HANDS-TYING IN PRINCIPAL-AGENT RELATIONSHIPS: VENTURE CAPITAL FINANCING, PUBLISHING CONTRACTS, AND ACADEMIC TENURE

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ABSTRACT

A principal who hires an agent to manage a project often knows that, as the project progresses, further information will be received that will permit a more accurate forecast of the project's likelihood of success. Yet it is common in such cases for the principal to commit himself, at the time of hiring the agent, not to act on the basis of such information -- and, in particular, not to withdraw financing from the project if subsequent information indicates that the project will be less profitable than originally expected. We explore the incentives for making such commitments, which we term "hands-tying" agreements, and examine their role in several familiar contractual settings.

I. INTRODUCTION

Venture capitalists often contract to give voting control over a start-up firm to an entrepreneur who invests relatively little money of his own. Publishers frequently agree to publish and promote an established author's new book long before they have inspected a completed manuscript. And universities usually consent to grant a full professor job tenure and research autonomy without reserving any authority to supervise the kind and quality of the professor's future publications. In each of these cases, principals commit themselves in advance to continue to finance an agent's projects even though future information may reveal that these projects are no longer attractive investments. We term such commitments "hands-tying" agreements.

In this paper we develop a simple intuition to explain hands-tying: a principal ties his own hands when he must enter a profit-sharing contract with his agent that would otherwise give the principal an excessively strong incentive to reject efficient projects.[1/] It is well known that when an agent's efforts are not observable the agent must, for incentive purposes, be compensated at least in part with a share of the returns of the project on which he works (e.g., Hart and Holmstrom, 1987). Yet, if the agent lacks capital to invest, the only feasible profit-sharing contract will be one that gives the principal and

1. Our concern with the allocation of control among co-participants in a common project is in the spirit of the recent property rights literature (Hart & Moore, 1988; Aghion & Bolton, 1988), although we approach the problem differently.

agent asymmetric stakes in the project's outcome by awarding the agent a disproportionate share of potential gains while leaving the principal, who supplies the capital, with a disproportionate share of potential losses. Consequently, a principal who receives further information about a project's prospects <u>after</u> negotiating such a profit-sharing contract may find that the project is personally unprofitable, and wish to reject it, even though it has a positive expected return not only for the agent but also for the principal and agent combined. An agent who anticipates this incentive <u>before</u> contracting will demand that, when the principal retains the power to reject the project, the terms of the agent's employment contract be adjusted to compensate for the loss in his expected return. As a result, a principal who retains the right to reject a project that has a negative expected return for him may find that the benefit from having such authority is outweighed by the resulting additional cost of recruiting an agent. In such circumstances, the principal will be willing to tie his hands.

In Section II we present a simple model to analyze this intuition. In Section III we examine the application of the model to actual instances of hands-tying behavior.

I. A MODEL

Imagine a situation in which a principal hires an agent to develop a project in which the principal will invest. Agents have unique skills in project development that the principal does not possess. On the other hand, agents have no funds of their own with which to invest in the project; the capital required by the project must be supplied by the principal.[2]

The project can have either of two outcomes: good or bad. A good outcome has a dollar value $v = v_g > 0$ (net of the opportunity cost of any funds that the principal must invest in the project[3]), while a bad outcome has a value $v = -v_b < 0$. The agent has a choice between two different levels of effort to expend in project development. Either he can expend no effort on project development, in which case the outcome will always be bad, or he can expend a fixed positive amount of effort on which he places a dollar value of e, in which case there will be a probability of $q > 0$ that the outcome will be good and a probability of $1-q$ that it will be bad. An agent incurs no costs from accepting employment with the principal aside from the cost of expending effort in project development. In particular, an agent incurs no opportunity cost simply from accepting employment with the principal (an assumption we shall relax below). The market for agents is competitive, so that an agent must be paid only enough to cover his costs, which are e if he expends effort

2. While a wealth constraint on agents serves to motivate our results, risk aversion on the part of agents, as in the models of Shavell (1979) and Holmstrom (1979), would lead to similar results.

3. Thus, we do not explicitly treat the amount of funds that the principal must invest in the project. For further discussion of the nature of the principal's capital investment, see Section II.F below.

and zero if he does not.

The principal is unable to observe whether the agent has expended effort. However, after the agent (allegedly) expends effort to develop the project, the principal receives a costless signal s giving an indication of the likelihood that the outcome of the project will be good. This signal can take either of two values, s_g or s_b. If the outcome of the project will be good, the signal will take value s_g with probability r and value s_b with probability 1-r; similarly, if the outcome of the project will be bad, the signal will take value s_b with probability r and value s_g with probability 1-r. That is, $p(s=s_g|v=v_g) = p(s=s_b|v=v_b) = r$, where $.5 \leq r \leq 1$. When r = .5 the signal contains no information, while if r = 1 the signal gives a perfect forecast of the outcome of the project. We shall refer to r as the "reliability" of the principal's signal.[4]

After receiving his signal, the principal has the opportunity to decide whether or not to invest in the project. If he decides to reject the project, it will have value v = 0.

All individuals seek to maximize their expected returns. This means, in particular, that they are risk neutral, an assumption we make both for simplicity and to emphasize that our results do not depend on risk aversion. An individual is employed as an agent only once in his lifetime, so that he lacks the opportunity or incentive to develop a reputation for expending

4. We set the two conditional probabilities, $p(s=s_g|v=v_g)$ and $p(s=s_b|v=v_b)$, equal here only for simplicity.

effort.

All of the preceding is common knowledge, except that in any given case the principal cannot know whether the agent has actually expended effort. The structure of the model is diagrammed as an extensive form game in Figure 1.

