Transferring Control in a Firm. The role of Individual Rationality and share based rules.

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Motivation

Main question: how to transfer control rights in a firm in order to maximize firm value?

Problem: Every shareholder is interested in assigning control to the most efficient one. However, the controller could obtain private benefits from the firm in detriment of the rest of shareholders. This trade off makes difficult, and sometimes impossible, to reach an efficient transfer of control.

In this paper we apply the mechanism design technique to study the efficient transfer of control in a firm. We focus on the importance and pertinence of (IR)-(IC) constraints and the implementation problem.

Some Literature

Grossman and Hart (1980), Grossman and Hart (1988), Harris and Raviv (1988), Burkart, Gromb and Panunzi (2000) imply that private benefits affect negatively the efficiency in the transfer of control. All of these models consider private benefits under complete information.

Weifeng *et al.* (2008) and Doidge *et al.* (2009) have shown the importance of private benefits.

Some Literature (cont.)

Myerson (1983) and Myerson and Satterthwaite (1983) show that if it is not common knowledge that gains from trade exist, then no incentive compatible, individually rational trading mechanism can be ex post efficient.

Cramton *et al.* (1987) show that when there is a share initial ownership structure of the good and each player has a private valuation over it, then, under some constraints over the initial endowments, it is possible to dissolve the partnership efficiently.

Nagarajan (1995) studies the problem of an efficient transfer of control under incomplete information in the absense of private benefits, The subset of shares endowments where an ex post efficient mechanism exist depends only on the incumbent's initial share.

The Model

Consider a firm that is jointly owned by n stockholders. The vector $\alpha = (\alpha_1 \ldots \alpha_n)$ denotes the initial shareholdings and $\sum_{i=1}^{n} \alpha_i = 1$.

Control is defined as the right to operate the firm. All shareholders are assumed risk neutral, with linearly separable utility for the value of their shareholdings and money.

The potential value of the entire firm if stockholder i gains control and operate the firm is v_i, this valuation is private information, but it is common knowledge that these valuations are i.i.d. $F\,[\underline{v}, \overline{v}]$.

This potential value of the firm is divided as follows:

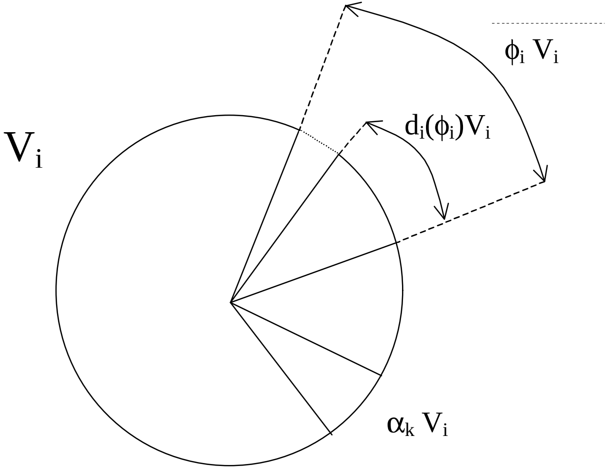

Figure: Potential value, private benefits and deadweight loss.

A Mechanism

Formally, $\forall v = (v_1 \ldots v_n) \in [\underline{v}, \overline{v}]^n$ and $\alpha = (\alpha_1 \ldots \alpha_n) \in \Delta^{n-1}$, a direct revelation mechanism $M(v|\alpha) = \langle d, t, x|\alpha \rangle$ consist of:

i.- A decision rule $d : [\underline{v}, \overline{v}]^n \longrightarrow N$ such that

$$d(v|\alpha) = i \text{ if } v_i(1 - \phi_i + \xi(\phi_i)) \geq v_j(1 - \phi_j + \xi(\phi_j)) \quad \forall j \in N$$

ii.- A share allocation correspondence $x(v|\alpha) = \{x_1(v|\alpha) \ldots x_n(v|\alpha)\}$ where $x_i(v|\alpha)$ is the net change in shareholdings allocated to stockholder i subject to $\sum_{i=1}^n x_i(v|\alpha) = 0$.
iii.- A transfer correspondence $t(v|\alpha) = \{t_1(v|\alpha) \ldots t_n(v|\alpha)\}$ where $t_i(v|\alpha)$ is the net monetary transfer made to stockholder i under the mechanism, subject to budget balance, i.e., $\sum_{i=1}^n t_i(v|\alpha) = 0$.

The payoff to agent i under the mechanism is then given by:

$$\pi_i(v \mid M) = v_i \left[(\alpha_i + x_i(v_i, v_{-i}))(1 - \phi_i) + \xi(\phi_i) \right] \mathbf{1}_{\{d(v)=i\}} + \sum_{j \neq i} v_j (\alpha_i + x_i(v_i, v_{-i}))(1 - \phi_j) \mathbf{1}_{\{d(v)=j\}} + t_i(v_i, v_{-i})$$

or equivalently:

$$\pi_i(v \mid M) = \left[y_i(v_i, v_{-i})(1 - \phi_i) + \xi(\phi_i) \right] v_i \mathbf{1}_{\{d(v)=i\}} + \sum_{j \neq i} y_i(v_i, v_{-i})(1 - \phi_j) v_j \mathbf{1}_{\{d(v)=j\}} + t_i(v_i, v_{-i})$$

The *interim payoff* for i when his valuation is v_i, conditional on the use of a mechanism M, is given by:

$$\Pi_i[v_i|M] = (1-\phi_i)v_i Y[v_i|M] + \sum_{j\neq i} Z_j[v_i|M] + \xi(\phi_i)v_i I[v_i|M] + \tau_i[v_i|M]$$

Lemma 1: *A direct revelation mechanism* $M = \langle d, t, x \rangle$ *is interim incentive compatible if and only if* $\Pi_i[\cdot|M]$ *is convex with*:

$\Pi_i'[v_i|M] = (1 - \phi_i) Y[v_i|M] + \xi(\phi_i) I[v_i|M] > 0$ *a.e.*
where $(1 - \phi_i) Y[\cdot|M] + \xi(\phi_i) I[\cdot|M]$ *is non decreasing* $\forall i \in N$.

