Unanimous Efficient Mechanisms and The Role of Objective Management

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Theoretical background for the separation of management and ownership is rather weak in the extant literature. This paper emphasizes the management's role in coordinating the shareholders' decisions when unanimity is lost as the marginal return vector fails to be spanned by sufficient financial instruments. When there are differences of opinions among shareholders on the prospective projects in the absence of unanimity, profitable projects (shareholders' ownership-weighted subjective net present value being positive) may not be undertaken. Efficiency can be achieved when the shareholders voluntarily design a side-payment mechanism and agree on the efficient coordination mechanism. However, some coordination mechanisms may not be implementable without the help of an objective third party since the "first mover problem" could arise. The management can, acting as such a third party, promote efficiency by implementing a coordination mechanism. It is shown that implementation of any mechanism which is not *ex post* budget balancing and *ex post* individually rational requires the service of management as a coordinator. And it is also shown that an ex *post* individually rational incentive efficient mechanism may be "self-enforcing" only when the valuations of shareholders are likely to be negatively correlated. Lastly, it is noted that efficient multiple equilibria could result in this framework and the shareholders' expected payoffs depend on the mechanism to implement. In this situation, an objective management can promote fairness by selecting and implementing a mechanism that achieves fair and equitable allocation of gains among alternative shareholders and valuations. This paper sheds some light on the role of management as promoting a fair and efficient resolution of shareholders' conflicts and provides a rationale of having a separation of management and ownership, which has been viewed as undesirable according to the agency theory. A policy implication is that stock options which could be used to provide incentives to the management could cause the management to lose its neutral position and so its role as a coordinator could become limited. An issue addressed here among shareholders can be extended to different groups of stakeholders of a firm. The management, in that case, takes (or should take) a pivotal role in coordinating all the conflicts among stakeholders whose diverse interests are intertwined through the nexus of contracts constituting the firm.

Key words: Unanimity; Efficient Mechanisms; Objective Management; Self-enforcing

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Ⅰ. Introduction

The relationship between shareholder's (expected) utility maximization and the principle of firm value maximization has been extensively studied (Baron (1979) is a good review article). The extant literature reaches a few important consensuses: 1) Each individual shareholder's marginal utility from an additional dollar investment in a project is isomorphic to the shareholder's subjective evaluation of the net present value of the additional dollar investment, and both variables have the same sign. 2) An equivalence between two optimization principles holds if perfect competition plus the spanning condition are assumed. In other words, those assumptions are necessary to have unanimity among initial shareholders in a firm.

A competitive condition is needed to exclude the possibility of any shareholder's strategic behavior in the marginal value evaluation scheme. For the spanning property, either a complete market or a "restrictive" condition on the firm's production function is assumed. The bottom line of the spanning argument is that as long as all initial shareholders evaluate their subjective net present values(NPVs) identically, unanimity can be reached. The unanimity conditions thus far characterized are restrictive in the sense that no collective behavior on the part of the whole body of initial shareholders has been considered. In other words, the existing literature concludes that if the spanning conditions are not met, there is no hope for unanimity. However, if a dialogue channel is open among shareholders and they can negotiate side-payments, then it is conceivable that they would try to reach Pareto improving unanimity as long as the shareholders' ownership-weighted NPV is positive. In other words, unanimity does not break down and the traditional principles of investment decisions can be restored even in the absence of the spanning condition.

On the other hand, if we consider an asymmetry of information among shareholders about their subjective values of a prospective project, then an introduction of side-trading may result in a rejection of a profitable project as a result of an adverse selection problem. The role of management can be viewed coordinating seemingly conflicting interests among shareholders by restoring efficiency in the process of unanimity. In this sense, an advantage of the separation of ownership and control can be found in the management's third party role as well as in its expertise or comparative advantages in running the firm relative to those of the owners of the firm. This interpretation follows more closely that of Jensen and Meckling(1976) by looking at the firm as an organization composed of a nexus of numerous contracts made with lenders, external equity holders, suppliers, customers and even

the general public, and the role of management is to satisfy all the stakeholders.

The adverse selection arises because each shareholder has an incentive to lie about his own subjective NPV of the project to get compensated more in the event that the project is taken and side-payments are made for those who are reporting (ex-ante) net losses from the investment. This asymmetry of information present in the market, which could lead to an under-investment or no-investment problem as in Akerlof(1970), can be alleviated through an intervention of a third party (management), which however, may incur a possible agency problem with the shareholders.

One might wonder why the firm is not bought out by a single individual to avoid potential conflict of interest. A simple response to this question is that investors desire to achieve well-diversified portfolios. This is in a sense similar to the reason the firm is raising funds externally in Jensen and Meckling(1976). It also might be puzzling to see why unanimity is made a big concern knowing that seemingly contradictory evidence suggests that a simple majority rule is often adopted in many shareholders' meetings convened in the U.S. One reason is that if the majority of the firm's shareholders systematically abuse the minority without trying to please them by pursuing unanimity, then the minority will leave the firm and the value of the firm will drop to reflect the conflict of interest among shareholders. We assume that this cost is so prohibitive that unanimity should be reached for the firm to take any project.