In this model, the principal enters a hands-tying contract when he binds himself, at the time of hiring the agent and before the latter has expended effort, to invest in the project regardless of the value subsequently taken by his signal. With such a contract, the model collapses to the form diagrammed in Figure 2.

A. The First-Best Outcome

As a preliminary matter it is helpful to explore the first-best outcome that maximizes the joint returns to the principal and agent combined. This outcome provides a benchmark for evaluating outcomes under the contracts that are feasible in our model, where the parties are constrained by the inability of the principal to observe the agent's effort.

Consider first the situation in which the agent expends no effort. Then, since the project will always be bad, the parties' maximum joint return is zero, which is the result obtained if the principal declines to invest regardless of the value taken by his signal.

Consider next the situation in which the agent expends effort. If the principal always invests, then a good outcome will occur with probability q and a bad outcome with probability

FIGURE 1

GAME TREE WITHOUT HANDS-TYING

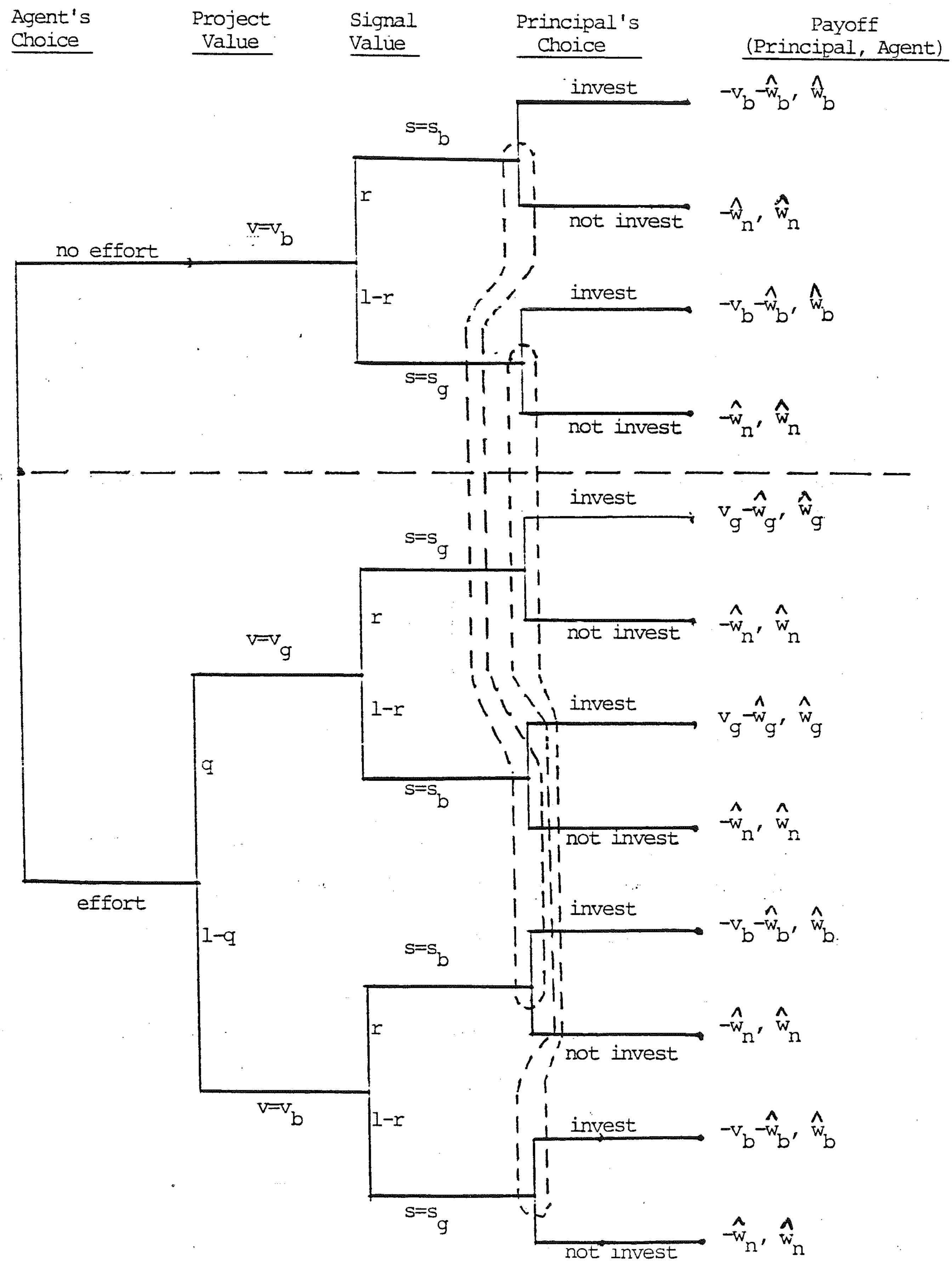
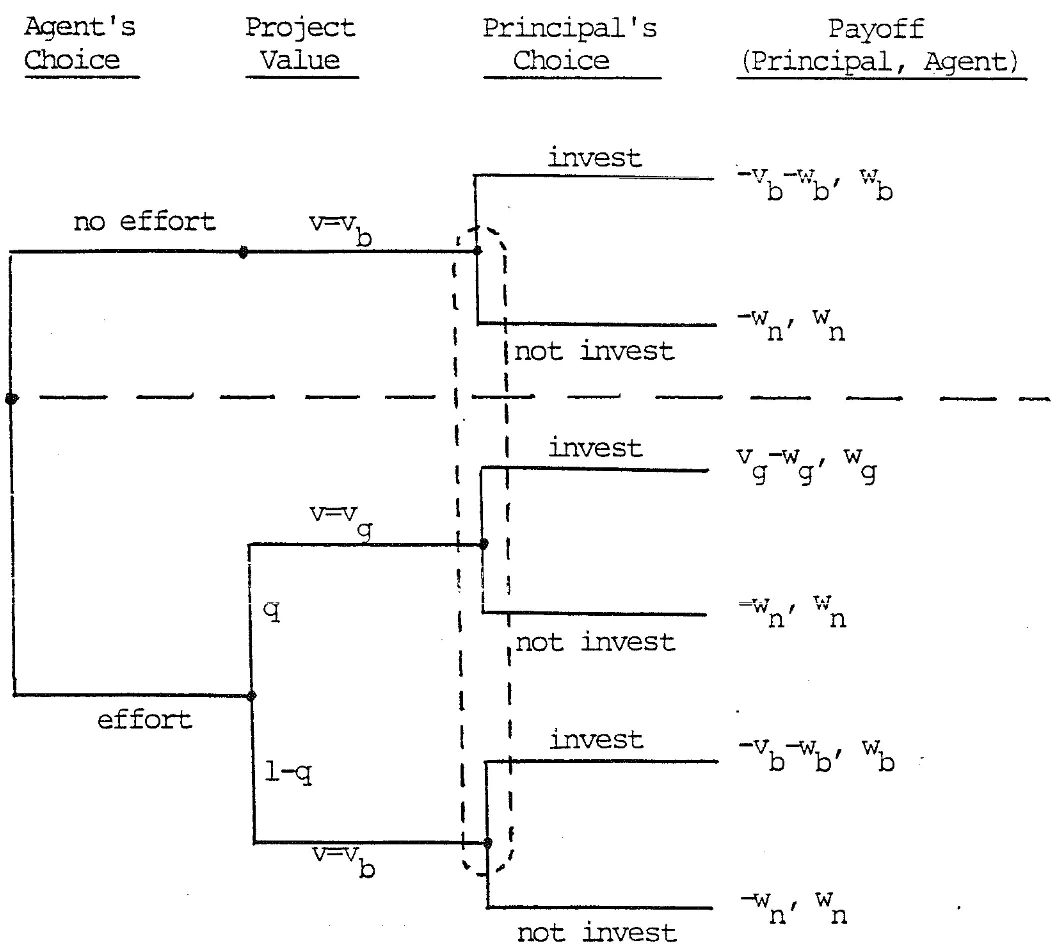


