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Agency conflicts in the presence of random private benefits from project implementation

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HIGHLIGHTS

- We study a moral hazard problem involving project implementation.
- The moral hazard problem arises because the agent gets random private benefits from implementing a project.
- Such problems are pervasive.
- The optimal contract excessively (insufficiently) discourages the agent from implementing positive (negative) NPV projects.
- The residual value of the principal's claim is uniformly increasing.

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ABSTRACT

We study a contracting problem where a principal delegates the decision to implement a "project" to an agent who obtains private information about the value of the project before making the implementation decision. Moral hazard arises because the agent gets private random non-contractible benefits, or incurs private random non-contractible costs, if the project is implemented. This contracting problem is pervasive, when "project" and "benefits" are interpreted broadly.

Even when the agent is risk-neutral, we show that the principal's optimal contract always insufficiently discourages the agent from implementing negative NPV projects and also insufficiently encourages the agent to implement positive NPV projects. We also show that the principal's residual claim always increases in the project's NPV, a result that is generally unobtainable for optimal contracts in effort-based moral hazard problem settings.

1. Introduction

This paper studies a principal–agent problem involving "project" selection where the source of the incentive conflict between the principal and agent arises because the agent receives private non-contractible "benefits" (which are costs, if negative) from implementing the "project". By interpreting what constitutes a "project" and what constitutes the agent's "benefits" from implementing the project broadly, this problem characterizes well a variety of agency relationships, perhaps even more than are characterized by the effort-based sources of agency conflict studied by Holmstrom (1979), Harris and Raviv (1979), and Ross (1973). Examples involving the firm as the principal and the manager as the agent include: a "project" consisting of a new business in a foreign country where the "benefit" is the cost to the manager of adapting to the culture and language of the foreign country; the "project" consisting of changing production technologies where the "benefit" is the cost to the manager of learning to manage the new technologies; the "project" consisting of a new business strategy (e.g., developing a new on-line division) and the "benefits" one of: the increase in the manager's future wages after his current contract is over from implementing the new strategy,[2] the utility the manager

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[2] While the non-contractible "benefits" arising from implementing the "project" consist of the effects on the manager's career after the present contract with his current principal/employer is over typically will be positive – and beneficial to the manager – sometimes, they can be negative. A famous example appears in the movie Moneyball: in the movie, the Oakland A's manager, Art Howe, refuses to cooperate in fielding players according to the A's general manager's (Billy Beane's) wishes using a so-called sabermetric approach out of fear that implementing this approach (viewed here as Art Howe's project choice) will damage his future career prospects with other baseball clubs.

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gets implementing the new strategy (e.g., interacting with movie stars, if the new strategy consists of buying a media business[3]) or the bribes the manager receives by having the new strategy steer business toward a particular contractor (e.g., letting a certain waste management company handle the firm's waste disposal).

Other models exist (e.g., Stein (1997), Aghion and Bolton (1992), Aghion and Tirole (1997)) where decisions are influenced by a manager's private benefits, but in these other models, the manager's private benefits are taken as positive, fixed, and known to the principal. In contrast, we take the agent's "benefits" to be random, possibly positive or negative, and unknown to the principal. In many settings, we consider our formulation to be the more reasonable one. For example, how likely is it that an employer will know how much an employee's future career prospects will be improved as a consequence of overseeing the implementation of a particular project, or how can an employer reliably assess how much utility the employee will obtain by consorting with movie stars?

In the model, the value-added by the agent derives from the agent learning the NPV of the project prior to deciding whether to adopt the project. The contract the principal gives the agent accounts for how the agent's project implementation decision is affected by both the contract and the agent's private benefits from proceeding with the project. We show that the optimal second-best contract entails: paying the agent too much (relative to the first-best) to sufficiently discourage the agent from not implementing all sufficiently negative NPV projects and paying the agent too little to encourage him to invest in all positive NPV projects. These results accord well with practice: employees who implement negative (resp., positive) NPV projects are seldom penalized enough (or rewarded enough) to result in their personal returns to project implementation matching up with employers' returns. The optimal contract also naturally, i.e., without any ad hoc arbitrary restrictions, entails the principal's residual claims increasing in output. This result is uncommon in conventional agency-based models, as Grossman and Hart (1983) have stressed.[4] Our approach also naturally generates information about the magnitude of the agent's compensation: it must be on the same order of magnitude as the agent's non-contractible benefits/costs from implementing the project. This also contrasts with the standard agency theory, which provides little guidance about the magnitude of the agent's compensation.

2. Model description

The sequence of events is as follows: there is a principal who owns a firm and needs to hire an agent to run the firm. The principal knows the firm has the option to undertake a new project, but the principal does not know the new project's NPV. The principal delegates the decision to implement the project or not to the agent, because after being hired the agent privately learns the new project's NPV.

