Multifaceted Transactions, Incentives, and Organizational Form

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Abstract

We provide a unified explanation for partnerships, mutuals, cooperatives, government ownership, and vertical integration, based on the desirability of providing low-powered incentives when not every facet of a transaction is contractible: investment might otherwise be diverted towards the transaction’s contractible facets, to the overall transaction’s possible detriment. We distinguish between the two cases of resource allocation and resource creation and show that creation calls for higher powered incentives than allocation. We allow for the partial contractibility of investment and the previously non-contractible transaction facets and show that the former decreases the power of incentives whereas the latter increases that power.

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1 Introduction

*The strong do as they can and the weak suffer what they must (Thucydides, The Peloponnesus War, Book V, 89).*

It is perhaps not entirely unfair to characterize much of Organization Theory and Corporate Finance as having been concerned primarily with those who do, that is, with agents. This has been true both in positive terms – explaining existing arrangements and institutions – and in normative terms – devising what may be considered to be optimal institutional arrangements, those that maximize the combined payoffs of those who do, agents, and those who suffer, principals.

Our purpose in the present paper is to complement the prevailing focus on those who do with an analysis of those who suffer, those who are residual claimants. This shift in focus will be seen to rationalize low-powered incentives, whose relative ubiquity and often highly satisfactory performance (Bøhren and Josefsen, 2013; Hansmann and Thomsen, 2012) may not always be easy to reconcile with the predictions that stem from perhaps too exclusive a focus on those who do.

Our basic premise is Barzel (2002, 2013), Hansmann (1996), and Holmstrom and Milgrom’s (1991, 1994) central insight that when not every facet of a transaction can be contracted upon, low-powered incentives for those facets of the transaction that can be contracted upon may be necessary to avoid too large a distortion in those facets that cannot be. For example, a currency trader may need to be provided with low- rather than high-powered incentives when the bulk of possible trading losses would be borne by investors rather than the trader.\(^1\) Distinguishing among different transaction facets (financial, physical, or intangible capital, quality or quantity of products, services, or labor supplied or demanded) and different transacting parties (shareholders, managers, senior employees, workers, suppliers, buyers, customers, depositors, policyholders), we extend the preceding insight to explain partnerships, mutuals, cooperatives, government ownership, and vertical integration. Optimal organizational ownership allocates the right to set the power of managerial incentives to those parties that are most affected by the non-contractible facets of the organization’s paramount transactions. For example, a buyer seeking to steer a supplier away from contractible quantity towards non-contractible quality integrates backward by acquiring the supplier, thereby acquiring the right to set the power of supplier’s incentives to the low level consistent with the choice of quality over quantity. Distinguishing between the allocation of existing resources and the creation

\(^1\)Traders generally are acutely aware of their ‘trader’s option,’ the asymmetry in their gains and losses from taking large, risky positions: profitable positions result in a large bonuses, unprofitable positions mean, at worse, being fired, the losses from the positions being suffered not by the traders but by their employers.
of new resources, we show that resource creation calls for higher powered incentives than does resource allocation. Allowing for diversification-induced economies of scale in the use of capital, we establish the result that larger, more diversified firms offer higher-powered incentives. Finally, allowing for the partial contractibility of investment and of previously non-contractible transaction facets, we show that the former decreases the power of incentives whereas the latter increases that power, thereby providing a combined explanation for the Nineteenth- and Twentieth-Century rise of large military and civilian bureaucracies and the more recent outsourcing of products and services previously sourced internally.

Our model has an agent invest resources towards uses that can be either safe or risky. Risky investment is more profitable, but it requires costly evaluation and financial capital. Incentives serve to induce the agent to evaluate risky investment and, in the later sections of the paper, to bring forth total investment. Capital may be provided by the agent as well as the principal, but the agent’s cost of capital will generally be higher than the principal’s. Investment affects not only financial capital, but also physical (e.g., a rail or water distribution network) or intangible (e.g., a garage’s reputation for undertaking only necessary repairs, a senior lawyer’s reputation for competence) capital as well as the quantity or quality of a host of other factors (e.g., products, services, labor) supplied or demanded. In one section of the paper, we allow total and safe investment and the use of capital and other factors to be partially contractible. Using these basic ‘ingredients,’ we establish the results that follow:

- Low-powered incentives are superior to agent own capital provision when incentives serve only to steer the agent’s choice between safe and risky investment: low-powered incentives decrease the agent’s otherwise excessive use of capital that the principal but not the agent provides; requiring the agent to provide some capital would make higher-powered incentives possible, but would decrease total and principal payoff in the likely case where the agent’s cost of capital is higher than the principal’s.

- Diversification intended to economize on capital results in higher powered incentives for the agent: there is less need for the low-powered incentives intended to induce the agent to economize on the use of capital when the principal puts less capital at stake by virtue of diversification. The decrease in costly capital made possible by diversification increases payoffs, unless offset by diversified firms’ failure to tailor managerial incentives to specific project characteristics

- Low-powered incentives intended to ensure product quality and the recognition of

\[^2\text{That smaller, more focused firms generally provide higher powered incentives than do their larger, more diversified counterparts suggest the greater importance of resource creation for the former.}\]
incidental effects such as diminished unemployment or expanded production may be achieved through vertical integration or supplier, buyer, or worker cooperatives. Low-powered incentives intended to ensure the integrity of bank deposits, insurance premia, or utilities’ capital equipment may be achieved through mutual, cooperative, or government ownership. Low-powered incentives intended to preserve senior employees’ reputational capital may be achieved through partnerships. In all such cases, the departure from shareholder ownership is intended to allocate the discretion to set the power of agent incentives to the parties whose interests include the aforementioned considerations. For example, workers in a high-unemployment area may wish to form a workers’ cooperative which, by recognizing that unemployment drives the shadow cost of labor below prevailing salaries (Salanié, 2000, p. 44), will provide the agent with low-powered incentive that will induce him to expand employment beyond that which would be chosen by a shareholder-owned firm that would consider salaries but not the (lower) shadow cost of labor in setting its demand for labor.

• When the agent’s task extends from allocating existing resources between investments (safe/risky, high/low quality) to creating new resources for investment, high-powered incentives and own capital provision may strictly dominate low-powered incentives: there is now a trade-off between the agent’s higher cost of capital and the larger total investment higher-powered incentives make possible. Resource creation requires higher powered incentives than does resource allocation.

• Partial contractibility of investment makes possible lower powered incentives (from concentrated ownership in the early stages of an industry to dispersed ownership in the later stages, from venal officeholders to salaried civil servants). Partial contractibility of the use of capital and the quantity and quality of other factors makes possible higher powered incentives (from vertically integrated to independent firms, from salaried employees to independent consultants). A greater ability to contract upon investment decreases the need to rely upon incentives to induce investment; in contrast, a greater ability to contract upon the previously non-contractible transaction facets that motivated the original choice of low-powered incentives decreases the need to rely on these low-powered incentives.

The paper proceeds as follows. Section 2 reviews the relevant literature. Section 3

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3Partnerships’ generally higher powered incentives rarely extend to the partnerships’ top management, whose ‘first among equals’ status precludes too large a compensation difference with the other senior partners.

4We refer to ownership by investors whose relation with the firm is limited to the provision of equity capital as shareholder ownership. Shareholder ownership thus excludes other relations between investors and the firm, such as employment or trade relations.
presents the model and Section 4 the basic results. Section 5 analyzes the desirability of agent capital provision and of firm diversification. Section 6 extends the notions of transaction facets and transacting parties to analyze ownership and vertical integration. Section 7 considers the case of endogenous total investment and its implications for agent capital provision. Section 8 considers partial contractibility and its implications for the power of incentives. Section 9 provides some supporting empirical evidence. Finally, Section 10 concludes.

2 Literature review

Barzel (1982, 1997) recognizes the multifaceted nature of most goods, assets, and transactions and the inability to contract upon every single such facet: contracting requires measurement, which generally can be done only with error and sometimes cannot be done at all. He analyzes the opportunities imperfect measurement provides for wealth transfers and identifies a wide variety of institutions intended to avoid such transfers. For example, regular investors in initial public offerings subscribe to every issue, thereby committing not to ‘pick and choose’ among issues. Such commitment denies regular investors the incentive to produce information intended to distinguish between overpriced and underpriced offerings, information that would be of benefit to its holder but to the detriment of both the issuer and other investors lacking the demand side information that determines how well ‘received’ an issue ultimately will be. Regular investors are compensated for their commitment by being allocated a disproportionate share of issues that are, on average, underpriced. Observing that the desire to engage in wealth transfers is proportionate to the power of incentives, Barzel (2002, 2013) argues that within-firm transactions, by muting the power of incentives, correspondingly decrease the desire to exploit imperfect measurement to engage in wealth transfers. A supplier is thus less likely to skimp on quality when it is owned by its buyer than when it is independent. Transactions will therefore be within-firms when measurement of a valuable attribute is difficult or impossible; they will be in the market when it is not. Barzel (2002, 2013) develops a theory of firm boundaries on that basis.

Holmstrom and Milgrom (1991, 1994) consider the case of multitask agency: numerous tasks are to be performed, effort expanded on one task is to some extent denied the

\[5\text{See Barzel, Habib, and Johnsen (2006) and Gondat-Larralde and James (2008).}\]

\[6\text{Noe, Rebello, and Rietz (2015) argue that the replacement of owner management by delegated management achieves a similar result: by making the manager rather than the owner the beneficiary to wealth transfers, delegated management increases the owner’s incentive to invest in control structures designed to preclude such transfers, thereby bonding the the manager’s provision of quality in a manner that would not be credible if the owner were also the manager.}\]

\[7\text{For an extended discussion of firm boundaries and vertical integration, see Bresnahan and Levin (2013) and Hart (1995) and the references therein.}\]
other. They show that when effort expanded on a given task is measured only imperfectly, high-powered incentives may decrease total payoff as compared to the case of low-powered incentives. High-powered incentives may divert effort away from the less-well measured to the better measured. If the task towards which less-well measured effort is directed is important to total payoff, then the diversion of effort may not be desirable.\footnote{Multitask agency is but one of a number of rationales for low-powered incentives. Others are risk-aversion, distorted or subjective performance measures, relative performance evaluation, and monitoring. See Lazear and Oyer (2013) and the references therein.}

Holmstrom and Milgrom’s (1991, 1994) multitask agency model has been used to analyze agency contracts in a wide range of settings. Among the multiple tasks considered have been teaching and research in business schools (Brickley and Zimmerman, 2001), basic and applied research in pharmaceutical firms (Cockburn, Henderson, and Stern, 1999), quality improvement and cost reduction in government services (Hart, Shleifer, and Vishny, 1997), cooperation and competition in hierarchies (Itoh, 1992), gasoline sales, automobile repairs, and convenience stores in service stations (Slade, 1997), and transportation and service in the trucking industry (Baker and Hubbard, 2003, 2004).

Hansmann (1996) considers a wide variety of ownership forms: investor- and employee-owned firms, agricultural cooperatives, customer- and supplier-owned firms, utilities, clubs, housing cooperatives and condominiums, nonprofits and mutuals. While he evaluates a broader range of explanations than we do, it is interesting to note that the basic mechanism in our paper, the undesirability of high-powered incentives where important facets of a transaction cannot be contracted upon, can account for many of the ownership forms Hansmann (1996) considers. Our paper can be viewed as formalizing much but certainly not all of Barzel (2002, 2013) and Hansmann (1996), using a model which, albeit much simpler than Holmstrom and Milgrom’s (1991), makes possible a perhaps more explicit analysis of managerial ownership, diversification, and the consequences of making investment and selected transaction facets contractible.