FIGURE 2

GAME TREE WITH HANDS-TYING



1-q, so the expected joint return will be

(1) $qv_g - (1-q)v_b - e.$

If, alternatively, the principal invests only when his signal takes the value s_g, then there will be four possible cases as shown in columns (1) - (5) of Table 1.

TABLE 1

RETURNS WHEN PRINCIPAL'S SIGNAL IS EMPLOYED

Case	(1) Project Value	(2) Signal Value	(3) Ex Ante Probability	(4) Principal Invests?	(5) Project Return	(6) Agent's Wage	(7) Principal's Return
(i)	v_g	s_g	qr	yes	v_g	$\hat{w}_g$	$v_g - \hat{w}_g$
(ii)	v_g	s_b	q(1-r)	no	0	$\hat{w}_n$	$-\hat{w}_n$
(iii)	$-v_b$	s_b	(1-q)r	no	0	$\hat{w}_n$	$-\hat{w}_n$
(iv)	$-v_b$	s_g	(1-q)(1-r)	yes	$-v_b$	$\hat{w}_b$	$-v_b - \hat{w}_b$

In case (i), the outcome will be good and the principal's signal accurately takes the value s_g. The ex ante probability of this result -- that is, the probability as of the time that the principal hires the agent -- is $p(v=v_g)\cdot p(s=s_g|v=v_g) = qr$. The principal will invest (since $s=s_g$), and the return from the investment will be v_g. In case (ii), $v=v_g$ but the principal's signal inaccurately takes the value s_b. The principal will therefore not invest, and the return will be 0. Cases (iii) and (iv) follow similarly. Adding across the four cases, and subtracting the cost of the agent's effort, the expected joint return will therefore be:

(2) $$qrv_g + q(1-r)\cdot 0 + (1-q)r\cdot 0 - (1-q)(1-r)v_b - e$$

$$= qrv_g - (1-q)(1-r)v_b - e.$$

It will be worthwhile to expend effort to develop a project if and only if either (1) > 0 or (2) > 0. Given that either (1) > 0 or (2) > 0, it will be worthwhile to condition investment on the receipt of a good signal ($s = s_g$) if and only if (2) > (1), which is equivalent to:

(3) $$(1-q)rv_b > q(1-r)v_g.$$

Condition (3) simply states that conditioning investment on the value of the signal will increase the expected joint returns from the project if and only if the expected value of the bad outcomes that are thereby avoided is greater than the expected value of the good outcomes that are mistakenly rejected.[5/] If the

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5. Alternatively, we can approach the same issue explicitly in terms of posterior probabilities (that is, the probability that the project outcome will be good given the value taken by the principal's signal), rather than following the development in the text employing ex ante probabilities using the reliability measure r. Viewed in this alternative fashion, it will be worthwhile to condition investment on receipt of a good signal only if the expected return from a project is negative given that a bad signal ($s=s_b$) has been received. The expected return from investing in a project for which a bad signal has been received is

(i) $$p(v=v_g|s=s_b)v_g - p(v=v_b|s=s_b)v_b.$$

Applying Bayes' rule, (i) is equivalent to

(ii) $$\frac{p(v=v_g)p(s=s_b|v=v_g)v_g - p(v=v_b)p(s=s_b|v=v_b)v_b}{p(v=v_g)p(s=s_b|v=v_g) + p(v=v_b)p(s=s_b|v=v_b)}$$

$$= \frac{q(1-r)v_g - (1-q)rv_b}{q(1-r) + (1-q)r}.$$

The latter expression will be negative whenever its numerator is negative, a condition that is equivalent to condition (3).

principal could observe the agent's level of effort, then it would be straightforward to devise a contract between the principal and his agent that would always assure the first best outcome. When (1) < 0 and (2) < 0, an agent would not be employed. When either (1) > 0 or (2) > 0, the principal would employ an agent and pay him a flat amount e, conditional upon the agent's expending effort. The principal would then either invest in all cases or invest only when $s = s_g$, depending on whether or not (2) > (1).

