv 0$. If liquidation occurs in period 1, the return from the assets is $l_1 \equiv l > 0$, where $l$ is a *known* constant.

We assume that there is a *given* corporate structure $D, E$ at date 0 that is sufficient to finance the project,[3] that is,

$$D + E = B. \tag{1}$$

All decision makers (creditors, shareholders, the manager) are risk neutral and have a common discount factor of one. Financing the project is ex-ante efficient, that is $\mathbb{E}[y_1 + y_2] > B$. The issuance of debt follows a standard debt contract $(D, p_1, p_2)$ where creditors agree to lend $D$ at date 0, for coupon payments $p_1, p_2$ at dates 1,2 respectively. What is left from the incoming cash flows at each period is given to the shareholders as dividend payments. Failure to make a *full* payment to creditors at date 1 initiates a debt restructuring procedure.[4] In case the debt restructuring occurs, the manager proposes a new coupon payment $\hat{p}_2$ for period 2. The members of the creditor board (and only them) have to decide between accepting the new contract and continuing the project or liquidation. The voting outcome is determined via some pre-specified rule[5] where the number of votes casted by each creditor

[3] $D, E$ should be understood as the dollar value of debt and equity respectively at date 0.

[4] Here we do not allow for the issuance of short term debt to pay off date 1 debt, that is, debt roll-over is prohibited.

[5] Although the U.S. law specifies different rules, from unanimity outside bankruptcy to a majority rule in bankruptcy, we allow for a general rule here.

is proportional to the fraction of debt she holds.

Given all these assumptions, the payments to creditors are[6]

If $y_1 \geq p_1$ pay $p_1$ in period 1

$\rightarrow$ if $y_2 \geq p_2$ pay $p_2$ in period 2 $\Box$

$\rightarrow$ if $y_2 < p_2$ pay $y_2$ in period 2 $\Box$

If $y_1 < p_1$ propose $\hat{p}_2$ and debt restructuring procedure starts

$\rightarrow$ if voting outcome is *yes* pay $y_1$ in period 1

$\rightarrow$ if $y_2 \geq \hat{p}_2$ pay $\hat{p}_2$ in period 2 $\Box$

$\rightarrow$ if $y_2 < \hat{p}_2$ pay $y_2$ in period 2 $\Box$

$\rightarrow$ if voting outcome is *no* pay $y_1 + l$ in period 1$\Box$[7]

and, similarly, the payments to shareholders are

If $y_1 \geq p_1$ pay $y_1 - p_1$ in period 1

$\rightarrow$ if $y_2 \geq p_2$ pay $y_2 - p_2$ in period 2 $\Box$

$\rightarrow$ if $y_2 < p_2$ pay 0 in period 2 $\Box$

If $y_1 < p_1$ propose $\hat{p}_2$ and debt restructuring procedure starts

$\rightarrow$ if voting outcome is *yes* pay 0 in period 1

$\rightarrow$ if $y_2 \geq \hat{p}_2$ pay $y_2 - \hat{p}_2$ in period 2 $\Box$

$\rightarrow$ if $y_2 < \hat{p}_2$ pay 0 in period 2 $\Box$

$\rightarrow$ if voting outcome is *no* pay 0 in period 1$\Box$

Since creditors and shareholders are risk neutral they must be in expectation indifferent between financing the project or not, hence the following must hold

$$\begin{aligned} D &= \bar{F}(p_1)\left\{p_1 + \bar{F}(p_2)p_2 + \mathbb{E}[y_2\chi_{\{y_2<p_2\}}\right\} \\ &\quad +v\left\{\mathbb{E}[y_1\chi_{\{y_1<p_1\}}] + F(p_1)\left[\bar{F}(p_2)p_2 + \mathbb{E}[y_2\chi_{\{y_2<p_2\}}]\right]\right\} \\ &\quad +(1-v)\left\{F(p_1)l + \mathbb{E}[y_1\chi_{\{y_1<p_1\}}]\right\}, \end{aligned} \tag{2}$$

[6]Abusing notation slightly we use the same symbol for random variables and their realization.
[7]Assuming that $y_1 + l < p_1 + p_2$.

$$E = \mathbb{E}[(y_1 - p_1)\chi_{\{y_1 \geq p_1\}}] + \bar{F}(p_1)\mathbb{E}[(y_2 - p_2)\chi_{\{y_2 \geq p_2\}}] + F(p_1)\, v\, \mathbb{E}[(y_2 - \hat{p}_2)\chi_{\{y_2 \geq \hat{p}_2\}}], \tag{3}$$

where $\bar{F} = 1 - F$, $\chi$ is the indicator function, and $v$ is the probability of the outcome being yes in voting.