## 3 Model

Consider a firm that has resources $B > 0$ which it invests at time 0. The firm allocates resources $L \geq 0$ to safe investment and $B - L \geq 0$ to risky investment.\footnote{The present model is a much simplified version of Falkinger (2014).} The former has return $a > 0$ with probability 1, the latter return $A > 0$ with probability $p_r$, $0 < p_r < 1$. Firm payoff $K$ at time 1 has expectation $E[K] = p_r A (B - L) + a L$ and variance $\text{var}[K] = A^2 (B - L)^2 p_r p_u$, where $p_u = 1 - p_r$.

Risky investment has higher expected return than does safe investment, $p_r A > a$, but it also involves costs that safe investment does not: (i) its prospects for success
must be evaluated at a cost $\kappa (B - L)^2$ and (ii) it requires capital. Capital serves to bond the firm’s fulfillment of the numerous obligations that the undertaking of a project generally entails: employees’ salaries must be paid, suppliers’ bills honored, lenders’ loans serviced, and customers’ after-sales service provided. Should the firm have little or no capital, low payoff realizations may jeopardize the firm’s ability to fulfill these obligations, possibly deterring potential counterparties from transacting with the firm in the first place. We assume capital is proportional to the standard deviation of firm payoff $sd[K] = A (B - L) \sqrt{p_r p_u}$: the larger may be the difference between expected and realized payoff, between what is reckoned with on average and what ultimately is available, the more capital is needed to make up for that difference.

Assume that the firm’s shareholders (the principals) are unable themselves to evaluate and make the investments $L$ and $B - L$. They therefore hire a manager (the agent) to do so on their behalf. Neither the evaluation nor the making of investment is contractible, in contrast to payoff which is. The manager therefore must be provided with payoff-dependent incentive compensation to be induced to evaluate and make investments. Let the manager’s compensation be $\beta_1 K + \beta_0$, where the pay-for-performance parameter $\beta_1$, $0 \leq \beta_1 \leq 1$, measures the power of incentives; $\beta_0$ is the fixed component of compensation. We assume that both shareholders and the manager are risk-neutral; their concern with risk extends only in so far as it affects the cost of evaluating risky investment and the amount of capital to be provided. By analogy to the assumption that the evaluation and the making of investment are not contractible, we assume that the use of capital is not, either.

We now turn to the determination of the optimal managerial contract $(\beta_0, \beta_1)$ and the corresponding value of safe investment $L$; the value of risky investment $B - L$ naturally follows from the resource constraint, which has safe and risky investment together add up to total investment $B$.

4 Basic results

Initially assume that the manager provides no capital. He solves

$$\max_L \beta_1 E[K] + \beta_0 - \kappa (B - L)^2$$  \hspace{1cm} (1)

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10 The prototypical example is probably bank capital, which serves to bond the value of bank deposits against possible declines in the value of bank assets.
11 We set the proportion between capital and standard deviation to one for simplicity.
12 Returning to the example of a currency trader discussed in the Introduction, the failure to contract upon the trader’s risky positions implies the failure to contract upon the extent to which these positions put firm capital at risk.
13 Section 5 allows for partial contractibility.
14 We relax this assumption in Sections 6 and 7.
\[\iff \max_L \beta_1 [p_r A (B - L) + aL] - \kappa (B - L)^2. \]

This problem has solution

\[L = B - \frac{\beta_1}{2\kappa} [p_r A - a].\]

The manager’s reservation utility is normalized to zero; \(\beta_0\) therefore is

\[\beta_0 = \kappa (B - L)^2 - \beta_1 [p_r A (B - L) + aL].\]

Shareholders provide capital \(\Psi sd[K] = A (B - L) \sqrt{p_r p_u}\), with \(\Psi\) the per unit cost of capital to shareholders. They solve\(^{15}\)

\[\max_{\beta_1} E[K] - \beta_1 E[K] - \beta_0 - \Psi sd[K] \iff \max_{\beta_1} p_r A (B - L) + \kappa (B - L)^2 - \Psi A (B - L) \sqrt{p_r p_u}.\]

This problem has solution

\[\beta_1 = 1 - \frac{\Psi A \sqrt{p_r p_u}}{p_r A - a} < 1;\]

the manager therefore makes safe investment\(^{16}\)

\[L = B - \frac{1}{2\kappa} [p_r A - a - \Psi A \sqrt{p_r p_u}].\]

Comparing (2) and (5) reveals that the manager fails to consider the implications of his choice of investment for firm capital \(\Psi A (B - L) \sqrt{p_r p_u}\): as noted in Section 3, the use of capital is not contractible. Shareholders therefore provide the manager with low-powered incentives \((\beta_1 < 1)\) in order to achieve indirectly what they cannot achieve directly, specifically have the manager’s choice of investment be adjusted for costly firm capital. Note that \(L\) in (7) represents shareholders’ first-best choice of safe investment: it is the investment shareholders would instruct the manager to make if investment were contractible\(^{17}\). That shareholders can induce the manager to make the first-best investment through their choice of pay-for-performance parameter \(\beta_1\) in (6) simplifies but is not essential to the analysis of the present section and those of sections 5 and 6.\(^{18}\) The achievement of first-best is an artifact of our model, which attributes a single role to \(\beta_1\), that of steering investment between safe and risky investment. This is in contrast to the

\(^{15}\)Note that subtracting resources \(B\) in (1) or (4) would change neither (3) nor (7).

\(^{16}\)Substitute (6) into (3) to obtain (7). We assume \(p_r A - a > p_r A - a - \Psi A \sqrt{p_r p_u} > 0\)

and

\(B > \frac{1}{2\kappa} [p_r A - a] > \frac{1}{2\kappa} [p_r A - a - \Psi A \sqrt{p_r p_u}]\)

for the pay-for-performance parameter as well as risky and safe investment to be positive.

\(^{17}\)To see this, differentiate (5) with respect to \(L\) rather than \(\beta_1\) to obtain (7).

\(^{18}\)That first-best investment is not essential is made clear in sections 7 and 8.
‘classical’ principal-agent model, in which $\beta_1$ plays an insurance as well as an incentive role, the former role made necessary by the agent’s risk-aversion. It is also in contrast to the analysis of sections 7 and 8 in which $\beta_1$ plays the dual role of steering and eliciting investment.

We show\[19\]

**Proposition 1** Safe investment $L$ is increasing in resources $B$, the cost of evaluating risky investment $\kappa$, the return on safe investment $a$, and the cost of capital $\Psi$; it is decreasing in the return on risky investment $A$ and in the success probability of risky investment $p_r$.

The intuition is relatively simple. Resources in excess of what can profitably be allocated to risky investment are allocated to safe investment. A higher cost of evaluating risky investment increases the desirability of safe investment; so do a higher return on safe investment and more expensive capital needed for risky investment. In contrast, a higher return on risky investment decreases the desirability of safe investment. Finally, an increase in the success probability of risky investment can be shown to decrease the desirability of safe investment: when risky investment is profitable (that is, when $p_r A - a - \Psi A \sqrt{p_r p_u} > 0$ as assumed in Footnote 16), the more likely success of risky investment increases that investment; safe investment correspondingly decreases.

**Proposition 2** The power of incentives $\beta_1$ is decreasing in the return on safe investment $a$ and the cost of capital $\Psi$; it is increasing in the average return on risky investment $A$ and in the success probability of risky investment $p_r$. It is unaffected by resources $B$ and the cost of evaluating risky investment $\kappa$.

The results are intuitive for $a$, $\Psi$, $A$, and $p_r$ in that they complement the results in Propositions 1 and 2, for given resources $B$, a change in safe investment implies an opposite change in risky investment; the latter change is effected through a similar change in the power of incentives $\beta_1$. The result for $B$ reflects risky investment’s lack of dependence on $B$; as $\beta_1$ directs the manager’s risky investment, it too does not depend on $B$. The result for $\kappa$ reflects the role of the fixed component of compensation $\beta_0$ in allocating the cost of evaluating risky investment ultimately to shareholders; both the manager and shareholders face the same cost of evaluating risky investment; there is therefore no need for that cost to enter the determination of the incentives provided the manager through $\beta_1$.

\[19\] The proofs of Propositions 1, 2, 6, 8, and 9 are in the Appendix.
5 Manager capital provision and diversification

Section 4 has established the result that shareholders provide the manager with low-powered incentives in order to adjust the manager’s choice of investment for costly firm capital. This suggests that the power of incentives can be increased by having the manager provide part of the capital himself. We show this to be indeed the case, but that the manager’s higher-powered incentives need not – indeed will not in the present case – increase the combined payoff of shareholders and manager.

Suppose that the cost of capital to the manager is \( \Phi \) and that he is asked to provide a fraction \( m \) of firm capital. Denote the pay-for-performance \( \beta_1^m \). It can be shown to be\(^{20}\)

\[
\beta_1^m = 1 - \frac{(1 - m) \Psi A \sqrt{p_r p_u}}{p_r A - a}.
\] (8)

We have

**Proposition 3** Manager capital provision increases the power of incentives: \( \partial \beta_1^m / \partial m > 0 \).

The intuition is simple: the greater the fraction of firm capital the manager provides, the more the manager considers the implications for capital of his choice of investment, the lesser the need for shareholders to rely on low-powered incentives for the purpose of adjusting the manager’s choice of investment for costly capital. Higher-powered incentives do not, however, imply higher payoff. Indeed, in the present, simple setting in which first-best investment can be achieved through the choice of low-powered incentives, the higher-powered incentives made possible by manager capital provision actually decrease shareholder payoff when the manager’s cost of capital is higher than shareholders’, \( \Phi > \Psi \). To see this, first note that safe investment under manager capital provision is\(^{21}\)

\[
L^m = B - \frac{1}{2\kappa} \left[ p_r A - a - [m\Phi + (1 - m) \Psi] A \sqrt{p_r p_u} \right].
\] (9)

Substituting into shareholders’ objective function, we have

\[
\begin{align*}
p_r A (B - L^m) &+ a L^m - \kappa (B - L^m)^2 \\
&- [m\Phi + (1 - m) \Psi] A (B - L^m) \sqrt{p_r p_u} \\
&= aB + \frac{[p_r A - a - [m\Phi + (1 - m) \Psi] A \sqrt{p_r p_u}]^2}{4\kappa},
\end{align*}
\]

\(^{20}\)Expressions (8) and (9) are derived in the Appendix.

\(^{21}\)We assume \( p_r A - a - \Phi A \sqrt{p_r p_u} > 0 \) in order to obtain \( L^m < B \forall m \in (0, 1] \).
which decreases in \( m \) for \( \Phi > \Psi \). Manager capital provision is dominated by low-powered incentives when the manager’s cost of capital is higher than shareholders: both manager capital provision and low-powered incentives serve the same purpose, that of adjusting the manager’s choice of investment for costly capital, but the former arrangement does so at lower cost. We qualify this result in Section 7 where incentives play the additional role of raising total investment, but the fact remains that an attempt at increasing the power of managerial incentives through manager capital provision is not devoid of costs in the case where the manager has higher cost of capital than do shareholders.