Where the agent's effort is unobservable, however, such a contract with the agent will not be workable, since the agent will have no incentive actually to expend the effort promised and therefore the outcome of the project will always be bad. Rather, the only way to give the agent an incentive to expend effort will be to give him a share in the returns from good projects that will have an expected value of at least e if he expends effort (and zero otherwise). Therefore, we shall now turn our attention to contracts between the principal and agent that have this character.

Since there is no incentive for the principal to hire an agent if both (1) and (2) ≤ 0, we shall henceforth confine ourselves to situations in which either (1) > 0 or (2) > 0.

B. <u>Contracting with Hands-Tying</u>

For simplicity, consider first the situation in which the principal ties his hands -- that is, the principal commits himself, at the time of hiring the agent, to ignore the value his signal takes. (Equivalently, this is the case in which the principal receives no signal at all.) This is the situation diagrammed in Figure 2.

<u>The Agent's Return</u>. The agent's compensation can be conditioned according to the three different observable outcomes: the principal invests and the outcome is good; the principal invests and the outcome is bad; the principal declines to invest. Let the wages paid the agent in these three circumstances be w_g, w_b, and w_n, respectively. Because the agent has no wealth of his own, it is necessary that w_g, w_b, $w_n \geq 0$.

Since the principal can neither observe whether the agent has expended effort nor obtain a reading on the value of the project, his only available strategies here are either always to invest or always to decline to invest. And, since the principal cannot benefit by hiring an agent while planning never to invest (because $w_n \geq 0$, and the principal's expected return would then be $-w_n \leq 0$), we can confine our attention to cases in which the principal always invests, and ignore the cases in which the agent would receive a wage of w_n.

If the agent expends no effort the outcome will always be bad and his expected return will be w_b. If, alternatively, he expends effort, his expected return will be

(4) $$qw_g + (1-q)w_b - e.$$

To give the agent an incentive to expend effort it is necessary that (4) $\geq w_b$, which is equivalent to

(5) $$q(w_g - w_b) \geq e.$$

The principal will wish to minimize his expected cost of hiring an agent,

$$(6) \qquad qw_g + (1-q)w_b,$$

subject to (5). This can be done by treating (5) as an equality and using it to solve for w_g in terms of w_b, substituting the resulting value for w_g into (6), solving for the value of w_b that minimizes the latter expression subject to $w_b \geq 0$, and then using (5) (as an equality) to solve for w_g in terms of w_b. The resulting values are

$$(7) \qquad w_b = 0, \; w_g = e/q.$$

The principal will have no interest in hiring an agent who cannot be expected to expend effort. Therefore, if the principal hires an agent at all, he will offer the agent the wages given in (7) (or, more precisely, a wage w_g that is infinitesimally larger than that given in (7), so that the agent will not be indifferent about expending effort). With this wage structure we can ignore the part of the game tree that lies above the horizontal dashed line in Figure 2 -- that is, the part of the game tree in which the agent expends no effort.

<u>The Principal's Return</u>. Given that the agent expends effort in project development, the principal's expected return from investing is

$$(8) \qquad q(v_g-w_g) - (1-q)(v_b+w_b).$$

Substituting from (7), the principal's maximum expected return is then

$$(9) \qquad qv_g - (1-q)v_b - e.$$

This is identical to (1), reflecting the fact that the principal gets the full return from the project beyond the agent's cost of effort e.

C. <u>Contracting Without Hands-Tying</u>

Next, consider the alternative case in which the principal retains, and exercises, the right to reject a project if his signal takes the value s_b. In this case there are three possible outcomes on which the agent's wage can be conditioned: (a) $s = s_g$, the principal invests, and the outcome is good; (b) $s = s_g$, the principal invests, and the outcome is bad; (c) $s = s_b$ and the principal refuses to invest. We shall denote the compensation given the agent in these eventualities, respectively, as $\hat{w}_g$, $\hat{w}_b$, and $\hat{w}_n$. Because of the agent's wealth constraint, $\hat{w}_g, \hat{w}_b, \hat{w}_n \geq 0$.

<u>The Agent's Return</u>. If the agent expends no effort, then $v = v_b$ with probability 1. The agent will receive either $\hat{w}_n$ or $\hat{w}_b$ depending on whether the principal's signal accurately predicts that the outcome will be bad and hence discourages investment -- a result that will occur with probability r. The agent's expected return if he expends no effort is therefore

(10) $$r\hat{w}_n + (1-r)\hat{w}_b.$$

Alternatively, if the agent expends effort, there are the same four possible cases that appear in Table 1. Columns (6) and (7) of that table give the returns to the agent and the principal, respectively, under the wage structure just described. Adding across the four cases, the agent's expected return as of the time of contracting with the principal is

(11) $qr\hat{w}_g + q(1-r)\hat{w}_n + (1-q)r\hat{w}_n + (1-q)(1-r)\hat{w}_b - e.$

Because the principal's expected return will be nonpositive unless the agent expends effort, the principal, once again, will only hire an agent who can be expected to expend effort. But an agent will accept employment only if (11) ≥ 0, and will expend effort only if (11) $\geq$ (10). The principal's objective is therefore to minimize (11) subject to the conditions (11) ≥ 0, (11) $\geq$ (10), and $\hat{w}_n$, $\hat{w}_b$, $\hat{w}_g \geq 0$. It is easy to establish that this is accomplished by setting[6]

(12) $\hat{w}_n = \hat{w}_b = 0;\ \hat{w}_g = e/qr.$

A comparison of (12) with (7) indicates that, relative to the situation in which the principal ties his hands in his contract with the agent, the principal must increase his agent's return from a successful project by a factor of $1/r$ if he contracts without tying his hands. This increase is necessary to offset the expected loss that the agent would otherwise incur because, in the absence of hands-tying, the principal will

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6. Because $\hat{w}_n$, $\hat{w}_b$, $\hat{w}_g \geq 0$, it follows that (10) ≥ 0. Thus (11) $\geq$ 0 if (11) $\geq$ (10). We can therefore ignore (11) ≥ 0 as a separate constraint.