In this paper, we focus on the design of a mechanism which efficiently resolves conflicts among shareholders when unanimity is used in the firm's decision-making process. Unanimity is lost when the marginal return vector fails to be spanned by sufficient instruments (Baron, 1979). We show that implementation of any mechanism which is not ex-post budget balancing and ex-post individually rational requires the service of management as a coordinator. Furthermore, we also show that ex post individually rational incentive efficient mechanism may be "self-enforcing" only when the valuations of shareholders are likely to be negatively correlated. This paper sheds some light on the role of management and provides a rationale of having a separation of management and ownership. This separation, however, has been viewed as undesirable according to the agency theory. A policy implication is that stock options which could be used to provide incentives to the management could cause the management to lose its neutral position and so its role as a coordinator could become limited.

II. The Model

There are two shareholders, shareholder A

and shareholder B. The shareholders decide whether to take a project or not. We let $s_A > 0$ denote the fraction of the firm's shares that shareholder A owns and $s_B = 1 - s_A > 0$ represent the fraction of shareholder B's. Let NPV_i, i = A,B, denote the expected net present value (NPV) of the project for shareholder i. It is a common knowledge that shareholder A's reservation value of the project representing shareholder A's ownership-weighted NPV (i.e., $s_A NPV_A$) is either a_H or a_L with $-\infty < a_L < a_H < \infty$, and shareholder B's reservation value of the project is either b_H or b_L with $-\infty < b_L < b_H < \infty$. Without loss of generality, we let $-b_H < a_L < -b_L < a_H$. That is,

$s_A NPV_A + s_B NPV_B < 0$ if $s_A NPV_A = a_L$
and $s_B NPV_B = b_L$
and $s_A NPV_A + s_B NPV_B > 0$ otherwise.[1)]

At the time of decision, each shareholder knows his valuation but has only probabilistic beliefs about the other's valuation conditional upon his valuation. The shareholders regard their valuations as being drawn from the following joint probability distribution:

	b_L	b_H
a_L	$1-(1+\alpha+\beta)q$	$q\beta$
a_H	$q\alpha$	q

We let $q > 0$, $\alpha > 0$, $\beta > 0$, and $1 - (1 + \alpha + \beta) q > 0$. Notice that if we let $P_A(b_j|a_i)$ and $P_B(a_i|b_j)$, $i,j = L,H$, denote the conditional probability of shareholder A with valuation a_i on the event that the shareholder B's valuation is b_j and the conditional probability of shareholder B with valuation b_j on the event that shareholder A's valuation is a_i, respectively, then α and β are likelihood ratios with

$$\alpha = \frac{P_A(b_L|a_H)}{P_A(b_H|a_H)} \quad \text{and} \quad \beta = \frac{P_B(a_L|b_H)}{P_B(a_H|b_H)}.$$

Given the message space of the reported valuations of shareholders, a direct ex post budget-balancing mechanism[2)] m can be characterized by its outcome functions (y,x), with $y = (y(a_L,b_L), y(a_L,b_H), y(a_H,b_L), y(a_H,b_H))$ and $x = (x(a_L,b_L), x(a_L,b_H), x(a_H,b_L), x(a_H,b_H))$, where $y(a,b)$ is the probability that the project is taken and $x(a,b)$ represents the transfer payment from shareholder B to shareholder A when a and b are reported valuations of shareholder A and shareholder B, respectively.[3)]

1) For the other cases, we can show that there exist posted-price mechanisms that are ex post efficient.
2) This is from the Revelation Principle. In our context, it says "for any Bayesian equilibrium of bargaining game, there always exists an incentive compatible direct bargaining mechanism with the same outcome." A direct mechanism is one in which the individuals report their valuations simultaneously to the mechanism coordinator and the outcomes corresponding to these reports are assigned by the outcome functions prespecified by the mechanism coordinator in the mechanism. Revelation Principle has been developed by many authors in alternative contexts. See Myerson(1979) for the bargaining case.
3) Notice that we restrict our attention to ex post budget balancing mechanisms.

Both shareholders are risk-neutral von Neumann-Morgenstern expected utility maximizers. Then under the mechanism m, shareholder A's utility is

$u_A(m(a,b);a_i) = y(a,b)a_i + x(a,b)$ for each $i, \mathrm{i} = \mathrm{L},\mathrm{H}$,

and shareholder B's utility is

$u_B(m(a,b);b_i) = y(a,b)b_i - x(a,b)$ for each $i, \mathrm{i} = \mathrm{L},\mathrm{H}$,

given that shareholder A reported a and shareholder B reported b.

Each shareholder selects the report that maximizes his (interim) expected utility. We let $E_m U_A(a|a_i), \mathrm{i} = \mathrm{L},\mathrm{H}$, denote shareholder A's (interim) expected utility in the mechanism m when, with valuation a_i, he reports a and shareholder B reports truthfully. And let $E_m U_B(b|b_i), \mathrm{i} = \mathrm{L},\mathrm{H}$, represent the (interim) expected utility of shareholder B with valuation b_i in the mechanism m when he reports b and shareholder A reports honestly.