A direct implication of the preceding result is that an entrepreneur may choose to sell his firm to diversified shareholders whose cost of capital is lower than his. The entrepreneur, now manager, would willingly accept a decrease in the power of his incentives for the purpose of increasing his total payoff through shareholders’ lower cost of capital. Formally, his payoff as entrepreneur is

\[
aB + \frac{[p_r A - a - \Phi A \sqrt{pru}]}{4\kappa},
\]

whereas his payoff as manager is the preceding plus his share of the increase in payoff made possible by shareholders’ lower cost of capital

\[
\left( \frac{[p_r A - a - \Phi A \sqrt{pru}]}{4\kappa} \right) - \left( \frac{[p_r A - a - \Phi A \sqrt{pru}]}{4\kappa} \right).
\]

The power of his incentives would correspondingly decrease from \( \beta_1 = 1 \) to \( \beta_1 \) in (6).

The comparison of \( \beta_1 \) in (6) and \( \beta_1^m \) in (8) suggests that shareholders increase the power of incentives when there is manager capital provision because the capital shareholders themselves provide itself decreases; formally, the term \( \Phi A \sqrt{pru} \) in (6) is replaced by \((1 - m) \Psi A \sqrt{pru} \) in (8). An alternative means to decreasing shareholder capital provision is the diversification that is inherent to the joining together of various projects that have less than perfectly correlated payoffs. We show in what follows that diversification does indeed increase the power of incentives; we further show that, unlike manager capital provision in the present, simple setting in which incentives serve only to steer investment, diversification can increase shareholder payoff.

Consider two projects 1 and 2, indexed by \( i \), \( i \in \{1, 2\} \). Index each project by \( i \) to write: \( A_i, a_i, pr_i, pu_i, B_i, L_i, \) and \( \kappa_i \). Define \( \rho_i \equiv A_i \sqrt{pr_i pu_i} \) and denote \( \rho \) the correlation between the two projects. When the two projects are undertaken separately by two different firms, we have from (6)

\[
\beta_{1,i} = 1 - \frac{\Psi \rho_i}{pr_i A_i - a_i}.
\]
When the two projects are undertaken jointly within the same firm, the firm’s payoff has variance

\[
\text{var } [K_1 + K_2] = \beta_1^2 (B_1 - L_1)^2 + \beta_2^2 (B_2 - L_2)^2 + 2\varrho_1 \varrho_2 (B_1 - L_1)(B_2 - L_2).
\]

Suppose the firm offers its manager project-specific incentives with pay-for-performance parameter \(\beta_{1,i}^s\) for project \(i\); the superscript \(s\) indicates that the two projects are undertaken within the same firm. We have\(^{22}\)

\[
\beta_{1,1}^s = 1 - \frac{\Psi \rho_1 \{\rho_{1,1}^2 \kappa_1 + \rho_{2,1}^2 \kappa_2 \}^{\frac{1}{2}}}{(p_{r,1} A_1 - a_1) \left\{ \frac{\rho_{1,1}^2 \kappa_1}{\kappa_1} + \frac{\rho_{2,1}^2 \kappa_2}{\kappa_2} \frac{p_{r,2} A_1 - a_2}{p_{r,1} A_1 - a_1} \right\}^{\frac{1}{2}}}
\]

\[
\geq 1 - \frac{\Psi \rho_1 \{\rho_{1,1}^2 \kappa_1 + \rho_{2,1}^2 \kappa_2 \}^{\frac{1}{2}}}{(p_{r,1} A_1 - a_1) \left\{ \frac{\rho_{1,1}^2 \kappa_1}{\kappa_1} + \frac{\rho_{2,1}^2 \kappa_2}{\kappa_2} \frac{p_{r,2} A_1 - a_2}{p_{r,1} A_1 - a_1} \right\}^{\frac{1}{2}}}
\]

\[
= \beta_{1,1},
\]

where the inequality is true by the observation that the ratio on the RHS of the first equation increases in \(\varrho\), with equality at \(\varrho = 1\). We similarly show that \(\beta_{1,2}^s \geq \beta_{1,2}\). We thus have

**Proposition 4** Larger, more diversified firms provide more high-powered incentives: \(\beta_{1,i} \geq \beta_{1,i}^s\), with equality at \(\varrho = 1\).

Because of ‘coinsurance’ among projects, large, diversified firms can profit from ‘economies of scale’ in capital provision (Barzel and Suen, 1997): a large firm undertaking many less than perfectly correlated projects needs less capital per project than does a small firm undertaking only a subset of these projects. Less capital at stake makes higher powered incentives possible, for less capital implies less capital-induced discrepancy to be remedied through low-powered incentives; the discrepancy is due to the manager’s failure to consider the implications for firm capital of his choice of investment.

Unlike the case of manager capital provision, which increases the power of incentives without increasing shareholders’ payoff because of the manager’s higher cost of capital, diversification increases payoff by decreasing the amount of costly capital shareholders provide. To see this, compare shareholders’ payoffs in the case where the two projects are undertaken separately

\[
\Pi_{spt} = p_{r,1} A_1 (B_1 - L_1) + a_1 L_1 - \kappa_1 (B_1 - L_1)^2
\]

\[
+ p_{r,2} A_2 (B_2 - L_2) + a_2 L_2 - \kappa_2 (B_2 - L_2)^2
\]

\[
- \Psi \left[ \rho_1 (B_1 - L_1) + \rho_2 (B_2 - L_2) \right]
\]

\[(11)\]

\(^{22}\)Expression (10) is derived in the Appendix.
and jointly
\[
\Pi_{\text{jnt}} = p_{r,1}A_1 (B_1 - L_1) + a_1L_1 - \kappa_1 (B_1 - L_1)^2 \\
+ p_{r,2}A_2 (B_2 - L_2) + a_2L_2 - \kappa_2 (B_2 - L_2)^2 \\
- \Psi \sqrt{\rho_1^2 (B_1 - L_1)^2 + \rho_2^2 (B_2 - L_2)^2 + 2\rho_1\rho_2 (B_1 - L_1)(B_2 - L_2)}. \tag{12}
\]

The payoffs are equal for \( \varrho = 1 \) and \( \beta_{1,i}^* = \beta_{1,i} \). As \( \varrho \) decreases below 1, its direct effect on \( \Pi_{\text{jnt}} \) is of first order whether its indirect effect through \( \beta_{1,i}^* \) and \( L_i \) is of second order only, implying that \( \Pi_{\text{jnt}} \) increases as \( \varrho \) decreases. This is in turn implies that \( \Pi_{\text{jnt}} > \Pi_{\text{spt}} \) for \( \varrho < 1 \), because \( \varrho \) has no effect on \( \Pi_{\text{spt}} \). Larger, more diversified firms enjoy economies of scale in costly capital provision; these lower the firms’ total cost of capital, thereby increasing these firms’ payoff.

The preceding result has assumed that shareholders can offer the manager project-specific incentives. If the manager’s ability to engage in transfers between the two projects should limit the firm to offering identical incentives for all projects, then it is not necessarily the case that diversification increases shareholder payoff, despite decreasing shareholder capital provision. To see this, denote \( \beta_1^* \) the firm-wide pay-for-performance parameter and \( \Pi_{\text{jnt}} (\beta_1^*) \) the corresponding payoff; it is clear that \( \Pi_{\text{jnt}} (\beta_1^*) \leq \Pi_{\text{jnt}} \), with strict inequality in the case \( \beta_{1,1}^* = \beta_{1,2}^* \) where the two projects call for different pay-for-performance parameters.\(^{23}\)

Now consider the case \( \varrho = 1 \) at which \( \Pi_{\text{jnt}} = \Pi_{\text{spt}} \) and \( \beta_{1,i}^* = \beta_{1,i} \). Neglecting the non-generic case \( \beta_{1,1} = \beta_{1,2} \), we have \( \Pi_{\text{jnt}} (\beta_1^*) < \Pi_{\text{jnt}} = \Pi_{\text{spt}} \) at \( \varrho = 1 \); by continuity and again using the Envelope Theorem, we have that \( \Pi_{\text{jnt}} (\beta_1^*) < \Pi_{\text{spt}} \) for a range of \( \varrho \) below 1. Larger, more diversified firms’ more limited ability to tailor managerial incentives to specific project characteristics may decrease these firms’ payoffs.

Summarizing, we have

\[^{23}\text{We provide} \beta_1^* \text{for completeness. It is}
\]

\[
\beta_1^* = 1 - \frac{\Psi}{p_{r,1}A_1 - a_1 + p_{r,2}A_2 - a_2} \cdot \left\{ \frac{\rho_1^2 (p_{r,1}A_1 - a_1) \kappa_2 + \rho_2^2 (p_{r,2}A_2 - a_2) \kappa_1}{\rho_1^2 (p_{r,1}A_1 - a_1) \kappa_2 + \rho_2^2 (p_{r,2}A_2 - a_2) \kappa_1} \right\} + \frac{\rho_1^2 (p_{r,1}A_1 - a_1)^2 \kappa_2 + \rho_2^2 (p_{r,2}A_2 - a_2)^2 \kappa_1^*}{\rho_1^2 (p_{r,1}A_1 - a_1) \kappa_2 + \rho_2^2 (p_{r,2}A_2 - a_2) \kappa_1 \kappa_2} + 2\rho_1 \rho_2 (p_{r,1}A_1 - a_1)(p_{r,2}A_2 - a_2) \kappa_1 \kappa_2
\]

When \( \varrho = 1 \), \( \beta_1^* \) becomes

\[
\beta_1^* = 1 - \frac{\Psi (\rho_1 + \rho_2)}{p_{r,1}A_1 - a_1 + p_{r,2}A_2 - a_2} \cdot \frac{p_{r,1}A_1 - a_1}{p_{r,1}A_1 - a_1 + p_{r,2}A_2 - a_2} \beta_{1,1}^* + \frac{p_{r,2}A_2 - a_2}{p_{r,1}A_1 - a_1 + p_{r,2}A_2 - a_2} \beta_{1,2}^*
\]

\( \beta_1^* \) is an ‘expected return-weighted’ average of \( \beta_{1,1}^* \) and \( \beta_{1,2}^* \).
Proposition 5. Diversification within large firms decreases shareholder costly capital provision; it thereby increases payoffs, unless offset by diversified firms’ failure to tailor managerial incentives to specific project characteristics.

6 Beyond capital and shareholders/manager: ownership and vertical integration

We now extend our analysis from managers’ non-contractible use of shareholder capital to a multitude of transaction facets and transacting parties. Specifically, we consider transactions involving the non-contractible use of reputation (Section 6.1), deposits and policy premia (6.2), rail and water infrastructure (6.3), labor (6.4), farm produce and implement (6.5), and product quality (6.6), between parties that include senior lawyers (6.1), depositors and policyholders (6.2), household and corporate users of infrastructure (6.3), workers (6.4), farmers, farm produce processors and shippers, and farm implement providers (6.5), and suppliers and buyers (6.6), to analyze the ownership of organizations. We argue that optimal organizational ownership allocates the right to set the power of managerial incentives to those parties that are most affected by the non-contractible facets of the organization’s paramount transactions.