Suppose $\hat{w}_b > 0$. Then (10), (11) > 0. By reducing $\hat{w}_b$, we reduce (11). This is an improvement unless the result would be that (11) $<$ (10). But the latter could happen only if, at the initial value of $\hat{w}_b$, (11) = (10) and $d(11)/d\hat{w}_b > d(10)/d\hat{w}_b$. Yet

$$\frac{d(11)}{d\hat{w}_b} = (1-q)(1-r) < (1-r) = \frac{d(10)}{d\hat{w}_b}.$$

Thus $\hat{w}_b > 0$ cannot be a solution. Since $\hat{w}_b \geq 0$, it must be that $\hat{w}_b = 0$. Similar logic establishes that $\hat{w}_n = 0$. Consequently, (10) = 0 and (11) = $qr\hat{w}_g - e$. Minimizing the latter with respect to $r\hat{w}_g$, subject to the condition that (11) $\geq$ (10) = 0, gives $\hat{w}_g = e/qr$.

mistakenly reject some good projects in which the agent would otherwise share. (Note that the agent gains nothing from the fact that the principal's signal permits him accurately to reject some bad projects, since the agent's wage is zero whether a project has a bad outcome or is simply rejected.)

With the wage structure given in (12), the agent will always expend effort; the portion of the game tree in Figure 1 that lies above the horizontal dashed line can therefore be ignored.

The Principal's Return. Adding up the expected returns from the four cases listed in the table, the principal's expected return without hands-tying is

$$(13)\quad qr(v_g-\hat{w}_g) - (1-q)r\hat{w}_n - q(1-r)\hat{w}_n - (1-q)(1-r)(v_b+\hat{w}_b).$$

Substituting from (12), (13) becomes

$$(14)\qquad qrv_g - (1-q)(1-r)v_b - e.$$

This is identical to (2) -- the expected net joint return from a contract without hands-tying -- again reflecting the fact that, because we are assuming that the agent is paid only the cost of his effort, the principal reaps all the net returns from investing.

D. When Does Hands-Tying Pay?

The principal will agree to contract with the agent to tie the principal's hands if, as a result, the principal's expected return will be greater than it would be if he retained his right to reject projects that his signal indicates are likely to be bad. That is, the principal will agree to tie his hands if (9) > (14), which is equivalent to

(15) $q(1-r)v_g - (1-q)rv_b > 0.$

This is just the inverse of (3), which is the condition under which there are joint efficiency gains to the agent and principal combined from acting on the principal's signal. Again, this coincidence reflects the fact that the principal receives all the net returns from projects, and hence all the net benefits of hands-tying. As the analysis of the first best above indicates, condition (3) fails, and (15) obtains, when the principal's signal cannot increase the total value of the project because the value of the good projects it rejects is greater than the costs of the bad projects that it avoids.

As an aid to interpretation, we can rewrite (15) as a condition on the value of r:

(16) $$r < r_{max} \equiv \frac{qvg}{qv_g + (1-q)v_b}.$$

That is, given values for q, v_g, and v_b, hands-tying can benefit the principal only when the reliability of his signal is less than the expression on the right-hand side of (16), which we shall term r_{max}. From (16) we see that the magnitude of r_{max} is directly proportional to v_g and q, and inversely proportional to v_b.

Condition (16) is, however, only a necessary and not a sufficient condition for hands-tying. Even when (16) holds, the principal will often lack an incentive to act on his signal even if he has not contractually tied his hands. A contractual commitment to the agent is important only if the principal would act on his signal in the absence of such a commitment.

To see when a contractual commitment is needed to bind the principal, suppose that an agent contracted on the assumption that the principal would <u>not</u> act on his signal, and thus agreed to the terms of compensation given by (7). And suppose that the contract did not tie the principal's hands, but left him free to reject projects without making any payment to the agent (or, equivalently, required only that the principal pay the agent $\hat{w}_n = 0$ upon rejecting a project, as under the contract without hands-tying). The principal's expected return, if he were to proceed to reject projects whenever $s = s_b$, would then be

(17) $\quad qr(v_g-w_g) + (1-q)(1-r)(-v_b-w_b) = qrv_g - (1-q)(1-r)v_b - re.$

This expression is equivalent to (13) -- the principal's expected return from a contract without hands-tying -- but with w_g (the wage from (7) that the agent would insist on with hands-tying) substituted for $\hat{w}_g$, w_b substituted for $\hat{w}_b$, and $w_n = 0$ substituted for $\hat{w}_n$.