A mechanism is (Bayesian) incentive compatible if truthtelling is a Bayesian-Nash equilibrium strategy for each shareholder. Thus, incentive compatibility requires

$E_m U_A(a_i|a_i) \geq E_m U_A(a_j|a_i)$ for all i and j, $i,j = L,H$,

and $E_m U_B(b_i|b_i) \geq E_m U_B(b_j|b_i)$ for all i and j, $i,j = L,H$.

And an incentive compatible mechanism is ex post efficient if $y = (y(a_L,b_L), y(a_L,b_H), y(a_H,b_L), y(a_H,b_H)) = (0,1,1,1)$. That is, an ex post efficient mechanism undertakes the project whenever the weighted sum of the NPVs of the shareholders are greater than zero so that the project is expected to be profitable. We let y^* represent the ex post efficient allocation rule.

For an incentive compatible mechanism, interim individual rationality requires

$E_m U_A(a_i|a_i) \geq 0$ for all $i, \mathrm{i} = \mathrm{L},\mathrm{H}$,

and $E_m U_B(b_i|b_i) \geq 0$ for all $i, \mathrm{i} = \mathrm{L},\mathrm{H}$.

III. Efficient Mechanisms with Side-Payment

Given the ex post efficient outcome function y^*, we restrict our attention to incentive compatible mechanisms in which money payment from one shareholder to the other is not permitted when the project is not taken(i.e., $x(a_L,b_L) = 0$).[4]

4) We are eventually interested in ex post individually rational mechanisms and $x(a_L,b_L) = 0$ for any ex post individually rational mechanism.

Theorem 1 Let $x(a_L,b_L)=0$. Then a Bayesian incentive compatible, ex post efficient, and interim individually rational mechanism exists if and only if

$$\alpha(a_H+b_L)+\beta(b_H+a_L)\geq-(a_L+b_L). \quad (1)$$

Proof: (*If*) Choose (y^*,x) with $x(a_L,b_L)=0$, $x(a_L,b_H)=-a_L$, $x(a_H,b_L)=b_L$,

and $\max\{-a_L-\alpha(a_H+b_L), b_L+\omega(b_L+a_L)\}$

$\leq x(a_H,b_H)\leq$

$\min\{b_L+\beta(b_H+a_L), -a_L-\nu(a_L+b_L)\}$, (2)

where $\upsilon=\dfrac{P_A(b_L|a_L)}{P_A(b_H|a_L)}=\dfrac{1-(1+\alpha+\beta)q}{\beta q}$ and

$\omega=\dfrac{P_B(a_L|b_L)}{P_B(a_H|b_L)}=\dfrac{1-(1+\alpha+\beta)q}{\alpha q}$.

Notice that, given that $a_L<a_H$, $b_L<b_H$ and $-b_H<a_L<-b_L<a_H$, $-a_L-\nu(a_L+b_L)>\max\{-a_L-\alpha(a_H+b_L), b_L+\omega(b_L+a_L)\}$.

And

$$b_L+\beta(b_H+a_L) > b_L+\omega(b_L+a_L)$$

and

$$b_L+\beta(b_H+a_L) \geq -a_L-\alpha(a_H+b_L)$$

by inequality (1).

That is, the set of $x(a_H,b_H)$ satisfying inequality (2) is non-empty under inequality (1).

(*Only if*) Given y^* and $x(a_L,b_L)=0$, it follows from incentive compatibility of shareholder A with a_H that

$$\alpha a_H+\alpha x(a_H,b_L)+x(a_H,b_H)-x(a_L,b_H)\geq 0. \quad (3)$$

And incentive compatibility of shareholder B with b_H implies that

$$\beta b_H-\beta x(a_L,b_H)-x(a_H,b_H)+x(a_H,b_L)\geq 0. \quad (4)$$

From inequalities (3) and (4), we get

$\beta b_H-\beta x(a_L,b_H)+x(a_H,b_L)\geq x(a_H,b_H)\geq$

$-\alpha a_H-\alpha x(a_H,b_L)+x(a_L,b_H)$.

Or, equivalently,

$$\alpha a_H+\beta b_H\geq(\beta+1)x(a_L,b_H)-(\alpha+1)x(a_H,b_L). \quad (5)$$

And from individual rationality of shareholder A with a_L and shareholder B with b_L, we know that

$$-a_L\leq x(a_L,b_H) \quad (6)$$

and

$$x(a_H,b_L)\leq b_L. \quad (7)$$

Substituting (6) and (7) into (5), it is straightforward to show that

$\alpha(a_H+b_L)+\beta(b_H+a_L)\geq-(a_L+b_L)$

is a necessary condition. *Q.E.D.*

Following Gresik(1991), we call a mechanism that is incentive compatible, interim individually rational, and ex post efficient an "ex post incentive efficient" mechanism for notational simplicity.