6.1 Legal partnerships

The non-contractibility of reputation may help explain why established, senior lawyers rather than outside shareholders are the main residual claimants – the owners – in legal partnerships: it is the senior lawyers’ reputation that constitutes the main asset of a law office; outside shareholders, who do not bear the cost of any decline in the senior lawyers’ reputation to the same extent as do the lawyers themselves, may be tempted to ‘over-use’ that reputation, for example by directing the firm – or incentivizing the firm manager – to take on at least some legal cases that the firm ultimately may not be able to deal with properly. Such a development is less likely to happen under senior lawyers’ ownership. In the context of a legal partnership, \( B \) would be total cases taken on, \( L \) those that can be dealt with properly, \( B - L \) those that may not be so, \( \kappa (B - L)^2 \) the cost of evaluating these latter, ‘borderline’ cases, whose probability of success presumably is harder to assess, \( p_r \) the probability that the outcome of these cases nonetheless be satisfactory, \( \Psi \rho (B - L) \) the capital that even a partnership must have, and \( \Theta (B - L) \) the (expected) cost to the senior partners’ of the decline in their reputation in the event the firm were to lose the borderline cases. A shareholder-owned firm would set \( \beta_i = 1 - [(\Psi \rho) / (p_r A - a)] \) rather than the \( 1 - [(\Psi \rho + \Theta) / (p_r A - a)] \) that would properly account for the senior partners’ reputational cost \( \Theta \), which senior partners would not fail to account for if themselves
making the decision in a partnership. Note that the presence of reputational costs may justify the choice of the partnership form even if the partners’ cost of capital, $\Phi$, is greater than shareholders’ $\Psi$: $\Phi > \Psi$. Formally, the partnership form can be shown to dominate for $\Theta > \Theta_0$, where

$$\Theta \equiv \sqrt{\rho (\Phi - \Psi) [\rho (\Phi - \Psi) + (p_rA - a - \Phi\rho) + (p_rA - a - \Psi\rho)]} - \rho (\Phi - \Psi) \geq 0,$$

(13)

with equality at $\Phi = \Psi$: in the presence of a cost of capital advantage to shareholders over partners ($\Psi < \Phi$), high senior lawyers reputational costs ($\Theta > \Theta_0$) nonetheless justify the choice of the partnership form.

### 6.2 Mutual ownership

Hansmann (1996) has explored the implications of the observation that ownership by outside shareholders may lead to the over-use of various firm assets to explain the wide variety of ownership patterns observed in practice: customer-owned utilities; mutually-owned financial institutions such as insurers, banks, and savings and loan associations; worker, supplier, and farmer cooperatives; partnerships; etc. Hansmann (1996, pp. 246-251) writes for example that many banks were mutually owned in the Nineteenth-Century United States because ownership by shareholders might have led to too risky an investment policy, as shareholders bore only a fraction – admittedly the senior fraction – of the possible losses from such a policy. In that context, $B$ would be total bank deposits, $L$ would be deposits invested into relatively safe assets, $B - L$ those invested into risky assets that pay off with probability $p_r$, and $\Theta (B - L)$ would be the cost to depositors of the risky investment policy. Such policy would less likely be pursued should depositors own the bank, that is, should the bank be organized as a mutual, for a mutually owned bank would provide the bank manager with lower powered incentives that would not fail to take depositor losses into account. The same reasoning applies to savings and loans associations, building societies in Britain, and insurance companies (see O’Hara (1981), Valnek (1999), and Mayers and Smith (1981), respectively).

The difference in pay-for-performance parameters stems from the difference in objective functions: shareholders maximize $p_rA (B - L) + aL - \kappa (B - L)^2 - \Psi\rho (B - L)$, whereas senior partners maximize $p_rA (B - L) + aL - \kappa (B - L)^2 - (\Psi\rho + \Theta) (B - L)$. We assume $p_rA - a - \Psi\rho - \Theta > 0$ for $\beta_1 = 1 - [(\Psi\rho + \Theta) / (p_rA - a)] > 0$.

Expression (13) is derived in the Appendix.
6.3 Government and customer ownership

Closer in time, Kay (2003, 2010) writes that the disasters that bedeviled the now defunct rail infrastructure (track, signaling, tunnels, bridges, railroad crossings, . . .) company Railtrack in the United Kingdom could to some extent be attributed to its privatization. Privatization was followed by a number of tragic accidents, which Kay attributes to a decrease in maintenance expenses. In the context of Railtrack, $B$ would be resources available for maintenance, $L$ would be resources the firm chose to allocate to maintenance, $B - L$ would be those the firm ultimately chose not to allocate to maintenance, $\kappa (B - L)^2$ would be the cost to the firm of distinguishing between essential maintenance expenses and those deemed less so, $p_r$ would be the probability that the foregone maintenance expenses have no meaningful impact on train operations, and $\Theta (B - L)$ would be the cost to users of the rail infrastructure (Train Operating Companies, passengers, public at large, . . .) of the problems, small and large, due to insufficient maintenance. Along with other privatized companies, Railtrack offered high powered incentives to its managers (so much so that the then Labour opposition railed against privatized companies’ ‘fat cats’), $\beta_1 = 1 - [(\Psi \rho) / (p_r A - a)]$, whereby the recognition of the costs of insufficient maintenance would have called for the lower powered incentives, $\beta_1 = 1 - [(\Psi \rho + \Theta) / (p_r A - a)]$, that may be viewed as characterizing the public sector. The corresponding maintenance expenses are $L = B - [(p_r A - a - \Psi \rho) / (2\kappa)]$ and $L = B - [(p_r A - a - \Psi \rho - \Theta) / (2\kappa)]$ for the private and the public sector, respectively, with the former lower than the latter. While the bulk of Railtrack’s assets was eventually returned to the public sector, an alternative to government ownership may have been ownership by the users of Railtrack’s infrastructure, the Train Operating Companies. This is what happened to many of the United Kingdom’s privatized water utilities, which encountered similar – albeit thankfully less tragic – problems as did Railtrack; many such as Yorkshire Water chose to transform themselves into customer-owned utilities.

6.4 Worker cooperatives

What of cooperatives? Consider worker cooperatives first. As already mentioned in the Introduction, Salanié (2000, p. 44) notes that a situation of involuntary unemployment introduces a difference between the prevailing wage and the shadow cost of labor, with the former higher than the latter. Worker cooperatives may be considered more likely to recognize the gain resulting from employment than would shareholder-owned firms. (Note that a decrease in wage to its shadow value may not be desirable, if the shadow value were lower than the efficiency wage; it certainly would not be the to benefit of the

\[^{26}\text{Indeed, Hansmann (2013, p. 897) considers governments, when democratic, as “essentially a form of consumer cooperative.”}\]
infra-marginal workers, those already employed at the initial, higher wage.) In the context of worker cooperatives, \( B \) would be the cooperative’s need for labor, \( L \) would be locally-sourced labor, \( B - L \) would be non-locally sourced labor, though subcontracting contracts for example, \( \kappa (B - L)^2 \) would be the cost of evaluating the opportunities presented by subcontracting, \( p_r \) would be the probability that subcontracting would prove profitable, and \( \Theta (B - L) \) would be cost to local labor of the decision to source \( B - L \) ‘units’ of labor non-locally, with \( \Theta \) a measure of the difference between the wage and the shadow cost of labor. As in previous instances, a shareholder-owned firm would offer its manager more high-powered incentives than would the worker cooperative; it would source less labor locally.

6.5 Farm marketing, processing, and supply cooperatives

A related sort of externality may explain the existence of farm marketing and/or processing cooperatives. Hansmann (1996, pp. 122-123) notes that many agricultural products are sold to highly concentrated middlemen and processors, whose monopsony power would if exercised keep prices and production well short of welfare-maximizing levels. Unlike shareholder-owned middlemen and processors who likely would find it beneficial to incentivize managers to exercise such power, their farmer-owned counterparts would not, at least not to as great an extent, for they would recognize the gains to farmer welfare that can be had from raising prices and expanding production. In the context of farm marketing cooperatives, \( B \) would be feasible production of a given agricultural commodity in a given geographical region, \( L \) would be production purchased and marketed by the monopsony middleman, \( B - L \) would be production foregone because of low monopsonist purchase price, \( p_r \) would be the probability that the benefits of the commodity’s low purchase price dominate the costs of reduced quantity supplied, \( \kappa (B - L)^2 \) would be the cost of evaluating the trade-off between price and quantity, and \( \Theta (B - L) \) would be the decrease in farmer welfare due to the decision to forego production because of low purchase price. A very similar rationale can be provided for the existence of farm supply cooperatives, with monopsonistic purchase replaced by monopolistic supply (Hansmann, 1996, pp. 150-151).

6.6 Vertical integration

Farmer ownership of marketing, processing, or supply cooperatives are a form of vertical integration, but such integration extends well beyond farmer ownership in situations of monopsony or monopoly. Barzel (2002, 2013) has argued that vertical integration serves to lessen the power of an independent supplier’s incentives, when the high powered incentives chosen under independent ownership would induce the supplier to provide too
low a level of non-contractible quality. Specifically, consider a supplier who can provide high quality, well-engineered products that function in all circumstances, or lower quality, less well engineered products that function only with some probability. Such products may nonetheless be desired by the buyer if produced at lower prices/in higher quantities. Assume that there is a cost to determining the optimal level of quality/engineering and that, should the product fail to function as intended or at all, the cost of malfunction will in the first instance be borne by the buyer. In the context of supplier quality, $B$ would be total resources, $L$ would be resources invested in the high quality alternative, $B - L$ would be those invested in the lower quality alternative, $p_r$ would the probability that the lower quality, less well engineered products nonetheless function satisfactorily, $\kappa (B - L)^2$ would be the cost of evaluating the trade-off between price/quantity and quality, and $\Theta (B - L)$ would be the cost of product malfunction to the user/buyer.

An independent supplier would set managerial incentives $\beta_1 = 1 - [(\Psi \rho) / (p_r A - a)]$ for resources invested in the high quality alternative $L = B - [(p_r A - a - \Psi \rho) / (2\kappa)]$, whereas the buyer having integrated backward by acquiring the supplier would set lower powered incentives $\beta_1 = 1 - [(\Psi \rho + \Theta) / (p_r A - a)]$, for higher resources invested in the high quality alternative $L = B - [(p_r A - a - \Psi \rho - \Theta) / (2\kappa)]$. Note, however, that similarly to the case of diversification discussed in Section 5, the possibly limited ability to tailor incentives to the specific characteristics of supplier and buyer may decrease the gains from vertical integration.

An alternative to vertical integration may be a supply contract between buyer and supplier: where vertical integration grants the buyer the discretion to set the power of managerial incentives directly, a supply contract allows him to do so indirectly, through his setting of the power of the supply contract’s incentives. We show

**Proposition 6** A supply contract with pay-for-performance parameter $\beta_{1,C} \equiv 1 - [\Theta / (p_r A - a)]$ induces the supplier to set its manager a pay-for-performance parameter $\beta_{1,S} \equiv 1 - [\Psi \rho / (p_r A - a - \Theta)]$. The combined effect of these two pay-for-performance parameters is identical to the effect of the pay-for-performance parameter that would be chosen under vertical integration, $\beta_{1,C} \beta_{1,S} = 1 - [(\Psi \rho + \Theta) / (p_r A - a)] \equiv \beta_{1,B}$.

The intuition is simple: by limiting the extent to which the supplier can profit from providing the higher return, lower quality products, $\beta_{1,C} = 1 - [\Theta / (p_r A - a)] < 1$, the buyer decreases the supplier’s incentive to economize on quality. Interestingly, the supplier sets higher managerial pay-for-performance parameter than he would absent the supply contract, $\beta_{1,S} = 1 - [\Psi \rho / (p_r A - a - \Theta)] > 1 - [(\Psi \rho) / (p_r A - a)]$; such adjustment is

27 Going beyond quality to a product’s multiple ‘design attributes’ (Milgrom and Roberts, 1992, p. 91), Besanko, Dranove, and Shanley (1996, pp. 89-90) and Milgrom and Roberts (1992, pp. 556-558) argue that one purpose of vertical integration is to make possible the coordination these attributes require.
made necessary by the requirement that the supply contract’s effect be limited to the manager’s choice of quality and not extend to his use of capital.