In order to analyze voting we specify in more detail the characteristics of creditors and shareholders. Let $\mathcal{S}$ be the set of shareholders each with $-E \leq e_i \leq E$ and $e_i \neq 0$, $i \in \mathcal{S}$ shares (in monetary units), that is $\sum_{i \in \mathcal{S}} e_i = E$, and let $S$ be the cardinality of $\mathcal{S}$.[8] Similarly, $\mathcal{C}$ is the set of creditors each with $d_j > 0$, $j \in \mathcal{C}$ debt share (in monetary units), that is $\sum_{j \in \mathcal{C}} d_j = D$, and $C$ is the cardinality of $\mathcal{C}$. Now the crux of this paper is the assumption that there is a set, $\mathcal{K}$ with cardinality $K$, of equity holders who also hold debt. That is $\mathcal{S} \cap \mathcal{C} = \mathcal{K}$ but there also pure equity and pure debt holders, that is $\mathcal{S} \not\subseteq \mathcal{C}$ and $\mathcal{C} \not\subseteq \mathcal{S}$.[9]

When creditors decide to vote in favor or against the restructuring they will compare the payoff they get in each case.[10] *Given* the manager's proposed period 2 payment $\hat{p}_2$ the continuation payoff (that is if the outcome is yes) to a *pure* creditor (that is not in $\mathcal{K}$) is,

$$\hat{p}_2 \bar{F}(\hat{p}_2) + \mathbb{E}[y_2 \chi_{\{y_2 < \hat{p}_2\}}] \triangleq D(\hat{p}_2), \tag{4}$$

and the continuation payoff for a *pure* shareholder (that is not in $\mathcal{K}$) is

$$\mathbb{E}[(y_2 - \hat{p}_2)\chi_{\{y_2 \geq \hat{p}_2\}}] \triangleq E(\hat{p}_2), \tag{5}$$

also[11]

$$D(\hat{p}_2) + E(\hat{p}_2) = \mathbb{E}[y_2] \triangleq y, \tag{6}$$

[8] We impose a limit on how short a position in equity can be.

[9] All sets are finite.

[10] We assume that there is no cost associated with voting and that voting is compulsory for all creditors. The rationale for doing so is to avoid worrying about each creditor's willingness to vote which is a function of the probability of being pivotal.

[11] The non-continuation payoff is $l$ and 0 for a creditor and a pure shareholder respectively.

Note that $D(\underline{y}) = \underline{y}$ and so $E(\underline{y}) = y - \underline{y}$ while $D(\bar{y}) = y$ and so $E(\bar{y}) = 0$. To make continuation efficient in the expected sense we assume that $l < \mathbb{E}[y_2] = y$. Moreover, in order to make liquidation beneficial in some cases we need $l > \underline{y}$. These are summarized below.

**Main Assumption:** $\underline{y} < l < y$.

**Lemma 1.** *$D(\hat{p}_2)$ ($E(\hat{p}_2)$) is increasing (decreasing) in $\hat{p}_2$.*

*Proof.* We have $D(x) = x(1 - F(x)) + \int_0^x y f(y) dy$, so the derivative is $1 - F(x) - xf(x) + xf(x) = 1 - F(x) > 0$ for $x \in [\underline{y}, \bar{y})$, hence D(x) is increasing in $x$. Since $E(x) = y - D(x)$, $E(x)$ is decreasing in $x$. □