Notice that a requirement for an "ex post incentive efficient" mechanism is interim individual rationality. In other words, an "ex post incentive efficient" mechanism may not be ex post individually rational. We say that

an incentive compatible mechanism is ex post individually rational if

$u_A(m(a_i,b_j);a_i) = y(a_i,b_j)a_i + x(a_i,b_j) \geqq 0$
for all i and j, $i,j = L,H$,
and $u_B(m(a_j,b_i);b_i) = y(a_j,b_i)b_i - x(a_j,b_i) \geqq 0$
for all i and j, $i,j = L,H$.

That is, in an ex post individually rational mechanism, each type of shareholders gets nonnegative payoff ex post in every state. In Theorem 2 below we show that there exists an "ex post incentive efficient" mechanism which is also ex post individually rational if inequality (1) holds. On the other hand, Theorem 1 shows that inequality (1) is necessary for the existence of "ex post incentive efficient" mechanisms. Thus, we can infer from Theorem 1 that inequality (1) is also necessary and sufficient for the existence of a mechanism that is "ex post incentive efficient" and ex post individually rational. Before going to Theorem 2, it is convenient to establish a lemma.

Lemma 1 Given the efficient allocation rule y^*, an "ex post incentive efficient" mechanism is ex post individually rational if and only if

$x(a_L,b_L) = 0, -a_L \leqq x(a_L,b_H) \leqq b_H,$
$-a_H \leqq x(a_H,b_L) \leqq b_L$
and $-a_H \leqq x(a_H,b_H) \leqq b_H$.

Proof: Straightforward.

Theorem 1 shows that inequality (1) is a necessary condition for the existence of "ex post incentive efficient" mechanisms with $x(a_L,b_L) = 0$. And we know from Lemma 1 that $x(a_L,b_L) = 0$ for any "ex post incentive efficient" mechanism which is ex post individually rational.

Theorem 2 An "ex post incentive efficient" and ex post individually rational mechanism exists if and only if inequality (1) holds.

Proof: (*If*) Modify(y^*,x) in inequality (2) in the proof of Theorem 1 as

$$\max\{-a_H, -a_L - \alpha(a_H + b_L), b_L + \omega(b_L + a_L)\} \leqq x(a_H,b_H) \leqq \min\{b_H, b_L + \beta(b_H + a_L), -a_L - \nu(a_L + b_L)\}. \quad (8)$$

Notice that, given that $a_L < a_H$, $b_L < b_H$ and $-b_H < a_L < -b_L < a_H$,

$\min b_L + \beta(b_H + a_L), -a_L - \nu(a_L + b_L) > -a_H$
and
$\max\{-a_L - \alpha(a_H + b_L), b_L + \omega(b_L + a_L)\} < b_H$.

That is, the set of $x(a_H,b_H)$ satisfying inequality (8) is non-empty under inequality (1).

(*Only if*) Notice that ex post individual rationality implies interim individual rationality. And we know from Theorem 1 that inequality (1) is necessary for the existence of "ex post incentive efficient" mechanisms with $x(a_L,b_L) = 0$. Hence, the rest of the proof follows from Lemma 1. *Q.E.D.*.

Inequality (8) in the proof of Theorem 2 shows that the set of money transfers for "ex post incentive efficient" and ex post individually rational mechanisms is more restricted than that for "ex post incentive efficient" mechanisms with $x(a_L,b_L)=0$. However, Theorem 2 also shows that this does not matter if we concern only about existence. Thus, Theorem 2 implies Theorem 1 since ex post individual rationality implies interim individual rationality. And from Theorem 1 and Theorem 2, we get Corollary 1.

Corollary 1 If beliefs are consistent, then there exists an "ex post incentive efficient" and ex post individually rational mechanism if and only if there exists an "ex post incentive efficient" mechanism with $x(a_L,b_L)=0$.

Proof: We know from Theorem 1 and Theorem 2 that inequality (1) is the necessary and sufficient condition for the existence of both class of mechanisms.

Remark 1 As we can see in Lemma 1 and inequalities (2) and (8), the set of money transfers for "ex post incentive efficient" and ex post individually rational mechanisms is more restricted than that for "ex post incentive efficient" mechanisms with $x(a_L,b_L)=0$. However, Corollary 1 shows that this does not matter if we concern only about existence. On the other hand, we can also show that there are cases in which the set "ex post incentive efficient" and ex post individually rational mechanisms is a proper subset of the set of "ex post incentive efficient" mechanism with $x(a_L,b_L)=0$.

Ⅳ. Implementation of Mechanisms without Coordinator

In this subsection, we show that implementation of some "ex post incentive efficient" and ex post individually rational mechanisms may require a service of third-party.

4.1 Preliminary: The First-Mover Problem

We are interested in mechanisms that are ex post efficient. It is well known that implementation of any mechanism which is not ex post individually rational requires the service of mechanism coordinator to enforce the terms in the mechanism. And we know from Theorem 2 that "ex post incentive efficient" and ex post individually rational mechanisms exist for some set of valuations and beliefs.