Does the result in Proposition 6 invalidate the rationale for vertical integration? Perhaps, but a more nuanced interpretation is that both the supply contract and vertical integration have essentially the same effect, which is to make the buyer the main claimant to what was previously the supplier’s payoff. The high cost of malfunction Θ that warrants vertical integration makes the buyer the claimant to a fraction $1 - \beta_1, C = \Theta / (p_r A - a)$ of gross payoff $E[K]$ under contract, $1 - \beta_1, B = (\Psi \rho + \Theta) / (p_r A - a)$ under vertical integration; the difference is due to the fact that the buyer ‘subcontracts’ the provision of capital to the supplier in the case of the supply contract. The low-powered supply contract may to some extent be viewed as a ‘disguised’ form of vertical integration, very similar in effect yet different in appearance.

7 Endogenous total investment

The present section reverts to the case of no incidental effects, Θ = 0. It abandons the assumption of fixed, exogenous resources for that of variable, endogenous resources: the manager creates resources $B$ at a cost $cB^2$. These remain to be allocated between safe investment $L$ and risky investment $B - L$. The manager consequently engages in the combined problem of resource creation – bringing forth total investment $B$ – and resource allocation – dividing total investment $B$ between safe investment $L$ and risky investment $B - L$. He solves

$$\max_{B, L} \beta_1 (p_r A (B - L) + aL) + \beta_0 - \kappa (B - L)^2 - cB^2,$$

which has solution

$$B = \frac{\beta_1 a}{2c} \quad (14)$$

and$^{28}$

$$L = B - \frac{\beta_1}{2\kappa} [p_r A - a] = \beta_1 \left[ \frac{a}{2c} - \frac{p_r A - a}{2\kappa} \right]. \quad (15)$$

Shareholders solve

$$\max_{\beta_1} p_r A (B - L) + aL - \kappa (B - L)^2 - \Psi \rho (B - L) - cB^2,$$

which has solution

$$\beta_1 = 1 - \frac{\Psi \rho (p_r A - a) c}{(p_r A - a)^2 c + a^2 \kappa} = W \beta_{1, B - L} + (1 - W) \beta_{1, B}, \quad (16)$$

$^{28}$We assume $\frac{a}{c} > \frac{p_r A - a}{\kappa}$ for the solution (15) to be interior.
where

$$W \equiv \frac{(p_r A - a)^2 c}{(p_r A - a)^2 c + a^2 \kappa},$$

$$\beta_{1,B-L} \equiv 1 - \frac{\Psi \rho}{p_r A - a},$$

and

$$\beta_{1,B} \equiv 1.$$

The pay-for-performance parameter $\beta_1$ is a weighted average of $\beta_{1,B-L}$ and $\beta_{1,B}$, the former being the parameter that would equate the manager’s choice of risky investment to the shareholders’ FB ($B - L)^{FB} = (p_r A - a - \Psi \rho) / (2\kappa)$, the latter being the parameter that would do likewise for the manager’s choice of total investment ($B^{FB} = a / (2c)$).

Note that $\beta_{1,B} = 1 > \beta_{1,B-L}$ and that $W$ increases in $c$ and decreases in $\kappa$. The inequality $\beta_{1,B} = 1 > \beta_{1,B-L}$ reflects the contrast between the absence of costly capital considerations in the process of creating resources and their presence in that of allocating resources. The increase of $W$ in $c$ decreases the weight put on $\beta_{1,B}$: an increase in the cost of bringing forth total investment decreases the desirability of inducing total investment. Finally, the decrease of $W$ in $\kappa$ decreases the weight put on $\beta_{1,B-L}$: an increase in the cost of evaluating risky investment decreases the desirability of inducing risky investment.

We let the ratio $\kappa/c$ denote the importance of resources creation relative to that of resource allocation: the lower is $\kappa/c$, the lower is the cost of evaluating risky investment relative to that of bringing forth total investment, the more attractive is resource allocation relative to resource creation. Conversely, the higher is $\kappa/c$ and therefore the lower is $c/\kappa$, the lower is the cost of bringing forth total investment relative to that of evaluating risky investment, the more attractive is resource creation relative to resource allocation. We show

\textbf{Proposition 7} The power of incentives $\beta_1$ increases in the relative importance of resource creation: $\partial \beta_1 / \partial (\kappa/c) > 0$.

Proposition \ref{prop:beta1} may be viewed as serving to identify a condition under which high-powered incentives are desirable: the cost of resource creation $c$ must be small in relation to that of resource allocation $\kappa$. Two examples vividly illustrate the pitfalls of high-powered incentives when that condition is not satisfied. The extremely high powered incentives

\footnote{Note $\beta_1$ would have simultaneously to equal $\beta_{1,B-L}$ and $\beta_{1,B}$ for safe investment to equal its first-best value $L^{FB} = [a / (2c)] - [(p_r A - a - \Psi \rho) / (2\kappa)]$.}

\footnote{The proof is immediate: rewrite $\beta_1$ in (16) as

$$\beta_1 = 1 - \frac{\Psi \rho (p_r A - a)}{(p_r A - a)^2 + a^2 \kappa}$$

which is increasing in $\kappa/c$.}
granted those who would become the Russian oligarchs did not revive Russia's moribund industrial sector, but led to a no-holds-barred fight for that country's immense natural resources. Similarly, the very high powered incentives provided interest rate and currency traders in London and New York led not so much to traders' identification of bona fide profitable trading opportunities as to the traders' manipulation of settlement prices. In both cases, high powered incentives that were intended to lead to value creation instead led to what can perhaps best be described as value appropriation, from the Russian State and minority shareholders in the case of the oligarchs, from clients and, through the fined imposed by regulators, bank shareholders in the case of the traders. In both cases, such appropriation was made possible by a very low ratio of \( \kappa \) to \( c \): corruption in Russia and lack of proper supervision in banks lowered \( \kappa \), corruption again and intense competition in financial markets raised \( c \).31

Unlike what was the case in sections 4, 5, and 6, it is no longer the case that the optimal pay-for-performance parameter \( \beta_1 \) is effective at inducing the manager to choose shareholders' FB investment: as two types of investment, total \( B \) and risky \( B - L \), are to be induced by means of a single instrument, \( \beta_1 \), it is impossible for that single instrument to achieve FB for both investments, that is, it is impossible for \( \beta_1 \) simultaneously to equal \( \beta_{1,B} \) and \( \beta_{1,B-L} \neq \beta_{1,B} \). This suggests the need for an additional instrument. We show in Proposition 8 that, unlike the result in Section 5, the provision by the manager of a fraction of capital \( m > 0 \) may increase total payoff even if the manager should have cost of capital \( \Phi \) higher than shareholders' \( \Psi \).

**Proposition 8** When incentives play the dual role of steering and eliciting investment, the power of incentives provided the manager and the fraction of capital contributed by the manager are

\[
\beta_1 = 1 - \frac{(1 - m) (p_r A - a) \Psi \rho c}{a^2 \kappa + (p_r A - a)^2 c} \quad (18)
\]

and

\[
m = \frac{(\Phi - \Psi) \left[ (p_r A - a)^2 c (p_r A - a - \Psi \rho) + a^2 \kappa (p_r A - a) \right] - \Phi \Psi \rho a^2 \kappa}{(\Phi - \Psi) \left[ (p_r A - a)^2 c (\Phi - \Psi) \rho + a^2 \kappa \Phi \rho \right] - \Phi \Psi \rho a^2 \kappa}, \quad (19)
\]

respectively, with \( 0 < \beta_1 \leq 1 \) and \( 0 \leq m \leq 1 \).

31 The following comment by Anatoly Chubais, architect of the Russian privatizations, illustrates both the extremely high power of the oligarchs' incentives and the hope that these incentives would lead to value creation. “They steal and steal and steal. They are stealing absolutely everything and it is impossible to stop them. But let them steal and take their property. They will then become owners and decent administrators of this property.” However, as noted by former Financial Times Moscow Bureau Chief Chrystia Freeland, who reported Chubais’s comments in her book on the Russian privitizations (Freeland, 2000, pp. 67-68), “[i]t didn’t quite work out that way. Even after they got rich, most of Russia’s oligarchs judged that continuing to manipulate the rules of the game in their own favor was a more lucrative strategy […]” In the context of our model, Freeland’s (2014) statement can be interpreted as stating that \( \kappa \) was much lower than \( c \) in Russia.
To interpret the results in Proposition 8, consider (18) first. Note that $\beta_1 = 1$ when $m = 1$: the manager is the unique residual claimant when he alone provides the capital. Further note that $\beta_1 > 0$: there would be no investment otherwise, $B = L = 0$. Next consider (19). Recall that $\Psi \rho < p_r A - a$ and consider the following three cases in turn.

1. When the manager’s cost of capital is very high, specifically when

$$2\Psi > \Phi$$

$$\geq \Psi_0 = \frac{(p_r A - a)^2 (p_r A - a - \Psi \rho) c + (p_r A - a) a^2 \kappa}{(p_r A - a)^2 (p_r A - a - \Psi \rho) c + (p_r A - a - \Psi \rho) a^2 \kappa} \Psi$$

then it is optimal for shareholders to provide the entirety of capital, $m = 0$.\(^{33}\)

2. When $\Psi_0 \rho > \Phi \rho > p_r A - a$, meaning that the manager’s cost of capital is high but not overly so, then it is optimal for shareholders to provide part of the capital, $0 < m < 1$. This is immediate from (19). Shareholders realize that the manager would make no risky investment whatsoever if he were to provide the entirety of capital.\(^{34}\) Note that there would be no interior solution $0 < m < 1$ if $\Psi_0 \rho < p_r A - a$; instead, there would be a ‘bang-bang’ solution $m = 0$ for $\Phi \rho \geq \Psi_0 \rho$ and $m = 1$ for $\Phi \rho < \Psi_0 \rho < p_r A - a$.

3. When $\Phi \rho < p_r A - a$, then it is clear from (19) that the constraint $m = 1$ is binding. When the manager’s cost of capital is low, even if it should be somewhat higher than that of shareholders ($\Phi > \Psi$), then the shareholders maximize the manager’s incentives by selling the firm to him. This is a fortiori the case when $\Phi < \Psi$.

In essence, cases 1-3 confirm the natural intuition that the lower the manager’s cost of capital (the lower $\Phi$), the more shareholders can rely on capital provision by the manager for the purpose of having him consider the implications for firm capital of his choice of investment (the higher $m$), and the more therefore they can rely on high-powered incentives for the purpose of having the manager bring forth total investment (the higher $\beta_1$).

Note from (20) that $\partial \Psi_0 / \partial A < 0$: the larger is the payoff at risk $A$, the more capital $sd[K]$ is required, the wider is the range $\Psi_0 \leq \Phi < 2\Psi$ over which shareholders provide the entirety of capital.\(^{35}\)

---

\(^{32}\)To see this, substitute $\beta_1 = 0$ into (37) in the Proof of Proposition 8 in the Appendix and note that $L = 0$ when $B = 0$: no resources can be allocated to safe investment when there are no resources available.