Also, $D(\hat{p}_2)$, $E(\hat{p}_2)$ are strictly positive functions for $\hat{p}_2 \in [\underline{y}, \bar{y})$. Therefore a *pure* creditor $i$ ($i \in \mathcal{K}^c$) will vote yes for restructuring if

$$D(\hat{p}_2) \geq l,$$

otherwise she will vote no. On the other hand a *mixed* creditor $i$ ($i \in \mathcal{K}$) will vote yes if

$$D(\hat{p}_2)\frac{d_i}{D} + E(\hat{p}_2)\frac{e_i}{E} \geq l\frac{d_i}{D} \Rightarrow D(\hat{p}_2) + E(\hat{p}_2)\frac{e_i}{d_i}\frac{D}{E} \geq l,$$

and otherwise she will vote no. To simplify notation, for any $i \in \mathcal{C}$ define

$$\delta_i = \frac{e_i}{d_i} \cdot \frac{D}{E}.$$

Given this new metric $\delta_i$ the condition for a yes vote for all $i \in \mathcal{C}$ becomes

$$D(\hat{p}_2) + E(\hat{p}_2)\delta_i \geq l.$$

At the moment of voting default already occurred so the dollar values of debt and equity are no longer $D, E$ respectively. However the fraction of shares for each $i \in \mathcal{C}$ are constant and remain $d_i/D, e_i/E$. Hence, the fraction of yes votes is

$$\sum_{i \in \mathcal{C}} \frac{d_i}{D} \chi_{\{D(\hat{p}_2)+E(\hat{p}_2)\delta_i \geq l\}} \triangleq A(\hat{p}_2). \tag{7}$$

So if $A(\hat{p}_2) \geq \tau$ the outcome of voting is yes, where $\tau$ denotes the arbitrary threshold that is stipulated by the regulators; recalling our definition of $v$ as the probability of yes in voting we canwrite that, $v = \chi_{\{A(\hat{p}_2) \geq \tau\}}$.

A remaining question is how the manager picks $\hat{p}_2$. Initially, we assume that the manager knows the sets of shareholders and creditors as well as the position each one holds, which we denote as $F_{d,e}$. Since we assume no agency problems the manager's goal is to maximize the expected return to shareholders ex-ante, that is before voting. That payoff is simply $vE(\hat{p}_2) = \chi_{\{A(\hat{p}_2) \geq \tau\}} E(\hat{p}_2)$. Since $v$ is a $\{0,1\}$ function the manager will first try to pick a $\hat{p}_2$ such that the outcome of voting is yes. If there are more than one $\hat{p}_2$ that guarantee continuation the manager picks the smallest. The following Lemma gives us the monotonicity of $D(\hat{p}_2) + E(\hat{p}_2)\,\delta_i$ with respect to $\hat{p}_2$ for different values of $\delta_i$.

**Lemma 2.** *If $\delta_i < (>)1$ then $D(\hat{p}_2) + E(\hat{p}_2)\delta_i$ is increasing (decreasing) with $\hat{p}_2$.*

*Proof.* $D(\hat{p}_2) + E(\hat{p}_2)\delta_i = D(\hat{p}_2)\,(1-\delta_i) + y\delta_i$, where the equality follows from (6). From Lemma 1 we see that for $\delta_i < (>)1$ the above is increasing (decreasing) with $\hat{p}_2$. □

Now, define $\hat{p}_2^0$ as

$$D(\hat{p}_2^0) = l$$

and $\hat{p}_2^i$ for $i \in \mathcal{K}$ as

$$D(\hat{p}_2^i) + E(\hat{p}_2^i)\delta_i = l \Rightarrow E(\hat{p}_2^i) = \frac{y-l}{1-\delta_i},$$

for all $i$. Since $\underline{y} < l < y$, if $1-\delta_i \leq 0$ or $\delta_i \geq 1$ for some $i$, then for those $i$'s the definition of $\hat{p}_2^i$ is vacuous and by convention we set it equal to $\underline{y}$ because these (mixed) creditors vote yes no matter what. Similarly, if $\delta_i < 1$ and $\delta_i > \frac{l-y}{y-\underline{y}} \Rightarrow E(\underline{y}) < \frac{y-l}{1-\delta_i}$, those $i$'s always vote yes and so we set their $\hat{p}_2^i$ to $\underline{y}$. However, a solution for $\hat{p}_2^i$ exists in the case where $\delta_i < 1$

and $\delta_i \leq \frac{l-y}{y-\underline{y}} \Rightarrow E(\underline{y}) \geq \frac{y-l}{1-\delta_i}$.[12] These (mixed) creditors vote yes for payments $\hat{p}_2$ greater or equal to $\hat{p}_2^i$ and vote no otherwise. These are summarized in Table 1.

| $\delta_i$ | $\leq \frac{l-y}{y-\underline{y}}$ | $> \frac{l-y}{y-\underline{y}}$ |
|---|---|---|
| $i$ votes | YES, if $\hat{p}_2 \geq \hat{p}_2^i \in [\underline{y}, \bar{y}]$,<br>NO, otherwise, | always YES, set $\hat{p}_2^i = \underline{y}$. |

Table 1: Individual ratios of equity to debt and voting decisions.