The *interim individual rationality*

$$\widehat{\Pi}_i[v_i|M] = \Pi_i[v_i|M] - \alpha_i(1-\phi_1)v_0 \geq 0, \quad \forall i = 1 \ldots n \text{ and } v_i \in [\underline{v}, \overline{v}]$$

where v_0 is the historical value under the controller of the firm.
The set of constraints can be reduced to:

$$\widehat{\Pi}_i[\underline{v}|M] = \Pi_i[\underline{v}|M] - \alpha_i(1-\phi_1)v_0 \geq 0, \quad \forall i \in N$$

Existence

Proposition

Proposition 1: For any incentive compatible mechanism $M = \langle d, t, x \rangle$ *we have:*

$$\begin{aligned}\sum_{i=1}^{n} \Pi_i[\underline{v}|M] &= \sum_{i=1}^{n} (1-\phi_i+\xi(\phi_i)) \int_D v_i \mathbf{1}_{\{d(v)=i\}} dF_n(v) \\ &- \sum_{i=1}^{n} \int_D ((1-\phi_i) y_i(v) + \xi(\phi_i)) \\ &\cdot \left[\frac{(1-F(v_i))}{f(v_i)} \right] \mathbf{1}_{\{d(v)=i\}} dF_n(v)\end{aligned}$$

Existence (cont.)

Proposition

Moreover, for any share correspondence $y(v)$, there exists a transfer correspondence $t(v)$ such that $M = \langle d, t, x \rangle$ is incentive compatible and individually rational iff:

a.- The function $(1-\phi_i)Y[\cdot|M] + \xi(\phi_i)I[\cdot|M]$ is non decreasing $\forall i \in N$, and

b.- The function:

$$W[\alpha, F, n, \{\phi_i\}_{i=1}^{n} |M] \equiv \sum_{i=1}^{n} \Pi_i[\underline{v}|M] - (1-\phi_1)v_0$$

satisfies $W[\alpha, F, n, \{\phi_i\}_{i=1}^{n} |M] \geq 0$.

Implementation

- At least we need that the implementation be feasible with the minimum requirement of ex post balance, .i.e $\sum_{i=1}^{n} t_i(v|\alpha) = 0$.
- It is well known in the mechanism design literature that, in order to facilitate such requirement, we have to use the Bayesian Nash equilibrium concept.
- Specifically, previous results from D´Aspremont and Gerard-Varet (1979) show that a balanced truthful revealing mechanism can be constructed.

Implementation (cont.)

Proposition

Proposition 2: If transfers are defined such that:
$t_i(v_i, v_{-i}) = E_{\widehat{v}_{-i}}[\sum_{j\neq i} u_j((v_i, \widehat{v}_{-i}), d(v_i, \widehat{v}_{-i}), \widehat{v}_j)] -$
$\frac{1}{n-1}\sum_{j\neq i}(E_{\widehat{v}_{-j}}[\sum_{k\neq j} u_k((v_j, \widehat{v}_{-j}), d(v_j, \widehat{v}_{-j}), \widehat{v}_k)$
then $M = \langle d, t, x \mid \alpha \rangle$ *is Bayesian incentive compatible and* t *is balanced for all* α*.*
Corollary: d *is implementable by* $M = \langle d, t, x = \mathbf{0} \mid \alpha \rangle$

- This results shows that incentive compatibility (IC) does not require any particular scheme of share transfer, just monetary transfers are required for truthful revelation.

Implementation (cont.)

- Participation constraints (or Individual Rationality constraints: IR) do not necessarily hold, as in many of these mechanism. Even though there is no a general impossibility theorem, it is hard to find Bayesians mechanism implementing an efficient social choice satisfying Individual Rationality (IR).
- However, in this particular environment of transfer of control, the net share vector x play a central role inducing to participate in the mechanism.
- As we noticed before, x does not have any effect in the social choice but it can help in inducing participation.

Implementation

Proposition

Proposition 3: There exist x *and* $A \subset [0,1]^n$ *such that if transfers for player* i *is*
$t_i(v_i, v_{-i}) = E_{\widehat{v}_{-i}}[\sum_{j \neq i} u_i((v_i, \widehat{v}_{-i}), d(v_i, \widehat{v}_{-i}), \widehat{v}_j)] - \frac{1}{n}\sum_{j \neq i}(E_{\widehat{v}_{-j}}[\sum_{k \neq j} u_k((v_j, \widehat{v}_{-j}), d(v_j, \widehat{v}_{-j}), \widehat{v}_k)$
then $M = \langle d, t, x \mid \alpha \in A \rangle$ *is Bayesian incentive compatible,t is balanced and satisfied the participation constraint for every player.*

Some Preliminar Conclusions

- In this paper we have shown that the structure of individual rationality constraints and the requirement that control be allocated through some minimal fraction of shares are critical in the design of efficient mechanisms to transfer control in a firm.
- We have shown that informational rents are increasing in the share assigned to the new controller, even under the most simple structure for the (IR) constraints. Accordingly, efficiency is more easily achieved when no minimal proportion of shares has to be collected to become the controller. This fact is consistent with the empirical separation of dividends and control rights through different class of shares.
- The structure of (IR) constraints is also critical for the results, in particular, some implementation results can be achieved when participation in mandatory.