In this subsection, we will show why some "ex post incentive efficient" and ex post individually rational mechanism may not be implementable in the absence of mechanism

coordinator. Let us consider an example.

Example 1 Let $a_L=-1, b_L=-2, a_H=4$, and $b_H=2$. And let $q=1/4$ and $\alpha=\beta=1$ so that the joint probability distribution is given as below.

Notice that the set of valuations and beliefs in this example satisfies inequality (1). We know from Theorem 2 that there exists an "ex post incentive efficient" and ex post individually rational mechanism. In fact, given the efficient allocation rule y^*, an "ex post incentive efficient" and ex post individually rational money transfer scheme is given as

$x(a_L,b_L)=0, x(a_H,b_L)=-2, x(a_L,b_H)=1, x(a_H,b_H)=-1$

Suppose that the shareholders make decisions without third party involvement (i.e., there is no mechanism coordinator). Then, shareholder A's(shareholder B's) honest money transfer offer $x(a_H,b_H)=-1$ reveals that his valuation is $a_H(b_H)$. On the other hand, shareholder A(shareholder B), when making an offer, does not know shareholder B's(shareholder A's) valuation. Knowing this, shareholder B with b_H(shareholder A with a_H) can be strictly better off by pretending that his valuation is $b_L(a_L)$ and thus by rejecting the offer if there is room for further negotiation. That is, shareholder B with b_H(shareholder A with a_H) would not accept the offer when shareholder A with a_H(shareholder B with b_H) makes money transfer offer $x(a_H,b_H)=-1$ unless the offer is final. However, the final offer $x(a_H,b_H)=-1$ from shareholder A with a_H(shareholder B with b_H) would not support ex post efficiency since it will be rejected by shareholder B with b_L(shareholder A with a_L).

We have shown that in the absence of mechanism coordinator the outcome rules (y^*,x) in Example 1 may not be implemented by a game in which shareholder A or shareholder B makes money transfer offers. Now consider the following game:

[G]: shareholder A or shareholder B offers outcome functions (y^*,x) in which

	b_L	b_H
a_L	1/4	1/4
a_H	1/4	1/4

- the game is played when the outcome functions offered by shareholder A (shareholder B) is accepted by shareholder B(shareholder A);
- shareholders simultaneously report their valuations to each other; and
- adoption of the project and money transfer occurs according to the outcome functions (y*, x) in the game.

We can easily see that game [G] is equi-

valent to the situation in which shareholder A and shareholder B make simultaneous money transfer offers or in which the shareholders voluntarily reach an agreement on the decision rule with the outcome functions (y,x) to save the costs involved in the mechanism coordinator's information processing service. We will show that (y^*,x) in Example 1 cannot be implemented by game [G] unless there is an institution or a mechanism coordinator that provides safeguard against the possibility of renegotiation. To see this, suppose that shareholder A with a_L and shareholder B tell the truth. And suppose that there is no third party that prevents the shareholders from renegotiation. We will show that shareholder A with a_H can be strictly better off by adopting a strategy in which he reports a_L and opens renegotiation later on. Suppose that shareholder A with a_H reports a_L. And consider the event in which shareholder B is b_L. Then according to the decision rule, the project is not adopted and the game ends. However, given that shareholder B tells the truth and shareholder B is b_L, shareholder A knows that there exists mutually beneficial renegotiation opportunity. For instance, if shareholder A offers take-it-or-leave-it money transfer offer $\hat{x}$ with $a_H > -\hat{x}$ and $\hat{x} < b_L$ and shareholder B accepts it, then both shareholder A with a_H and shareholder B with b_L gain from the renegotiation. And anticipating this renegotiation opportunity, it may not be the interest of shareholder B with b_H to tell the truth. That is, in the absence of the mechanism coordinator who enforces the outcomes, one or both shareholders may find it beneficial to scrap the mechanism and reach an alternative agreement after shareholder A or shareholder B misrepresenting the type. And some "ex post incentive efficient" and ex post individually rational mechanism may not be "self-enforcing".[5)]

The argument above suggests that the set of valuations and beliefs for which we can design an "efficient self-enforcing" mechanism[6)] may be smaller than the one for which there exists an ex post individually rational "ex post incentive efficient" mechanism. Next subsection establishes the result.

4.2 "Efficient Self-Enforcing" Mechanisms

In this subsection, we examine the "ex post incentive efficient" and ex post individually rational mechanisms that can be implemented without the services of the third-party (i.e., the "efficient self-enforcing" mechanisms). We present characterization result first.

5) We call a mechanism that can be implementable without the services of a third party "self-enforcing".
6) We call an "ex post incentive efficient" and ex post individually rational mechanism that is "self-enforcing" as an "efficient self-enforcing" mechanism.