\(^{33}\)The first inequality represents the necessary condition for a maximum identified in the Proof of Proposition 8 in the Appendix.

\(^{34}\)To see this, substitute $m = 1$ into (18) and (38) in the Proof of Proposition 8 in the Appendix and recall that $p_r A - a < \Phi \rho$ in the case under consideration.

\(^{35}\)It is simple but tedious to show that $\partial sd[K] / \partial A > 0$ from $sd[K] = \Psi \rho (B - L)$, (18), (19), and (38).
Partial contractibility and the power of incentives

Limited contractibility has been essential to our results, in the sense that it is the inability to contract upon the manager’s use of capital (financial or otherwise), his choice of quality, or his recognition of various incidental effects that makes low-powered incentives desirable. This suggests that increased contractibility should increase the power of incentives (Barzel, 2002, 2013). We show in what follows that this is indeed the case. Interestingly, however, we also show that when contractibility pertains to safe or total investment \((L, B)\) as opposed to capital, quality, or incidental effects \((\Psi(B - L)\rho, \Theta(B - L))\), then contractibility decreases rather than increases the power of incentives (Allen, 2012). As noted in the Introduction, a greater ability to contract upon investment \((L, B)\) should decrease the need to rely upon incentives to induce such investment; in contrast, a greater ability to contract upon those previously non-contractible facets \((\Psi(B - L)\rho, \Theta(B - L))\) that motivated the original choice of low-powered incentives should decrease the need to rely on these low-powered incentives.

8.1 Contractible capital

Suppose the manager’s use of capital is partially contractible: his variable compensation is no longer a fraction \(\beta_1\) of gross payoff \(E[K]\), but of payoff net of the cost of a fraction \(q\) of firm capital, \(E[K] - q\Psi sd[K]\). The index of contractibility \(q\), \(0 \leq q \leq 1\), equals 1 when the entire cost of capital \(\Psi sd[K]\) is netted out. The manager’s problem is

\[
\max_{B,L} \beta_1 [p_r A (B - L) + a L - q\Psi \rho (B - L)] + \beta_0 - \kappa (B - L)^2 - cB^2.
\]

Solving for \(B\) and \(L\), we obtain

\[
B = \frac{\beta_1 a}{2c}
\]

and

\[
L = B - \frac{\beta_1}{2\kappa} [p_r A - a - q\Psi \rho] = \beta_1 \left[ \frac{a}{2c} - \frac{p_r A - a - q\Psi \rho}{2\kappa} \right].
\]

Shareholders’ problem is

\[
\max \beta_1 p_r A (B - L) + a L - \kappa (B - L)^2 - cB^2 - \Psi \rho (B - L).
\]

Solving for \(\beta_1\), we have

\[
\beta_1 = 1 - \frac{(1 - q)(p_r A - a - q\Psi \rho)\Psi \rho c}{(p_r A - a - q\Psi \rho)^2 c + a^2 \kappa} = W \beta_{1,B-L} + (1 - W) \beta_{1,B},
\]

where

\[
W \equiv \frac{(p_r A - a - q\Psi \rho)^2 c}{(p_r A - a - q\Psi \rho)^2 c + a^2 \kappa}.
\]
\[ \beta_{1,B-L} \equiv 1 - \frac{(1 - q) \Psi \rho}{p_r A - a - q \Psi \rho}, \]

and

\[ \beta_{1,B} \equiv 1. \]

Similarly to the result in Section 7, the pay-for-performance parameter \( \beta_1 \) is a weighted average of \( \beta_{1,B-L} \) and \( \beta_{1,B} \), the former being the parameter that would equate the manager’s choice of risky investment \( B - L \) to the FB \( ((B - L)^{FB} = (p_r A - a - \Psi \rho) / (2\kappa)) \), the latter being the parameter that would do likewise for the manager’s choice of total investment \( B \) \( (B^{FB} = a / (2c)) \). We have

**Proposition 9** The power of incentives \( \beta_1 \) increases in the index of contractibility \( q \): \( \partial \beta_1 / \partial q > 0 \). Full contractibility maximizes the power of incentives: \( \beta_1 = 1 \) at \( q = 1 \). Shareholders’ payoff increases in the index of contractibility.

The results are intuitive. The greater contractibility of capital implies the lesser need for shareholders to rely on low-powered incentives for adjusting the manager’s choice of investment for costly firm capital. The higher-powered incentives thereby made possible increase investment, in turn increasing shareholders’ payoff. When the use of capital is fully contractible \( (q = 1) \), the manager becomes the unique residual claimant \( (\beta_1 = 1) \). First-best is attained in such case, as can be seen by substituting \( \beta_1 = 1 \) and \( q = 1 \) into (21) and (22) to obtain \( B = B^{FB} \) and \( L = L^{FB} \).

Turning from the contractibility of capital to that of quality or incidental effects, note that if low \( \beta_1 \) contracts are viewed as characterizing employment relations and in-house transactions within a single diversified firm, and high \( \beta_1 \) contracts as characterizing market-based transactions among independent, focused providers of products and services, then increased contractibility may at least partially explain the relatively recent increase in both product and service outsourcing.

### 8.2 Contractible inputs

Now consider inputs \( B \) and \( L \). Suppose that \( B \) and \( L \) may be partially contractible, in the sense that shareholders can impose the constraints \( B \geq B^i \) and \( L \geq L^i \), where the superscript \( i \) stands for ‘imposed.’

#### 8.2.1 Contractible total investment

Start with \( B \geq B^i \). The manager’s objective function becomes

\[ \beta_1 [p_r A (B - L) + aL] - \kappa (B - L)^2 - cB^2 + \lambda (B - B^i), \]
where $\lambda$ denotes the Lagrange multiplier associated with the constraint. Solving for $B$ and $L$ we have

$$B = \frac{1}{2c} \left[ \beta_1 a + \lambda \right]$$  \hspace{1cm} (25)

and

$$L = B - \beta_1 \left( \frac{p_r A - a}{2\kappa} \right) = \beta_1 \left[ \frac{a}{2c} - \frac{p_r A - a}{2\kappa} \right] + \frac{\lambda}{2c}.$$  \hspace{1cm} (26)

Shareholders’ objective function is

$$p_r A (B - L) + aL - \kappa (B - L)^2 - cB^2 - \Psi \rho (B - L).$$

Solving for $\beta_1$ we obtain

$$\beta_1 = 1 - \frac{a\lambda \kappa + \Psi \rho (p_r A - a) c}{a^2 \kappa + (p_r A - a)^2 c} = W \beta_{1,B-L} + (1 - W) \beta_{1,B},$$  \hspace{1cm} (27)

where

$$W = \frac{p_r A - a a \lambda \kappa + \Psi \rho (p_r A - a) c}{\Psi \rho a^2 \kappa + (p_r A - a)^2 c},$$

$$\beta_{1,B-L} = 1 - \frac{\Psi \rho}{p_r A - a},$$

and

$$\beta_{1,B} = 1.$$

The pay-for-performance parameter $\beta_1$ is yet again a weighted average of $\beta_{1,B-L}$ and $\beta_{1,B}$, with the weight $W$ increasing in the Lagrange multiplier $\lambda$ ($\partial W/\partial \lambda > 0$): the partial contractibility of total investment makes it possible to decrease the importance of the problem of inducing total investment (the weight put on $\beta_{1,B}$) and correspondingly increase that of inducing the optimal choice between safe and risky investment (the weight put on $\beta_{1,B-L}$). The overall effect is to decrease $\beta_1$: $\partial \beta_1 / \partial \lambda < 0$.

What is the effect of minimum total investment $B^i$? When $B = B^i$ and $\lambda > 0$, we have from (25) and (27)

$$\frac{\partial B^i}{\partial \lambda} = \frac{1}{2c} \left[ -\frac{a^2 \kappa}{a^2 \kappa + (p_r A - a)^2 c} + 1 \right] > 0.$$  

An increase in $B^i$ increases $\lambda$, which in turn decreases $\beta_1$: the larger is the minimum total investment that can be imposed through partial contractibility, the lesser the need to induce the manager to make such investment, and the more closely targeted at steering the choice between safe and risky investment is $\beta_1$. Summarizing, we have

**Proposition 10** The power of incentives $\beta_1$ decreases in the contractibility of total investment $B^i$. 
Full contractibility of total investment grants shareholders the ability to set \( B^i = B^{FB} = a/2c \); we show that it makes possible the achievement of first-best. To see this, let shareholders set \( \beta_1 = \beta_{1,B-L} = 1 - \left[ (\Psi \rho) / (p_r A - a) \right] < 1. \) From (25) and \( \beta_1 < 1 \) it is the case that the constraint \( B \geq B^i = B^{FB} \) is binding, so \( B = B^{FB} \). Substituting into (26) and using \( \beta_1 = \beta_{1,B-L} \), we obtain

\[
L = B^{FB} - \left[ 1 - \frac{\Psi \rho}{p_r A - a} \right] \frac{p_r A - a}{2\kappa} \\
= \frac{a}{2c} - \frac{p_r A - a - \Psi \rho}{2\kappa} \\
= L^{FB}.
\]

8.2.2 Contractible safe investment

Now consider \( L \geq L^i \). The manager’s objective function becomes

\[
\beta_1 [p_r A (B - L) + aL] - \kappa (B - L)^2 - cB^2 + \mu \left( L - L^i \right),
\]

where \( \mu \) denotes the Lagrange multiplier associated with the constraint. Solving for \( B \) and \( L \) we have

\[
B = \frac{1}{2c} [\beta_1 a + \mu] \tag{28}
\]

and

\[
L = B - \frac{1}{2\kappa} [\beta_1 (pA - a) - \mu] = \beta_1 \left[ \frac{a}{2c} - \frac{p_r A - a}{2\kappa} \right] + \mu \left[ \frac{1}{2c} + \frac{1}{2\kappa} \right]. \tag{29}
\]

Shareholders’ objective function is

\[
p_r A (B - L) + aL - \kappa (B - L)^2 - cB^2 - \Psi \rho (B - L).
\]

Solving for \( \beta_1 \) we obtain

\[
\beta_1 = 1 - \frac{\mu [ak - (p_r A - a) c] + \Psi \rho (p_r A - a) c}{a^2k + (p_r A - a)^2 c}. \tag{30}
\]

We have

\[
sign \left( \frac{\partial \beta_1}{\partial \mu} \right) = sign \left( (p_r A - a) c - ak \right) = sign \left( \frac{p_r A - a}{k} - \frac{a}{c} \right) = -1,
\]

where the last equality is true from the assumption in Footnote 28. As it did in \( \lambda \), \( \beta_1 \) decreases in \( \mu \); as was true of total investment \( B \), the partial contractibility of safe investment \( L \) heightens the importance of \( \beta_1 \)’s role in steering the choice between safe and risky investment.