The principal would then reject projects on the basis of his signal if (17) > (8), i.e., if

(18) $\quad (1-q)rv_b > q(1-r)(v_g-w_g).$

The left-hand side of (18) is the principal's gain from avoiding the losses of bad projects that his signal permits him to screen out. The right-hand side of (18) is the principal's loss from mistakenly rejecting good projects; this figure, however, is less than the full social loss from rejecting good projects by the amount $q(1-r)w_g$, which is the loss in expected value that the agent suffers from the principal's rejection of good projects. That is, in deciding whether to reject projects the principal will ignore the loss that the agent may suffer as a result. Another way to see this is to substitute for w_g in (18) from (7) and rearrange (18) as follows:

(19) $$(1-q)rv_b - q(1-r)v_g > - q(1-r)w_g = - (1-r)e.$$

The expression on the left of the inequality in (19) is the net social gain from using the principal's signal; the expression on the right is the agent's loss from the use of the signal. From (19) we see directly that, in the absence of hands-tying, the principal will have an incentive to act on his signal even in cases where the joint returns to the parties from doing so are negative.

Condition (19), like (15), can be rewritten as a condition on r:

(20) $$r > r_{min} \equiv \frac{qvg - e}{qv_g + (1-q)v_b - e}.$$

That is, a principal who has not tied his hands will reject a project only when the reliability of his signal exceeds the value of the expression on the right-hand side of (20), which we term r_{min}. If $r < r_{min}$, the principal will invest even after observing $s=s_b$ because his signal is too unreliable to prompt him to act on it <u>despite</u> his excessive incentive to reject projects.

Combining (19) with (15) yields the necessary and sufficient conditions for a contract to have a strictly larger expected joint surplus when it has a hands-tying term than when it does not. These conditions are

(21) $$(1-r)e > q(1-r)v_g - (1-q)rv_b > 0$$

or, written as conditions on the reliability of the principal's signal, $r_{max} > r > r_{min}$.

Expression (20) for r_{min} differs from (16) for r_{max} only in that the agent's cost of effort e is subtracted in the numerator and denominator of the former. Thus, so long as all parameters (q, v_g, v_b, and e) have positive values, it will always be the case that $r_{max} > r_{min}$ -- that is, there will always be a range of values of r for which hands-tying is worthwhile. Moreover, increasing e, ceteris paribus, reduces r_{min} without changing r_{max} and thus expands the range of values for r for which hands-tying is advantageous. The intuitive reason is that a larger e implies that the agent must be promised a larger share of the returns from a successful project to cover his cost of effort, and hence that the principal will have a stronger incentive to reject a project with positive expected joint returns. Thus, as e becomes larger, the more likely it is that the reliability of the principal's signal will fall into the range where hands-tying is worthwhile.

A Numerical Example. As an example, consider the case in which $v_g = v_b = 100$, $q = .75$, and $e = 25$. Given these values, $r_{max} = .75$ and $r_{min} = .67$. If $r = .7$, then a contract without hands-tying yields an expected return for the principal of 20, while a hands-tying contract increases the principal's expected return by 25%, to 25. (With these values, a principal and an agent who enter a hands-tying contract share equally the project's total expected proceeds of 50.) If e is increased to 30, then r_{max} remains at .75, but r_{min} falls to .64. With the same signal reliability as before ($r = .7$), the principal's expected returns with and without hands-tying become 20 and 15 respectively. And if r is reduced from .7 to .65, the principal's expected returns with and without hands-tying are 20 and 10 respectively.

E. An Alternative Interpretation of the Principal's Signal

In the preceding analysis we have assumed that the principal's signal has a fixed reliability of r that is known ex ante. Alternatively, we could assume that the reliability of the principal's signal is variable and that when the principal receives his signal he receives two pieces of information: the first is a prediction, $s = s_g$ or $s = s_b$, about the outcome of the project and the second is an indication, r, of the reliability of the prediction. In this case, the principal would have an incentive to reject projects whenever $r > r_{min}$, which would lead to inefficient outcomes whenever $r_{min} < r < r_{max}$. The parties would then have an incentive to write a hands-tying contract binding the principal to ignore his signal unless $r > r_{max}$.

Such a contract would be infeasible, however, if the reliability of the principal's signal were unverifiable by the agent (which may often be the case -- consider, for example, a publisher's subjective confidence in his prediction that a book will be successful, based on a reading of the manuscript).

Nevertheless, a different hands-tying contract would be feasible: A contract that simply prohibited the principal from acting on his signal in any circumstances (i.e., regardless of the value of r he observed) would be worthwhile if the distribution of r were common knowledge ex ante and were such that the expected gain from compelling the principal to accept projects when $r_{min} < r < r_{max}$ exceeded the expected loss from forcing him to accept projects when $r > r_{max}$.

F. <u>When the Agent's Cost of Taking Employment Is Positive</u>

We have assumed thus far that there is no cost to the agent from taking employment with the principal beyond the cost of the effort (if any) that the agent expends. If, alternatively, the agent incurs a cost of $c > 0$ by accepting employment with the principal regardless of whether the agent expends effort, it is easy to show that the model's basic results continue to hold, except that w_b can be set anywhere in the range $0 \leq w_b \leq c$ with appropriate adjustment in w_g to assure that condition (5) is satisfied. Or at least that is the case if c is only an opportunity cost in the form of income that the agent might have earned by accepting employment elsewhere. But suppose that c reflects an out-of-pocket expenditure by the agent that he cannot afford to meet from his own resources. (This might be the case, for example, if the agent is a starving author who must pay room and board while he writes the book that the principal is to publish.) Then it is necessary that $w_b = c$.

Indeed, in this model c can represent <u>any</u> investment that must be made during the project's development stage, and not simply the agent's opportunity wage. For example, the agent might be the manager of a start-up biotechnology firm that must purchase equipment and supplies during the project development phase, in which case c would be the cost of these items.

In short, since the actors in this model are risk neutral, the only consideration that bears on whether the cost c will be borne by the principal or by the agent in case the project outcome is bad -- that is, whether $w_b = c$ or $w_b = 0$ -- is the agent's wealth constraint.