The contract the principal offers the agent specifies the base wage w the agent receives regardless of whether or not he undertakes the project, along with a performance-contingent bonus $s = s(y)$ if he undertakes the project and the project's realized gross value turns out to be y, the realization of some random variable $\tilde{y}$. The principal learns the project's realized gross value y if, and only if, the agent decides to implement the project (thus, the bonus s can depend on y, but the base wage w cannot).[5] Concurrent with the agent learning the project's gross value y, the agent also privately learns the realized value b of the random variable $\tilde{b}$ determining the agent's non-contractible "benefit" (or cost, if $b < 0$) if he undertakes the project. b remains private information to the agent forever. The principal can observe whether the agent implements the project. Finally, the agent is paid according to the terms of the contract.

The agent's utility if he does not undertake the project is w; his utility if he does undertake the project, $\tilde{b} = b$, and $\tilde{y} = y$ is $b + w + s(y)$. All payments to the agent are restricted to be nonnegative, i.e., $w \geq 0$ and $w + s(y) \geq 0$ for all y.[6] The agent's opportunity cost of working for the principal is $\bar{U}$, where $\bar{U}$ is sufficiently small that the principal always earns nonnegative profits from hiring the agent.[7]

The principal incurs the loss $-w$ if the agent does not undertake the project, and the principal gets the profit $y - s(y) - w$ if the agent undertakes the project.

The prior distribution of $\tilde{y}$ is common knowledge and has continuous density $h(y)$, and the prior distribution of $\tilde{b}$ is also common knowledge and has continuous density $f(b)$ and distribution function $F(b)$. We suppose that both the support $(\underline{y}, \bar{y})$ of $\tilde{y}$ and the support $(\underline{b}, \bar{b})$ are $(-\infty, \infty)$; we assume $E[\tilde{y}]$ is positive and $E[\tilde{y}|\tilde{y} > 0]$ is finite. The distribution of $\tilde{b}$ possesses the increasing hazard rate property: $\frac{f(b)}{1-F(b)}$ strictly increases in b.[8] $\tilde{b}$ and $\tilde{y}$ are taken to be stochastically independent.

Clearly, given the contract $(w, s(y))$, an agent who learns $\tilde{b} = b$ and $\tilde{y} = y$ will choose to implement the project if and only if he is better off by doing so, i.e., iff[9]

$$b + s(y) > 0. \tag{1}$$

Accordingly, the principal's problem is to determine what compensation scheme to award the agent so as to solve the following program.

Program

$$\underset{w,s(y)}{Max} \int [y - s(y)] \times (1 - F(-s(y)))h(y)dy - w$$

subject to

$$w + \int \int_{b>-s(y)} (b + s(y))f(b)dbh(y)dy \geq \bar{U}; \tag{2}$$

$$w \geq 0; \tag{3}$$

$$w + s(y) \geq 0 \quad \text{for all } y. \tag{4}$$

Note the following features of this program:

1. the set of inequalities (1) determining when the agent undertakes the project is embedded in the above program;

[3] This example is not hypothetical. In Nathan's (1999) account of Sony's decision to acquire Columbia Studios, he asserted that "...it seems that Morita's long-standing dream of owning a Hollywood studio was the basis, or certainly a basis, for Sony's commitment to acquiring Columbia at more or less the asking price".

[4] See, in particular, the discussion in Grossman and Hart (1983) surrounding their Proposition 4.

[5] This is similar to Levitt and Snyder (1997) assumption that continuing with a project expands the set of variables available for contracting with the manager.

[6] b is either not a monetary value or, if it is, it is not translatable into immediate cash; hence we have the nonnegativity condition when the agent implements the project of $w + s(y) \geq 0$ rather than $b + w + s(y) \geq 0$.

[7] For example, given the assumption below that $E[\tilde{y}] > 0$, it is clear that $\bar{U} = 0$ is a "low enough" value for $\bar{U}$ so that the principal will earn at least nonnegative profits, because in the case, if the principal offers the agent the contract $s(y) \equiv 0$ and $w = 0$, the agent gets at least $\Pr(\tilde{b} > 0) \times E[\tilde{b}|\tilde{b} > 0] \geq \bar{U}$ in utility (so the agent is willing to accept the contract) and the principal earns expected profits $E[\tilde{y}] \times \Pr(\tilde{b} > 0) > 0$.

[8] Such increasing hazard rate assumptions are common in the incentive contracting literature. See, e.g., Tirole (1988).

[9] In the case of indifference, whether the employee proceeds with the project or not is not important for purposes of any of the subsequent analysis. For concreteness, we assume that the agent proceeds with implementing the project iff his utility strictly increases by implementing the project.