What is the effect of minimum safe investment \( L^i \)? When \( L = L^i \) and \( \mu > 0 \), we have from (29) and (30)

\[
\frac{\partial L^i}{\partial \mu} = \frac{1}{2ck} \left[ -\frac{(ak)^2 + (p_r A - a)^2 c^2 - 2 (p_r A - a) ak c}{a^2k + (p_r A - a)^2 c} + \kappa + c \right] > 0.
\]

25
An increase in \( L^i \) increases \( \mu \), which in turn decreases \( \beta_1 \): an increase in the minimum safe investment that can be imposed through partial contractibility results in a decrease in \( \beta_1 \), reflecting the greater importance of choosing between the two types of investment as opposed to inducing investment. We thus have

**Proposition 11** The power of incentives \( \beta_1 \) decreases in the contractibility of safe investment \( L^i \).

As for total investment, full contractibility of safe investment makes possible the achievement of first-best. To see this, set \( L^i = L^{FB} = \left[ a/(2c) \right] - \left[ (p_r A - a - \Psi \rho)/(2\kappa) \right] \) and \( \beta_1 = 1 - [(\Psi \rho)/(p_r A)] \) and substitute into (28) and (29) to obtain \( \mu = (\Psi \rho a)/(p_r A) \) and \( B = B^{FB} = a/(2c) \). Note that \( \beta_1 < 1 = \beta_{1,B} \): first-best total investment is induced without the need to equate the power of incentives \( \beta_1 \) to that which induces first-best total investment absent contractibility \( \beta_{1,B} \). This is because the \( L \geq L^i \) constraint directly affects both \( B \) and \( B - L \) (the Lagrange multiplier \( \mu \) is present in both (28) and (29)), unlike the \( B \geq B^i \) constraint which directly affects only \( B \) (the Lagrange multiplier \( \lambda \) is present in (25) but only through \( B \) in (26)). In words, the manager need not be made the unique residual claimant to make the first-best level of total investment, because part of his incentives are provided directly through the contractibility of safe investment. The converse is not true, however: the contractibility of total investment has no direct effect on the choice between safe and risky investment; this is why \( \beta_1 = \beta_{1,B - L} \) in Section 8.2.1, unlike \( \beta_1 < \beta_{1,B} \) in the present section.

9 Empirical evidence

Anderson (1985) and Anderson and Schmittlein (1984) examine the choice electronic components industry firms make between using a direct sales force composed of firm employees and an indirect sales force composed of independent sales representatives. The former are provided with low-powered incentives, the latter with extremely high-powered incentives.\(^{36}\) The authors find that two considerations appear to play a paramount role in the choice between direct and indirect sales, specifically (i) the difficulty of assessing performance and (ii) the importance of non-selling activities.\(^{37}\) Both considerations

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\(^{36}\)Anderson (1985, p. 76) notes that “rep agencies worked on a 100% commission basis” whereas “the direct sales force were salaried, often with a small bonus or commission in addition” but that “salary constituted over 90% of total compensation.”

\(^{37}\)Examples of non-selling activities a salesperson may be called upon to perform are trade shows attendance and after-sales service (Anderson, 1985, p. 78). As their name indicates, these activities do not to generate any (immediate) sales; they therefore do not generate any commission and are consequently of relatively minor importance to salespersons. In contrast, non-selling activities can be of major importance to the selling firms, as failure to engage in these activities may jeopardize future sales. For example, a firm that acquires a reputation for poor after-sales service likely will encounter at least some difficulty making new sales.
favor the choice of direct over indirect sales, that is, of low-powered incentives over their high-powered counterparts. These findings are consistent with our analysis if, again using quality for concreteness, we associate the difficulty of assessing performance with the difficulty of contracting upon quality ($q$ in Section 8.1) and the importance of non-selling activities with the importance of quality ($\Theta$ in Section 6.6): performance that is more difficult to assess (lower $q$) and non-selling activities that loom larger in importance (higher $\Theta$) lower the power of incentives $\beta_1$.

A very similar interpretation can be made of the findings of Azoulay (2004), who examines the decision by pharmaceutical companies to contract out clinical trials to Contract Research Organizations (CRO) or to conduct these ‘in-house.’ Azoulay (2004, p. 1592) finds that “[t]he choice is […] between the hierarchy of the firm – in which subjective performance evaluations are combined with flat incentives – and the hierarchy of its subcontractor – whose virtue stems precisely from the ability to provide high-powered incentives on a narrow set of monitorable tasks.” If one associates the ability to evaluate performance objectively and monitor a task with the index of contractibility $q$ in Section 8.1, then Azoulay’s (2004) findings are entirely in agreement with the predictions of Proposition 9. Of course, contractibility only matters if there is an asymmetry between pharmaceutical firm and clinical investigator payoffs, if $\Psi$ (the cost of capital) or $\Theta$ (the importance of quality or incidental effects) are strictly positive. In the context of clinical trials, there are important incidental effects that take the form of knowledge produced in the course of conducting the trials; in the words of Gelijns, Rosenberg, and Moskowitz (1998, p. 693), “[t]he unexpected and anomalous results of clinical experience […] pose new questions for basic biomedical research and enrich its ultimate payoff.” Such knowledge is generally of much greater importance to the pharmaceutical firm than it is to the investigator conducting the trial, for it is the former that can make by far the most of it. Azoulay (2004, p. 1592) further finds that “knowledge-intensive projects are more likely to be assigned to internal teams.” In the notation of our model and in accordance with our analysis, high $\Theta$ projects are assigned to low $\beta_1$ investigators.

The decrease in the power of incentives in response to the contractibility of total and safe investment analyzed in Section 8 is consistent with what Allen (2012) calls the ‘institutional revolution:’ the modern era replacement of purchase and patronage by merit for the purpose of staffing military, law enforcement, and tax collection positions. Consider the British Military for example. Where British Army and Royal Navy officers had once purchased their commissions (army) or owed it to patronage (navy) and had been compensated by a rank-dependent share of loot or prize money (high $\beta_1$), officer positions have come to be held by salaried personnel (low $\beta_1$) selected and promoted on merit. Allen (2005, p. 68) attributes the change to the greater measurability of officer
input made possible by modern technology, as (i) “changes in weapons allowed for training in ordinance and shooting; this training allowed the army to select soldiers on observable inputs” (army) and (ii) “the technical innovation of steam power in conjunction with the screw propeller [removed] wind as a critical element in battle; captains, and admirals [therefore] could no longer easily excuse their failure to engage [the enemy]” (navy). In the notation of our model, technology-induced increases in $B^t$ (increases in total inputs, e.g., increased ability to direct an attack on the enemy) and $L^t$ (increases in specific inputs, e.g., increased ability to direct an attack on a specific enemy target) resulted in decreases in $\beta_1$. Interestingly, and in accordance with our analysis, Allen (2005, 2012) notes that the high-powered incentives prevailing under purchase and patronage (high $\beta_1$) regularly distorted military personnel’s choices away from fighting and towards looting (lower $L$, higher $B - L$), at the expense of wider military aims (high $\Theta$). For example, a ship captain may attack an enemy merchant rather than military ship, despite the latter’s much higher military value, because of the easier and richer picking constituted by the former.

10 Conclusion

Twentieth-Century French Philosopher Alain (1928, p. 218) wrote that “no sooner does a man seek happiness than he is condemned not to find it.” More prosaically perhaps, proverbial wisdom holds something along the lines of “if you really want something, then you should not try too hard to get it.” The present paper has revolved around a very similar idea: the maximization of total payoff may call for low-rather than high-powered incentives. The reason is that when not every facet of a transaction is contractible, the provision of high-powered incentives for those facets that can be contracted upon may result in large distortions to those facets that cannot. By examining many transaction facets and many transacting parties, the paper has provided an explanation for partnerships, mutuals, cooperatives, government ownership, and vertical integration. The paper has also provided a rejoinder to both Alain and proverbial wisdom: when happiness is to be created rather than sought, if what is wanted is to be made rather than found, then actively seeking happiness and trying hard to get what is wanted may in fact be desirable. Specifically, the paper has established the result that resource creation calls for higher-powered incentives than does resource allocation. Finally, the paper has explored the implications for managerial incentives of managerial capital provision, diversification, and the contractibility of investment and selected transaction facets. In so doing, it has provided a combined explanation for the seemingly contradictory developments that have been the Nineteenth- and Twentieth-Century rise in salaried employment (low-powered incentives) and the more recent rise in outsourcing (high-powered incentives).
Appendix

Proof of Proposition 1: The results with respect to \( B, \kappa, \Psi, \) and \( a \) are immediate. We use \( p_r - \Psi \sqrt{p_r p_u} > a/A > 0 \) assumed in Footnote 16 to write

\[
\frac{\partial L}{\partial A} = -\frac{1}{2\kappa} [p_r - \Psi \sqrt{p_r p_u}] < 0.
\]

Finally, we have

\[
\frac{\partial L}{\partial p_r} = \frac{A}{2\kappa} \left[ 1 - \frac{\Psi (1 - 2p_r)}{2\sqrt{p_r p_u}} \right].
\]

If \( p_r \geq 1/2 \), it is clear that \( \partial L/\partial p_r < 0 \); if \( p_r < 1/2 \), we again use \( p_r - \Psi \sqrt{p_r p_u} > 0 \) to write

\[
\frac{\partial L}{\partial p_r} = \frac{A}{2\kappa} \left[ 1 - \frac{p_r (1 - 2p_r)}{2p_r p_u} \right] < 0.
\]

Proof of Proposition 2: The results with respect to \( a, \Psi, B, \) and \( \kappa \) are immediate. We have

\[
\frac{\partial \beta_1}{\partial A} = \frac{a\Psi \sqrt{p_r p_u}}{(p_r A - a)^2} > 0
\]

and

\[
\frac{\partial \beta_1}{\partial p_r} = \Psi A \left[ \frac{a (1 - p_r) + p_r (A - a)}{2\sqrt{p_r p_u} (p_r A - a)^2} \right] > 0.
\]

Derivation of (8) and (9): The manager solves

\[
\max_L \beta_1 [p_r A (B - L) + aL] - \kappa (B - L)^2 - m\Phi A (B - L) \sqrt{p_r p_u},
\]

which has solution

\[
L = B - \frac{1}{2\kappa} \left[ \beta_1 (p_r A - a) - m\Phi A \sqrt{p_r p_u} \right]; \quad (31)
\]

shareholders solve

\[
\max_{\beta_1} (p_r A - a) (B - L) + aB - \kappa (B - L)^2 - [m\Phi + (1 - m) \Psi] A (B - L) \sqrt{p_r p_u},
\]

which has first-order condition

\[
(p_r A - a) \frac{\partial (B - L)}{\partial \beta_1} - 2\kappa (B - L) \frac{\partial (B - L)}{\partial \beta_1} - [m\Phi + (1 - m) \Psi] A \sqrt{p_r p_u} \frac{\partial (B - L)}{\partial \beta_1} = 0.
\]

\[\text{Note that we have rewritten } p_r A (B - L) + aL \text{ as } (p_r A - a) (B - L) + aB. \text{ This transformation simplifies the derivation of the optimal pay-for-performance parameter } \beta_1; \text{ we use it repeatedly in our proofs.} \]
which, using (31), becomes

\[
\frac{(p_r A - a)^2}{2\kappa} - [\beta_1 (p_r A - a) - m\Phi A \sqrt{p_r p_u}] \frac{(p_r A - a)}{2\kappa} - [m\Phi + (1 - m) \Psi] A \sqrt{p_r p_u} \frac{(p_r A - a)}{2\kappa} = 0,
\]

which has solution (8); (9) is then obtained by substituting (8) into (31).