**Lemma 3.** *We have*

$$\hat{p}_2^i \leq \hat{p}_2^j \iff \delta_i \geq \delta_j.$$

*From that follows* $\hat{p}_2^i < \hat{p}_2^0 < \hat{p}_2^j$ *for all* $i \in \{\mathcal{C} : e_i > 0\}$ *and for all* $j \in \{\mathcal{C} : e_j < 0\}$.

*Proof.*

- Case 1: Two creditors $k, l$ such that $\delta_i \leq \frac{l-y}{y-\underline{y}}$. As mentioned for such $k, l$ we have $\hat{p}_2^k, \hat{p}_2^l \in [\underline{y}, \bar{y}]$, and

$$\begin{aligned} \delta_k &\geq \delta_l \iff \\ \frac{y-l}{1-\delta_k} &\geq \frac{y-l}{1-\delta_l} \iff \\ E(\hat{p}_2^k) &\geq E(\hat{p}_2^l) \iff \\ \hat{p}_2^l &\leq \hat{p}_2^k, \end{aligned}$$

  strict for $\delta_k > \delta_l$.

- Case 2: One creditor $C$ such that $\delta_m > \frac{l-y}{y-\underline{y}}$. She always votes yes and (by convention) $\hat{p}_2^m = \underline{y}$; hence, equal or more that any creditor for which $\delta_i \leq \frac{l-y}{y-\underline{y}}$. If there are two creditors like $C$ then $\hat{p}_2^i$ is the same for them even for different $\delta_i$.

- Case 3: Two creditors $k, l$ such that $\hat{p}_2^k = \hat{p}_2^k = \underline{y}$. They either both have $\delta_k = \delta_l = \frac{l-y}{y-\underline{y}}$ or (without loss of generality) $\delta_k = \frac{l-y}{y-\underline{y}} < \delta_l$.

[12] Note that $D(\bar{y}) = y > l$ so $E(\bar{y}) < y - l$ and $E(\bar{y}) < \frac{y-l}{1-\delta_i}$ for all $0 \leq \delta_i < 1$.

Note that there is no need for special treatment of a pure creditor ($e_i = \delta_i = 0$) or for creditors who are short on equity ($e_i < 0$). □

# 3 The $\tau$-Majority Rule with Full Information

## 3.1 No Mixed Positions allowed

As a benchmark we, initially, consider the case where there are no mixed creditors, that is $|\mathcal{K}| = K = 0$. Pure creditors have their interests aligned as exhibited earlier. Specifically, they all vote yes no matter their individual debt holdings $d_i$, if the proposed payment $\hat{p}_2$ is such that $D(\hat{p}_2) \geq l$. *Assuming* that they vote yes if indifferent we see that if $\hat{p}_2 \geq \hat{p}_2^0$ they *all* vote yes and otherwise they all vote no. Hence, all $\tau$-majority rules yield the efficient outcome (continuation) in the former case and the inefficient one (liquidation) in the later. Since the manager's concern is to pick the minimum $\hat{p}_2$ such that the voting outcome is yes, in this pure only creditor case we have that $\hat{p}_2^{pure} = \hat{p}_2^0$. The above are summarized in the following lemma.

**Lemma 4.** *Assume all creditors are pure creditors, that is $K = 0$. Then for all possible distributions of equity holdings $\{e_i\}_{i \in \mathcal{S}}$ and debt holdings $\{d_i\}_{i \in \mathcal{C}}$, $F_{d,e}$, and for all levels of regulatory established $\tau$, setting $\hat{p}_2^{pure} = \hat{p}_2^0$ yields the efficient outcome. This is independent of $\tau$ and of the joint distribution $F_{d,e}$.*

*Proof.* See discussion above. □

## 3.2 Allowing for Long Only Mixed Positions

Now we allow for mixed creditors but with the restriction that they only hold long equity positions, that is $K > 0$, and if $i \in \mathcal{K}$ this implies that $e_i \geq 0$. To see how the manager chooses potentially another equilibrium level of $\hat{p}_2$, we will rank the creditors on the basis of their $\hat{p}_2^i$ which is equivalent to using the metric $\delta_i$, cf. Lemma 3. Then we get a lemma corresponding to this case.