III. SOME APPLICATIONS

The hands-tying phenomenon explored by the model arguably appears in a broad range of real-world settings. We shall focus on several here for purposes of illustration.

A. Venture Capital

A common hands-tying contract that closely approximates our model is the standard financing arrangement between a venture capitalist and the entrepreneur or founder of a start-up firm. Here the firm itself is the project. The entrepreneur (the agent) is typically issued common stock that gives him a portion of any profits in case the firm succeeds, and thus provides a strong incentive for effort. The venture capitalist (the principal), in turn, is commonly issued convertible preferred stock that, while also providing a share in profits if the firm succeeds, leaves him bearing nearly all of the financial loss if the firm fails. Thus the returns to the venture capitalist and the entrepreneur are asymmetric, and the venture capitalist has an excessive incentive to abort the firm's investment plans, and perhaps liquidate the firm, if subsequent information should suggest an increased likelihood of failure. This is presumably important in explaining why venture capitalists often do not receive voting control over start-up firms, even when they require some representation on the board. The financing agreement generally leaves the founder with a control block of common stock that carries the power to manage the firm (Larson, 1984: 208; Hewitt and Ruhm, 1982: 194-95). The preferred stock issued to the firm's investors typically carries voting rights but lacks sufficient votes to dismiss the founder or control decision-making. In short, the investors' hands are tied.

We do not suggest that entrepreneurs always retain control of start-up firms or that the hands-tying motive analyzed here is the only possible explanation when they do retain control. Financing agreements for start-up firms are complex; numerous provisions may modify the underlying allocation of voting power (e.g., H. Hoffman and J. Blakey, 1986). In addition, legal control itself is sometimes a mere formality, as when investors cannot bail out upon learning bad news simply because the firm's assets lack significant salvage value. The hands-tying motive can plausibly account for entrepreneurial control only if outside investors might otherwise use voting control to trigger their liquidation preferences to real advantage.

Nevertheless, support for a hands-tying motive in the allocation of control over start-up firms may be found in other provisions of venture capital financings that limit investors' exposure to loss by adjusting the size of capital contributions. For example, entrepreneurs sometimes allow investors to choose between funding a firm's entire business plan at a low share price or funding only the initial stages of the plan at the low share price with the option to purchase additional shares somewhat later at a higher price.[7] In effect, this strategy offers a choice between contracting with, or without, a hands-tying commitment. If the investor funds the entire business plan by purchasing cheap shares at the outset, he cannot withhold investment from the plan's later stages on the basis of unfavorable information; his hands are tied. If instead the investor only funds the plan's initial stages, he retains the right to withhold funds from its later stages -- and thus,

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7. Thus, the actual minutes of a board meeting documenting one transaction read:

> The Board next discussed [the investor's] specific desire to invest in the Company in a two-stage process. After considerable discussion, the Board decided to give [the investor] the option of investing a full $1 million in [the Company] currently at $3.50 per share or . . . investing $500,000 currently at $3.50 per share and having the option of investing another $500,000 at $4.00 per share up to [six months from now].

(Clayton, 1989: 37). In this transaction, the investor chose to invest in two stages and, therefore, implicitly selected a contract without hands-tying. A second function that such multi-stage contracts may also serve is to resolve disagreement between the investor and the entrepeneur over the value of firm.

retains an informal veto over the project -- but only upon agreeing to pay a higher total price for the same ownership interest in the firm if future information indicates that the project is likely to succeed. This arrangement functions as a contract without hands-tying, since it allows the investor to withhold capital upon receiving unfavorable information regardless of the formal allocation of voting control. The exercise price of the option in such two-stage financing is presumably high enough to compensate the entrepreneur for the investor's veto right, but low enough to induce the investor to fund the later stages of business plan if he receives a favorable signal.[8]

B. Why Don't Bondholders Own the Firm?

It is by now a familiar observation (e.g., Jensen and Meckling, 1976) that the equity shareholders in a firm financed partly with debt have an incentive to engage in inefficiently speculative projects in an effort to take advantage of the fact that they receive a disproportionate share of any upside gains

8. Many start-up firms anticipate multiple financings that will require venture capitalists to invest at several points before their business plans are completed. In these cases, the final financing period defines the firm's project for purposes of the hands-tying model. The hands-tying motive, however, may also shed light on the size of earlier financings. These amounts determine when entrepreneurs must seek new financing in order to proceed. Investors who receive an unreliable signal at this point may have an excessive incentive to abandon the firm. Therefore, initial financings should support the firm at least until the point when the quality of available information suffices to motivate investors to make a jointly optimal decision about the next round of financing.

while the bondholders bear a disproportionate share of the downside losses. Bond covenants constraining the firm's investment activities are frequently drafted with this problem in mind (Smith and Warner, 1979). The situation modeled here is in a sense the reverse case: if control were given to persons who, like lenders and bondholders, participate disproportionately in downside losses, they would have an excessive incentive to avoid risky but valuable projects, in which case constraints on their discretion to reject investments would be called for. Since forcing investment by contract is far more difficult than drafting and enforcing contractual terms that constrain investment, it is not surprising that business firms are typically controlled by the holders of variable-return rather than fixed-return securities.[9]

There are, interestingly, some firms in which control is in the hands of parties who have a disproportionately small stake in upside gains. For example, limited partnerships formed for oil and gas exploration are often structured (for tax avoidance purposes) so that the general partners who control the firm have a larger share in the costs than in the returns from completion of wells. Not surprisingly, there is evidence that these firms

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9. Shareholders who issue risky debt may also have a perverse incentive to reject marginally valuable projects, since debtholders will receive a portion of the expected returns of any projects they undertake (Myers, 1977). In this context, dividend constraints and similar restrictions on corporate distributions may serve an investment-forcing role akin to hands-tying. Shareholders who cannot distribute cash flows have little alternative but to reinvest them (Smith and Warner, 1979: 134).