Theorem 3 Given the ex post efficient outcome function y^*, an "ex post incentive efficient" and ex post individually rational mechanism is "self-enforcing" if and only if either

$$-a_H \leqq x(a_H,b_L)=x(a_H,b_H)=x(a_H)\leqq b_L$$
$$<-a_L\leqq x(a_L,b_H)=x(a_L)\leqq b_H \quad (9)$$

or

$$-a_H\leqq x(a_H,b_L)=x(b_L)\leqq b_L<-a_L$$
$$\leqq x(a_H,b_H)=x(a_L,b_H)=x(b_H)\leqq b_H \quad (10)$$

Proof:

(If) Choose the take-it-or-leave-it money transfer offer $x(a_i)$, $i=L,H$, made by share holder A in (9). Or choose the take-it-or-leave-it money transfer offer $x(b_j)$ in (10), $j=L,H$.

(Only if) We will prove the assertion by contradiction.

Suppose that there exists an "efficient self-enforcing" mechanism in which the transfer rule is neither (9) nor (10). Then, from Lemma 1, we know that it must be one of the followings:

(i) $-a_H\leqq x(a_H,b_L)\neq x(a_H,b_H)\leqq b_L<-a_L$
$\leqq x(a_L,b_H)\leqq b_H$;

(ii) $-a_H\leqq x(a_H,b_L)\leqq b_L<x(a_H,b_H)<-a_L$
$\leqq x(a_L,b_H)\leqq b_H$; or

(iii) $-a_H\leqq x(a_H,b_L)\leqq b_L<-a_L\leqq x(a_H,b_H)$
$\neq x(a_L,b_H)\leqq b_H$.

We will show that none of the cases above can be implemented without third party involvement.

Consider case (i) first. We will show that shareholder A with a_H and shareholder B with b_H would not offer $x(a_H,b_H)$ in a do-it-yourself negotiation game. That is, an ex post efficient mechanism with money transfer scheme of type (i) is not "self-enforcing".

(i) First, Let $x(a_H,b_H)<x(a_H,b_L)\leqq b_L$.

Since the mechanism is "self-enforcing", $x(a_H,b_H)$ must be offered by shareholder A with a_H or by shareholder B with b_H during the negotiation process and it must be rejected(accepted) by shareholder B with b_L (shareholder A with a_H) if offered by shareholder A with a_H(shareholder B with b_H). Suppose that shareholder A with a_H makes the offer $x(a_H,b_H)$. By making this offer, shareholder A reveals his type but he is uncertain about shareholder B's valuation. Knowing this, shareholder B with b_L would not reject the offer $x(a_H,b_H)$ since he can be strictly better off by accepting it. And shareholder A with a_H, knowing this, would not make the offer $x(a_H,b_H)$ since he can be strictly better off by making a take-it-or-leave-it offer greater than that.

Thus, the offer $x(a_H,b_H)$ must be offered by shareholder B with b_H and be accepted by shareholder A with a_H in order for the

mechanism to be implementable. However, shareholder A with a_H would accept it only when it is the take-it-or-leave-it money transfer offer. Otherwise, shareholder A with valuation a_H, knowing that shareholder B's valuation is b_H and also knowing that shareholder B is uncertain about his valuation, would not accept the offer since he can be strictly better off by rejecting it and making an immediate counteroffer $x(a_L, b_H)$.

Alternatively, let $x(a_H, b_L) < x(a_H, b_H) \leq b_L$. Then, using the similar argument as above, we can show that $x(a_H, b_H)$ offered by shareholder B with b_H would not be accepted by shareholder A with a_H unless it is the take-it-or-leave-it offer. Otherwise, knowing that shareholder B's type is b_H and knowing that shareholder B is uncertain about his type, shareholder A with a_H can be better off by rejecting the offer and by making immediate take-it-or-leave-it counteroffer. That is, the offer $x(a_H, b_H)$ made by shareholder B with b_H must be the take-it-or-leave-it offer in order for the mechanism to be implementable. But then the take-it-or-leave-it offer $x(a_H, b_H)$ made by shareholder B with b_H would not support ex post efficiency since it will be rejected by shareholder A with a_L. Thus $x(a_H, b_H)$ must be offered by shareholder A with a_H and be accepted by shareholder B with b_H in order for the mechanism to be implementable. However, the offer $x(a_H, b_H)$ offered by shareholder A with a_H would not be accepted by shareholder B with b_H unless it is the take-it-or-leave-it offer. Otherwise, knowing that shareholder A's type is a_H and knowing that shareholder A is uncertain about his type, shareholder B with b_H can be better off by rejecting it and by making immediate take-it-or-leave-it counteroffer $x(a_H, b_L)$. A contradiction.

Using the argument similar to the proof of (i), we can show that the "ex post incentive efficient" mechanisms with money transfer schemes of type (ii) and type (iii) are not "self-enforcing". *Q.E.D.*.