**Lemma 5.** *Assume there are mixed creditors but with long* only *positions on equity. Then for all possible distributions of equity holdings* $\{e_i\}_{i \in \mathcal{S}}$ *and debt holdings* $\{d_i\}_{i \in \mathcal{C}}$, $F_{d,e}$, *and for all levels of regulatory established* $\tau$, *we can find* $\hat{p}_2^{mixed}$ *that yields the efficient outcome. This* $\hat{p}_2^{mixed}$ *depends on both* $\tau$ *and the joint distribution* $F_{d,e}$.

*Proof.* Note that the manager is restricted to suggest $\hat{p}_2 \in [\underline{y}, \bar{y}]$. To show that for any level of $\tau \in [0,1]$, the social optimum is reached, one has to compute $A(\hat{p}_2)$. We claim that $A(\hat{p}_2^0) = 1$: The *pure* creditors will always accept an offer of at least $\hat{p}_2^0$, by definition. For any *mixed* creditor $i$, Lemma 3 guarantees that they will accept $\hat{p}_2^0$ since $\delta_i > 0$. Therefore, all creditors (mixed or pure) will accept $\hat{p}_2^0$. Furthermore, if the particular joint distribution $F_{d,e}$ generates a voting relevant distribution $A(\cdot)$ such that there exists $\hat{p}_2 < \hat{p}_2^0$ with $A(\hat{p}_2) = \tau$ then $\hat{p}_2^{mixed} < \hat{p}_2^{pure}$ for all $\tau$. □

The previous result comes to confirm the intuitive implications of allowing creditors to be equity holders. By internalizing the capital structure of the company, the group of *mixed* creditors weakly lowers the required promised level of repayments and thus makes continuation even more likely than before. Since this is a $y$-sum game, the fact that less has to be promised to creditors for the company to avoid liquidation implies that the equity holders are the net beneficiaries of this process of capital structure internalizing. Arguably, *pure* creditors do not appreciate the existence of *mixed* creditors.[13]. However, no matter if there are mixed creditors or not the current voting scheme achieves the social optimum when there is no creditor with a short equity position.

[13] It would be interesting for us to check whether, in practice, restrictions on equity participation are imposed through credit contracts.

### 3.3 Allowing for Any Mixed Positions

The previous sub-sections showed us that the current voting scheme works perfectly in a world with long only positions. We extend the analysis now by bringing into the picture the *unregulated* agents, who are allowed to go short in the company's stock as well as be in its creditors' board. Since we have the whole apparatus in place, we proceed to our main result of the section, which tells us that the current voting scheme delivers the socially desirable outcome, if the manager has access to full information.

**Lemma 6.** *Assume there are mixed creditors with potentially long and short positions on equity. Then for all possible distributions of equity holdings* $\{e_i\}_{i \in \mathcal{S}}$ *and debt holdings* $\{d_i\}_{i \in \mathcal{C}}$, $F_{d,e}$, *and for all levels of regulatory established* $\tau$, *we can find* $\hat{p}_2^{short}$ *that yields the efficient outcome. This* $\hat{p}_2^{short}$ *depends on both* $\tau$ *and the joint distribution* $F_{d,e}$. *The suggested* $\hat{p}_2^{short}$ *satisfies* $\hat{p}_2^{mixed} \leq \hat{p}_2^{pure} \leq \hat{p}_2^{short}$.[14]

*Proof.* The manager has to suggest $\hat{p}_2 \in [\underline{y}, \bar{y}]$. Using Lemma 3, we can rank all the creditors in descending order of their $\hat{p}_2^i, \forall i \in \mathcal{C}$. As creditors are restricted in their potential short position for equity, the creditor with the highest $\hat{p}_2^i$, has $\hat{p}_2^{(1)} < \overline{y}$.[15] When the manager chooses $\hat{p}_2 = \hat{p}_2^{(1)}$, continuation has unanimity since then $A(\hat{p}_2) = 1$. There is always a $q \in \{2, .., C\}$ such that $A(\hat{p}_2^{(q)}) \geq \tau$ and $A(\hat{p}_2^{(q-1)}) < \tau$. When choosing $\hat{p}_2 = \hat{p}_2^{(q)}$ the manager guarantees continuation while maximizing the shareholders payoff. □