**Derivation of (10):** The manager solves

\[
\max_{L_1, L_2} \sum_{i=1,2} \left\{ \beta_{1,i}^* [p_{r,i} A_i (B_i - L_i) + a_i L_i] - \kappa_i (B_i - L_i)^2 \right\},
\]

which has solution

\[
L_i = B_i - \frac{\beta_{1,i}^*}{2\kappa_i} [p_{r,i} A_i - a_i];
\]

shareholders solve

\[
\max_{\beta_{1,1}^*, \beta_{1,2}^*} \sum_{i=1,2} \left\{ (p_{r,i} A_i - a_i) (B_i - L_i) + a_i B_i - \kappa_i (B_i - L_i)^2 \right\}
\]

\[-\Psi \sqrt{p_1^2 (B_1 - L_1)^2 + p_2^2 (B_2 - L_2)^2} + 2\rho_1 \rho_2 (B_1 - L_1) (B_2 - L_2) \]

The first-order condition for \(\beta_{1,1}^*\) is

\[
(p_{r,1} A_1 - a_1) \frac{\partial (B_1 - L_1)}{\partial \beta_{1,1}^*} - 2\kappa_1 (B_1 - L_1) \frac{\partial (B_1 - L_1)}{\partial \beta_{1,1}^*} - \Psi \frac{2p_1^2 (B_1 - L_1) \frac{\partial (B_1 - L_1)}{\partial \beta_{1,1}^*} + 2\rho_1 \rho_2 (B_2 - L_2) \frac{\partial (B_1 - L_1)}{\partial \beta_{1,1}^*}}{2\sqrt{p_1^2 (B_1 - L_1)^2 + p_2^2 (B_2 - L_2)^2} + 2\rho_1 \rho_2 (B_1 - L_1) (B_2 - L_2)};
\]

substituting \(B_i - L_i, i = 1,2\), from (32) and solving for \(\beta_{1,1}^*\), we obtain (10).

**Derivation of (13):** Shareholders maximize \(p_r A (B - L) + aL - \kappa (B - L)^2 - \Psi \rho (B - L)\) whereas senior partners maximize \(p_r A (B - L) + aL - \kappa (B - L)^2 - (\Phi \rho + \Theta) (B - L)\).

The former therefore set pay-for-performance parameter \(\beta_1 = 1 - [(\Psi \rho) / (p_r A - a)]\) whereas the latter set \(1 - [(\Phi \rho + \Theta) / (p_r A - a)]\). The manager is thereby induced to make safe investment \(L = B - [(p_r A - a - \Psi \rho) / (2\kappa)]\) in the former case and \(B - [(p_r A - a - \Phi \rho - \Theta) / (2\kappa)]\) in the latter. Substituting into the combined payoff of shareholders and senior partners, \(p_r A (B - L) + aL - \kappa (B - L)^2 - (\Psi \rho + \Theta) (B - L)\) and \(p_r A (B - L) + aL - \kappa (B - L)^2 - (\Phi \rho + \Theta) (B - L)\), respectively, we obtain total payoffs

\[
aB + \frac{[p_r A - a - \Psi \rho] [p_r A - a - (\Psi \rho + \Theta)]}{2\kappa} - \frac{[p_r A - a - \Psi \rho]^2}{4\kappa} \quad (33)
\]

and

\[
aB + \frac{[p_r A - a - (\Phi \rho + \Theta)]^2}{4\kappa}, \quad (34)
\]
in the two cases of shareholder and senior partners’ ownership, respectively. Senior
partners’ ownership dominates iff \((33)\) is smaller than \((34)\), which is equivalent to

\[
\Theta^2 + 2\rho (\Phi - \Psi) \Theta - \rho (\Phi - \Psi) [(p_r A - a - \Phi \rho) + (p_r A - a - \Psi \rho)] > 0.
\]

The quadratic has positive discriminant and a single positive root \(\Theta\) in \((13)\). The inequality
is true for \(\Theta > \Theta\).

**Proof of Proposition 6** The supply contract grants the supplier gross payoff \(\beta_{1,C} E[K] + \beta_{0,C}\). A manager that has pay-for-performance parameter \(\beta_{1,S}\) and fixed compensation \(\beta_{0,S}\) therefore solves

\[
\max_L \beta_{1,S} [\beta_{1,C} E[K] + \beta_{0,C}] + \beta_{0,S} - \kappa (B - L)^2
\]

\[
\iff \max_L \beta_{1,S} \beta_{1,C} [p_r A (B - L) + aL] - \kappa (B - L)^2.
\]

This problem has solution

\[
L = B - \frac{\beta_{1,S} \beta_{1,C}}{2\kappa} [p_r A - a].
\]

As the manager’s reservation utility is normalized to zero, the fixed component of com-
pensation equals \(\beta_{0,S} = \kappa (B - L)^2 - \beta_{1,S} [\beta_{1,C} E[K] + \beta_{0,C}].\)

The supplier solves

\[
\max_{\beta_{1,S}} \beta_{1,C} E[K] + \beta_{0,C} - \beta_{1,S} [\beta_{1,C} E[K] + \beta_{0,C}] - \beta_{0,S} - \Psi sd \ [K]
\]

\[
\iff \max_{\beta_{1,S}} \beta_{1,C} [(p_r A - a) (B - L) + aB] - \kappa (B - L)^2 - \Psi \rho (B - L).
\]

This problem has solution

\[
\beta_{1,S} = 1 - \frac{\Psi \rho}{\beta_{1,C} [p_r A - a]};
\]

substituting into \((35)\) we obtain

\[
L = B - \frac{\beta_{1,C} [p_r A - a] - \Psi \rho}{2\kappa}.
\]

For safe investment to equal the value \(L = B - [(p_r A - a - \Psi \rho - \Theta) / (2\kappa)]\) that would be
chosen under vertical integration, it must be that \(\beta_{1,C} = 1 - [\Theta / (p_r A - a)];\) substituting
into \((36)\) yields \(\beta_{1,S} = 1 - [\Psi \rho / (p_r A - a - \Theta)].\)

**Proof of Proposition 8** Let the manager provide a fraction \(m\) of capital at a cost \(\Phi\)
per unit of capital, the remaining fraction \(1 - m\) being provided by shareholders at a cost
\(\Psi\). The problem solved by the manager is therefore

\[
\max_{\beta_{1,S}} \beta_{1} [p_r A (B - L) + aL] + \beta_{0} - \kappa (B - L)^2 - cB^2 - m\Phi \rho (B - L).
\]
It has solutions
\[ B = \frac{\beta_1 a}{2c} \] (37)
and
\[ L = B - \frac{\beta_1}{2\kappa} [p_r A - a] + \frac{m\Phi\rho}{2\kappa} = \beta_1 \left[ \frac{a}{2c} - \frac{p A - a}{2\kappa} \right] + \frac{m\Phi\rho}{2\kappa}. \] (38)
The problem solved by shareholders is
\[ \max_{\beta_1,m} (p_r A - a) (B - L) + aB - \kappa (B - L)^2 - cB^2 - [m\Phi + (1 - m) \Psi] \rho (B - L). \]
Using (37) and (38), the two first-order conditions are
\[ (1 - \beta_1) \left[ a^2\kappa + (p_r A - a)^2 c \right] - (1 - m) (p_r A - a) \Psi \rho c = 0 \] (39)
and
\[ -(1 - \beta_1) (p_r A - a) \Phi \rho c - [\beta_1 (p_r A - a) - m\Phi \rho] (\Phi - \Psi) \rho c + (1 - m) \Psi \Phi \rho^2 c = 0. \] (40)
Solving (39) for \( \beta_1 \) yields (18); substituting (18) into (40) and solving for \( m \) yields (19).

Turning to the second-order condition, we note that the shareholders’ problem has
Hessian
\[ \begin{vmatrix} - \left[ a^2\kappa + (p_r A - a)^2 c \right] & (p_r A - a) \Psi \rho c \\ (p_r A - a) \Psi \rho c & (\Phi - 2\Psi) \Phi \rho^2 c \end{vmatrix}. \]
The first principal minor is negative; a necessary condition for the Hessian to be positive and the solution to be a maximum is that \( \Phi - 2\Psi < 0. \)

**Proof of Proposition 9** Differentiate (24) with respect to \( q \) to obtain
\[ \text{sign} \left\{ \frac{\partial \beta_1}{\partial q} \right\} = -\text{sign} \left\{ -[(p_r A - a - q\Psi \rho) + (1 - q) \Psi \rho] \left[ (p_r A - a - q\Psi \rho)^2 c + a^2\kappa \right] + 2(1 - q)(p_r A - a - q\Psi \rho)^2 \Psi \rho c \right\} \]
\[ = -\text{sign} \left\{ -\left( p_r A - a - q\Psi \rho \right)^2 (p_r A - a - \Psi \rho) c \right\} - (p_r A - a - q\Psi \rho) + (1 - q) \Psi \rho a^2\kappa \right\} \]
\[ = +1. \]
That \( \beta_1 = 1 \) at \( q = 1 \) is immediate from (24).

Use (21), (22), (23), and (24) to write shareholder payoff
\[ \Pi = \beta_1 \left[ (2 - \beta_1) \left( \frac{(p_r A - a - q\Psi \rho)^2}{4\kappa} + \frac{a^2\kappa}{4c} \right) - \frac{(1 - q) (p_r A - a - q\Psi \rho) \Psi \rho}{2\kappa} \right] \]
\[ = \frac{1}{4\kappa} \left[ (p_r A - a - q\Psi \rho)^2 c + a^2\kappa \right] - \frac{[(1 - q) (p_r A - a - q\Psi \rho) \Psi \rho]^2}{2\kappa} \]
\[ \text{sign} \left\{ \frac{\partial \beta_1}{\partial q} \right\} \]
\[ = \frac{1}{4\kappa} \left[ (p_r A - a - q\Psi \rho)^2 c + a^2\kappa \right] - \frac{(1 - q) (p_r A - a - q\Psi \rho) \Psi \rho}{2\kappa} \]
\[ = \frac{1}{4\kappa} \left[ (p_r A - a - q\Psi \rho)^2 c + a^2\kappa \right] - \frac{(1 - q) (p_r A - a - q\Psi \rho) \Psi \rho}{2\kappa}. \]
Define $D \equiv (p_r A - a - q \Psi \rho)^2 c + a^2 \kappa$ to rewrite
\[
\Pi = \frac{1}{4\kappa c} \frac{[D - (1-q) (p_r A - a - q \Psi \rho) \Psi \rho c]^2}{D}.
\]

Differentiate with respect to $q$ to obtain
\[
\text{sign} \left\{ \frac{\partial \Pi}{\partial q} \right\} = \text{sign} \left\{ \begin{array}{l}
2 \left[ \frac{\partial D/\partial q + (p_r A - a - q \Psi \rho) \Psi \rho c + (1-q) (\Psi \rho)^2 c}{D} \right] D \\
- \left[ D - (1-q) (p_r A - a - q \Psi \rho) \Psi \rho c \right] \frac{\partial D/\partial q}{D} \\
+ 2D \left[ (p_r A - a - q \Psi \rho) \Psi \rho c + (1-q) (\Psi \rho)^2 c \right]
\end{array} \right\}.
\]

Substitute $D$ and $\partial D/\partial q = -2 (p_r A - a - q \Psi \rho) \Psi \rho c$ to obtain
\[
\text{sign} \left\{ \frac{\partial \Pi}{\partial q} \right\} = \text{sign} \left\{ \begin{array}{l}
-2 (1-q) (p_r A - a - q \Psi \rho)^2 c \\
+2 \left[ (p_r A - a - q \Psi \rho)^2 c + a^2 \kappa \right] (1-q) (\Psi \rho)^2 c
\end{array} \right\}
= \text{sign} \left\{ 2a^2 \kappa (1-q) (\Psi \rho)^2 c \right\}
= +1.
\]
11 References

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