Theorem 3 shows that if an "ex post incentive efficient" mechanism is "self-enforcing" then it is a take-it-or-leave-it mechanism in which shareholder A(shareholder B) with $a_i(b_j)$makes take-it-or-leave-it money transfer offer $x(a_i)$ in (9), $i=L,H$,($x(b_j)$ in (10), $j=L,H$,) and shareholder B (shareholder A) accepts the offer if and only if his valuation greater than or equal to (greater than or equal to negative of) that. Thus, if the take-it-or-leave-it money transfer offers $x(a) =< x(a_L), x(a_H) >$ in (9)($x(b) =< x(b_L), x(b_H) >$ in (10)) are (Bayesian) incentive compatible for shareholder A(shareholder B), then there exists an "efficient self-enforcing" mechanism in which shareholder A(shareholder B) makes a take-it-or-leave-it money transfer offer. Theorem

4 describes necessary and sufficient conditions on the set of valuations and beliefs for which there exist "efficient self-enforcing" mechanisms.

Remark At this stage, we need to clarify our notion of an "efficient self-enforcing" mechanism. We identify an "efficient self-enforcing" mechanism as a take-it-or-leave-it mechanism. And any further room for renegotiation after an offer and an acceptance decisions is ruled out in a take-it-or-leave-it mechanism in this paper. So our notion of an "efficient self-enforcing" mechanism follows the notion of renegotiation-proofness of a mechanism in the standard approach in which a mechanism is renegotiation-proof with respect to a given renegotiation procedure.[7] And it differs from the stronger notion of ex post renegotiation-proofness in Neeman and Pavlov(2010) in which the renegotiation-proofness requires that an equilibrium of mechanism survives under all plausible renegotiation procedures.

Theorem 4 below describes the environment in which an "efficient self-enforcing" take-it-or-leave-it mechanism exists.

Theorem 4 There exists an "efficient self-enforcing" take-it-or-leave-it mechanism if and only if the set of valuations and beliefs satisfies one of the followings:

(a) $P_A(b_H|a_H)(a_H-a_L) \leqq b_L+a_H$;
(b) $P_B(a_H|b_H)(b_H-b_L) \leqq b_H+a_L$.

Proof: (*Only if*) If neither (a) nor (b), then
$P_A(b_H|a_H)[x(a_L)+a_H] \geqq P_A(b_H|a_H)(a_H-a_L)$
$> b_L+a_H \geqq x(a_H)+a_H$
under the decision rule with (9) and
$P_B(a_H|b_H)[b_H-x(b_L)] \geqq P_B(a_H|b_H)(b_H-b_L)$
$> b_H+a_L \geqq b_H-x(b_H)$
under the decision rule with (10). That is, neither (9) nor (10) is incentive compatible.

The rest of the proof follows from Theorem 3 and the fact that "efficient self-enforcing" mechanism is "ex post incentive efficient" and ex post individually rational. A contradiction.

(*If*) There are three cases to consider:

(i) $P_A(b_H|a_H)(a_H-a_L) \leqq b_L+a_H$ and
$P_B(a_H|b_H)(b_H-b_L) > b_H+a_L$;
(ii) $P_B(a_H|b_H)(b_H-b_L) \leqq b_H+a_L$ and
$P_A(b_H|a_H)(a_H-a_L) > b_L+a_H$; and
(iii) $P_A(b_H|a_H)(a_H-a_L) \leqq b_L+a_H$ and
$P_B(a_H|b_H)(b_H-b_L) \leqq b_H+a_L$.

If (i) holds, then there exists an "ex post incentive efficient" and ex post individually rational take-it-or-leave-it mechanism with

7) See Dewatripont(1989) for an example.

money transfers in (9). Similarly, there exists an "ex post incentive efficient" and ex post individually rational take-it-or-leave-it mechanism with money transfers in (10) when (ii) holds. Finally, there exist ex post individually rational "ex post incentive efficient" take-it-or-leave-it mechanisms of type (9) and type (10) for (iii). *Q.E.D.*.

Theorem 4 shows that "efficient self-enforcing" take-it-or-leave-it mechanisms exist when shareholder A with high valuation(shareholder B with high valuation) has pessimistic belief such that shareholder A with high valuation (shareholder B with high valuation) thinks shareholder B with low valuation(shareholder A with low valuation) is more likely. Thus, our results can be applied to negotiation problems in which the valuations of shareholders are likely to be negatively correlated. It also shows that even if beliefs of shareholders are independent of valuations, there may exist "efficient self-enforcing" take-it-or-leave-it mechanisms as in Example 1. And we can also apply our results to private-values negotiation problems in which the valuations of shareholder A and shareholder B are likely to be independent random variables.

We can easily show that the set of valuations and beliefs satisfying one of the conditions in Theorem 4 satisfies the inequality (1), but not conversely. Hence, we confirm our result in Section 4.1 that "efficient self-enforcing" take-it-or-leave-it mechanisms are "ex post incentive efficient" and ex post individually rational, while some "ex post incentive efficient" and ex post individually rational mechanisms are not "efficient self-enforcing".