# 4 The $\tau$-Majority Rule with Imperfect Information

So far we assumed that the manager is fully aware of the distribution of debt and equity amongst the creditors and shareholders respectively. This assumption lead to Lemmas 4-6 . In brief these stated that for any distribution of debt and equity, $F_{d,e}$, and any *fixed* majority rule $\tau$, the manager can pick new coupon payment $\hat{p}_2 \in [\underline{y}, \bar{y}]$ such that continuation is

[14] This result holds for any comparative statics exercise we could imagine.
[15] The $(i)$ notation refers to the $i$th highest.

achieved (or equivalently the outcome of voting is yes with probability one). In this section we wish to depart from this assumption. Specifically consider the case that the manager does not know the distribution $F_{d,e}$ but rather has some beliefs, captured by $G$, on the space of all possible $F_{d,e}$.

Initially we will be silent on how beliefs $G$ are formed. Taking $G$ as exogenous the manager will still try to maximize the expected value to shareholders prior to voting, $\mathbb{E}_G\left[E(\hat{p}_2)\chi_{A(\hat{p}_2\geq\tau)}\right]$, where $\mathbb{E}_G$ denotes the expectation with respect to beliefs $G$. The first term of the product inside the expectation is the expected (with respect to the second period outcome $y_2$) return to shareholders conditional on continuation and hence it does not depend on $F_{d,e}$. The second term is the probability of continuation and recalling the definition of $A(\hat{p}_2)$, cf. (7), it can be seen that it depends on $F_{d,e}$. So the manager's problem becomes

$$\max_x E(x)\mathbb{P}_G[A(x)\geq\tau],$$

and $\hat{p}_2 = \arg\max_x E(x)\mathbb{P}_G[A(x)\geq\tau]$.

## 4.1 Prevalent Creditor

To simplify exposition assume that there exists a prevalent shareholder, $h\in\mathcal{K}$, who has at least a fraction $\tau$ of bond holdings; in essence she can enforce whichever policy she wishes. Since $\tau\leq d_h/D\leq 1$ or $\tau\,D\leq d_h\leq D$ and, as before, $-E\leq e_h\leq E$ we have $-1/\tau\leq\delta_h\leq 1/\tau$, where $\delta_h=(e_h\,D)/(d_h\,E)$. Also, let $P$ be the distribution of $\delta_h$ assumed to be continuous, atom-less and differentiable with density $p$ in $[-1/\tau,1/\tau]$. Hence,

$$\begin{aligned}\mathbb{P}_G[A(x)\geq\tau] &= \mathbb{P}_P[D(x)+E(x)\,\delta_h\geq l]\\ &= \mathbb{P}_P\left[\delta_h\geq 1+\frac{l-y}{E(x)}\right]\end{aligned}$$

$$= \quad 1 - P\left(1 + \frac{l-y}{E(x)}\right).$$

Therefore the manager's problem is

$$\max_x \left\{ E(x)\left[1 - P\left(1 + \frac{l-y}{E(x)}\right)\right]\right\},$$

or

$$\max_z \left\{ z\left[1 - P\left(1 + \frac{l-y}{z}\right)\right]\right\},$$

where $z \triangleq E(x)$ and since $x \in [\underline{y}, \bar{y}]$, $z \in [0, y - \underline{y}]$ (recall that $y$ is the mean of the distribution on the period two cash flow). In order to secure continuation we must have,

$$1 - P\left(1 + \frac{l-y}{z}\right) = 1$$

$$\Rightarrow \quad 1 + \frac{l-y}{z} = -\frac{1}{\tau}$$

$$\Rightarrow \quad z = \tau\,\frac{y-l}{1+\tau}.$$

In order for this $z$ to be feasible in the manager's problem we must have $F(f)$ such that $(1+\tau)\underline{y} > y$, otherwise no matter $P$, the probability of continuation is less than one. Hence assume that we have $f$ and $\tau$ such that $(1+\tau)\underline{y} > y$. The following Lemma provides a sufficient condition on $P$ that guarantees that continuation does not occur with certainty.