V. Role of Management As A Coordinator

Now suppose that the shareholders hire an objective management (i.e., the managements share of the firm is zero and the management has no other objective than promoting efficiency and fairness) to coordinate their decisions and to enforce the terms of coordination mechanisms. We assume that the management knows the sets of possible valuations of shareholders (i.e., $\{a_H, a_L\}$ for shareholder A and $\{b_H, b_L\}$ for shareholder B) and he also knows the common prior distribution. An objective management coordinator can promote efficiency by implementing "ex post incentive efficient" and ex post individually rational mechanisms that are not "self-enforcing". And when there are many "ex post incentive efficient" and ex post individually rational mechanisms, an objective management can also promote fairness by selecting and implementing a mechanism that achieves fair allocation of gains among alternative shareholders and

among alternative valuations.

5.1 Promotion of Efficiency

We have shown in Theorem 2 and Theorem 4 that the set of valuations and beliefs for which "efficient self-enforcing" take-it-or-leave-it mechanisms exist is smaller than that for which "ex post incentive efficient" and ex post individually rational mechanisms exist. That is, the first mover problem may arise in the process of implementing mechanisms and some mechanisms may not be implementable without the help of an objective management. An objective management can promote efficiency by implementing ex post individually rational "ex post incentive efficient" mechanisms that are not "self-enforcing".

5.2 Promotion of Fairness

An objective management as a mechanism coordinator can also promote fairness. When there are many mechanisms to choose, shareholders' expected payoffs depend on the mechanism to implement. That is, in the selection of mechanism, there exists conflict of interest among alternative shareholders and among alternative valuations. And in the absence of a coordinator, it is likely that shareholders may engage in mechanism selection game and there is no reason to predict that a particular mechanism is more likely to be implemented than others. In this situation, an objective management can promote fairness by selecting and implementing a mechanism that achieves fair and equitable allocation of gains among alternative shareholders and valuations such as the Nash bargaining solution which divides the gain equally in this risk neutral utility case.

VI. Concluding Remarks

We emphasize the role of an objective management to promote efficiency and fairness. There are cases in which the first mover problem arise in the process of implementing mechanisms and some "ex post incentive efficient" and ex post individually rational mechanisms may not be implementable without the help of an objective third party. An objective management can promote efficiency by implementing these "ex post incentive efficient" and ex post individually rational mechanisms that are not "self-enforcing". And when there are many "ex post incentive efficient" and ex post individually rational mechanisms, shareholders' expected payoffs in one mechanism differ from these in other mechanisms in general. So there exists conflict of interest among alternative shareholders and among alternative types in the selection of a mechanism to implement. In this situa-

tion, an objective management can promote fairness by selecting and implementing a mechanism that achieves fair allocation of gain among alternative shareholders and among alternative types. We also show that "ex post incentive efficient" and ex post individually rational mechanism may be "self-enforcing" only when valuations of shareholders are likely to be negatively correlated or independent of valuations.

It seems to be more often the case that firms with groups of shareholders conflicting and distrusting each other tend to recruit the management outside. Unanimity is lost when the marginal return vector fails to be spanned by sufficient instruments. This paper has focused on the design of a mechanism and the role of objective management, which efficiently resolves conflicts among shareholders when unanimity is used in the firm's decision-making process. This paper sheds some light on the role of management and provides a rationale of having a separation of management and ownership. This separation, however, has been viewed undesirable according to the agency theory. A policy implication is that stock options which could be used to provide incentives to the management could cause the management to lose its neutral position and so its role as a coordinator could become limited. The issue addressed here among shareholders can be extended to different group of stakeholders of a firm. The management, in that case, may take a pivotal role in coordinating all the conflicts among stakeholders whose diverse interests are intertwined through the nexus of contracts constituting the firm.

In this paper, we examine the role of an objective management as a neutral third party. But in the real world, a management can take a partial position to form a coalition with a shareholder for his benefits and may act as an active player as well as the mechanism coordinator in the mechanism.[8] We leave this more complicated topic for future research.

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8) A management taking a partial position may ruin his reputation. And the competition in managerial market can discipline the management to restrain the partial position as it works for restraining the moral hazard problem.

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만장일치 효율적 기제에서의 객관적 경영자의 역할

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요 약

소유와 경영의 분리의 이점에 관해 분석한 연구는 찾아보기 힘들다. 본 논문에서는 주주들 모두 이득을 보는 프로젝트 시행에서의 객관적 조정자로서의 전문경영인의 역할을 살펴보았다. 주주들의 프로젝트 가치가 사적정보 하 주주들 모두 이득을 보는 프로젝트라도 주주들간의 조정기제의 시행 시 "선제행동에서의 정보누출문제"("first mover problem")로 인해 객관적인 제3자의 조정이 없이는 시행이 불가능한 경우가 있다. 이 경우 전문경영인이 객관적인 조정자로서 프로젝트 시행을 가능하게 하여 효율성을 증진시키고, 주주들간의 이익배분 조정을 통해 형평성도 증진시킬 수 있다.

주제어: 만장일치; 효율적 기제; 객관적 조정자; 자가시행(Self-enforcing)

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