**Lemma 7.** *Continuation occurs with probability less than one if we have distribution $P$, with density $p$, over the prevalent creditor's $\delta_h$ such that*

$$p\left(-\frac{1}{\tau}\right) \neq \frac{\tau}{1+\tau}.$$

*Proof.* The manager's problem is

$$\max_z \left\{ z \left[ 1 - P\left(1 + \frac{l-y}{z}\right)\right]\right\}.$$

The only choice of $z$ that guarantees continuation is $z_0 \triangleq \tau(y-l)/(1+\tau)$. If the derivative of the objective with respect to $z$ is not equal to 0 at $z_0$ then $z_0$ cannot be an extremum and hence the manager will not pick it when solving the above problem.[16] Taking the derivative of the objective function our sufficient condition is

$$1 - P\left(1 + \frac{l-y}{z_0}\right) + \frac{l-y}{z_0} p \left(1 + \frac{l-y}{z_0}\right) \neq 0$$

but by definition $1 - P\left(1 + (l-y)/z_0\right) = 1$ hence the above becomes,

$$p\left(1 + \frac{l-y}{z_0}\right) \neq \frac{\tau}{1+\tau},$$

or by substituting $z_0$

$$p\left(-\frac{1}{\tau}\right) \neq \frac{\tau}{1+\tau}.$$

□

Note that if the objective is concave the above condition is also necessary.

## 4.2 Symmetric Creditors

In this subsection consider, instead, the case where there are many investors with credit positions equal to $\epsilon D$, that is if $|\mathcal{C}| = C$ then $\epsilon = 1/C$. This is common knowledge between creditors and the manager. Furthermore, for all $i \in \mathcal{C}$, $-E \le e_i \le E$, so that $-1/\epsilon \le \delta_i \le 1/\epsilon$. In addition suppose that the distribution of $\delta_i$ is identical for all $i \in \mathcal{C}$, let $S$ with

[16] The existence of a maximum is guaranteed by Weierstrass' Theorem which states that every continuous function attains a maximum over a compact interval.

density $s$.[17] Then the probability of continuation is

$$\begin{aligned}\mathbb{P}_G[A(x) \geq \tau] &= \mathbb{P}_{\times_{i\in\mathcal{C}} S}\left[\sum_{i\in\mathcal{C}} \frac{d_i}{D}\chi_{\{D(x)+E(x)\,\delta_i \geq l\}} \geq \tau\right] \\ &= \mathbb{P}_{\times_{i\in\mathcal{C}} S}\left[\sum_{i\in\mathcal{C}} \chi_{\{D(x)+E(x)\,\delta_i \geq l\}} \geq \frac{\tau}{\epsilon}\right].\end{aligned}$$

Assume that $\tau/\epsilon = \kappa$, where $\kappa$ is some integer with $0 < \kappa \leq C$. Then the above expression is exactly the probability of at least $\kappa$ successes in $C$ trials of a binomial random variable with probability of success equal to,

$$\mathbb{P}_S\left[D(x) + E(x)\,\delta_i \geq l\right] = 1 - S\left(1 + \frac{l-y}{E(x)}\right),\ \forall i.$$

Hence,

$$\mathbb{P}_G[A(x) \geq \tau] = \sum_{r=\kappa}^{C} \begin{pmatrix} C \\ r \end{pmatrix} \left[1 - S\left(1 + \frac{l-y}{E(x)}\right)\right]^r S\left(1 + \frac{l-y}{E(x)}\right)^{C-r}.$$

Therefore the manager's problem is

$$\max_x \left\{ E(x) \sum_{r=\kappa}^{C} \begin{pmatrix} C \\ r \end{pmatrix} \left[1 - S\left(1 + \frac{l-y}{E(x)}\right)\right]^r S\left(1 + \frac{l-y}{E(x)}\right)^{C-r} \right\},$$

or

$$\max_z \left\{ z \sum_{r=\kappa}^{C} \begin{pmatrix} C \\ r \end{pmatrix} \left[1 - S\left(1 + \frac{l-y}{z}\right)\right]^r S\left(1 + \frac{l-y}{z}\right)^{C-r} \right\},$$

where $z = E(x)$ as before. Proceeding as in the previous subsection the only way we can guarantee continuation, that is $\mathbb{P}_G[A(x) \geq \tau] = 1$, is to have $S\,(1 + (l-y)/z) = 0$, which

[17] We are aware that the fact that the $\sum e_i/E = 1$ and $\sum d_i/D = 1$ impose more restrictions on the distribution of $\delta_i$ but we assume that pure shareholders trading balances stock's demand with supply.

results to

$$z = \epsilon \frac{y-l}{1+\epsilon}.$$

In order for this $z$ to be feasible in the manager's problem we must have $F(f)$ such that $(1+\epsilon)\underline{y} > y$, otherwise no matter $S$, the probability of continuation is less than one. Hence assume that we have $f$ such that $(1+\epsilon)\underline{y} > y$. The following Lemma shows that even then for any $S$ continuation occurs with probability less than one.

**Lemma 8.** *Continuation occurs with probability less than one for any distribution $S$ that has a bounded density function $s$.*

*Proof.* The manager's problem is

$$\max_z \left\{ z \sum_{r=\kappa}^{C} \left( \begin{array}{c} C \\ r \end{array} \right) \left[1 - S\left(1 + \frac{l-y}{z}\right)\right]^r S\left(1+\frac{l-y}{z}\right)^{C-r} \right\},$$

The only choice of $z$ that guarantees continuation is $z_0 \triangleq \epsilon(y-l)/(1+\epsilon)$. If the derivative of the objective with respect to $z$ is not equal to 0 at $z_0$ then $z_0$ cannot be an extremum and hence the manager will not pick it when solving the above problem.[18] Taking the derivative of the objective function yields

$$\begin{aligned} & \sum_{r=\kappa}^{C} \left( \begin{array}{c} C \\ r \end{array} \right) \left[1 - S\left(1 + \frac{l-y}{z}\right)\right]^r S\left(1+\frac{l-y}{z}\right)^{C-r} \\ + & \sum_{r=\kappa}^{C} \left( \begin{array}{c} C \\ r \end{array} \right) r\, s\left(1 + \frac{l-y}{z}\right) \frac{l-y}{z} \left[1 - S\left(1 + \frac{l-y}{z}\right)\right]^{r-1} S\left(1+\frac{l-y}{z}\right)^{C-r} \\ - & \sum_{r=\kappa}^{C} \left( \begin{array}{c} C \\ r \end{array} \right) \left[1 - S\left(1 + \frac{l-y}{z}\right)\right]^r (n-r-1)\, s\left(1 + \frac{l-y}{z}\right) \frac{l-y}{z} S\left(1+\frac{l-y}{z}\right)^{C-r-1} \end{aligned}$$

Substituting for $z_0$ in the above yields: for the first term 1 by definition, for the second term

[18] The existence of a maximum is guaranteed by Weierstrass' Theorem which states that every continuous function attains a maximum over a compact interval.

$-(1+\epsilon)s\left(-1/\epsilon\right)/\epsilon^2$, and for the third one $\infty$. Hence the sum is $\infty$ for all *bounded* $s$ and $\epsilon > 0$. $\square$

# 5 Conclusions and Extensions

We analyzed the implications of the fact that hedge funds are not required to report their exposure in a distressed company's stock prior to their voting in the creditors board. A CFO who wants to maximize shareholder's payoff chooses a restructuring plan based on her beliefs about creditors positions in the company's stock. This uncertainty leads to contingencies where the creditors board inefficiently rejects the restructuring plan. Although more work is required, it seems that a direct implication of our model is that requiring creditors to report their aggregate exposure to the company's securities might lead to a better voting outcome.

Future research should address the issue of how we can endogenize the distribution of creditors' position in the company's stock. This can be achieved by allowing for trading after the announcement of default and before voting and by placing random capital constraints for hedge funds' available capital. Besides exhibiting how this behavior can lead to inefficient outcomes one of our future goals is to provide a direction for the design of voting procedures that are "strategy-proof" in the sense that they prohibit such "arbitrage of regulation" practices. However, we acknowledge that a more general equilibrium like analysis might be required in order to generate policy recommendations.

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