often fail to complete a project when it appears that the project will be only marginally profitable overall, and thus not profitable at all for the general partners themselves. In an effort to attract investors on favorable terms, general partners sometimes seek to bond themselves to the limited partners not to be influenced by this incentive for undercompletion (Wolfson, 1986) -- that is, they seek to tie their hands in the sense described here.[10]

C. Contracts Between Authors and Publishers

The conventional publishing contract for hardcover books is another accessible example to analyze within the framework of the hands-tying model. Presumably for incentive reasons, an author receives most or all of his compensation in the form of royalties from sales, and these royalties comprise a large fraction of the

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10. The hands-tying model may also describe participation or loan commitment agreements offered by lenders to would-be borrowers to cover the period in which borrowers assemble loan documentation and attempt to meet pre-closing conditions. Presumably because lenders have an excessive incentive to renege on such commitments upon discovering unfavorable information, courts are sometimes skeptical of lenders who refuse to honor their commitments because borrowers failed to meet pre-closing conditions. See, e.g., Penthouse International Ltd. v. Dominion Federal Savings and Loan Ass'n, 665 F. Supp. 301 (S.D.N.Y. 1987), rev'd 855 F.2d 963 (2nd Cir. 1988).

overall net returns from publications.[11] In addition, the author typically receives an advance against royalties that is not refundable in case the book sells poorly. Under this system of compensation, returns are shared asymmetrically; while the author receives a portion of the returns if the book sells well, in the case of a loss the publisher bears all unrecovered costs of production, promotion, and distribution.[12] Consequently, if the expected joint profits from a book appear only marginal when the completed manuscript is finally available for inspection, the publisher has an incentive to be inefficiently conservative in deciding whether to publish it or, if it is published, in deciding how much to invest in printing and promotion. It follows that authors and publishers together have an incentive, at the time of initial contracting, to limit the publisher's leeway to cancel publication or to underinvest in printing and promotion. For this reason, established authors receive contracts fixing the magnitude of the publisher's investment ex

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11. Standard royalty rates for hardcover books are 10% for the first 5,000 sales, 12.5% for the next 5,000, and 15% thereafter (Beil, 1984: 153). These rates apply to adjusted gross returns and involve a substantially larger share of net returns. Industry participants estimate that, for moderately successful books, authors' royalties are roughly equal to the profits derived by the publisher. In addition, authors receive a return in the form of reputational enhancement, which in general is also positively correlated with sales.

12. Note that the author's opportunity cost of time in writing the book, as well as any nonrefundable advances paid to the author by the publisher, are sunk costs as of the time that the publisher receives the completed manuscript and therefore do not figure in the publisher's decision at that time concerning investment in printing and promotion.

ante through clauses specifying the size of the first printing and the publisher's minimal expenditure on promotion (Bunin: 35-37; Lindey: 128).[13]

Publishing contracts are thus a conspicuous example of hands-tying. Without commitments requiring publishers to invest in printing and promotion, established authors would presumably be forced to demand a significantly larger portion of the expected returns from successful books. Indeed, even in the absence of contractual provisions governing printing and promotional expenditures, courts are sensitive to publishers' incentives to "privish" books -- i.e., to "mount a wholly inadequate merchandising effort after concluding that a book does not meet prior expectations"[14] -- and, therefore, impose a minimal good faith obligation on publishers to allow books "a reasonable chance of achieving market success."[15]

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13. Informal inquiries suggest that first printing and promotional guarantees are common when publishers' advances range between $50,000 and $100,000 but rarely appear below this threshold. Authors also seek assurances that their books will remain in print and will not be placed on remainder lists prematurely.

14. Zilg v. Prentice-Hall, Inc., 717 F.2d 671, 676 (2d Cir. 1983) (Winter, J.).

15. Id. 680. The Zilg opinion is acutely sensitive to the publisher's excessive incentive to privish manuscripts:

> An author usually has a bigger stake in the success or failure of a book than a publisher . . . The publisher, of course, views the author's willingness to take large risks as a function of the fact that it is the publisher's money at peril. Moreover, the publisher will inevitably regard his or her judgment as to marketing conditions as greatly superior to that of a particular author.

On the other hand, an absolute commitment by the publisher to print and promote any manuscript that an author under contract might submit, even if it were conspicuously unmarketable to the most casual observer, would invite waste or overt opportunism on the part of the author. Not surprisingly, therefore, most publishing contracts, regardless of the commitments they otherwise impose on the publisher, contain a "satisfactory copy" clause that permits the publisher to reject completed manuscripts as "unsatisfactory in form or content." The satisfactory copy clause is not an unfettered license to reject manuscripts; indeed, it has been read to require the publisher to make a good faith effort to rescue marginal manuscripts by providing editorial assistance.[16] Rather, this clause is better viewed as an attempt to specify an r, which we can call r_{sat}, that is large enough to assure that (1) the publisher always acts efficiently when he rejects a manuscript which he predicts will turn out badly with reliability $r > r_{sat}$ (i.e., $r_{sat} > r_{max}$), and (2) the publisher's decision that $r > r_{sat}$ is relatively easy to verify. In any event, very prominent authors, whose reputation alone is probably sufficient hostage to prevent them from opportunistically submitting a clearly unmarketable manuscript,

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Id. 679 (reprinted in Biederman, et al., 1988: 143).

16. Harcourt Brace v. Goldwater, 8 Med. L. Rptr. 1217 (S.D.N.Y. 1982) (reprinted in Biederman, et al., 1988: 130-35). Of course, the hands-tying model presented here provides an efficiency rationale for imposing such a good faith duty and limiting the exercise of the clause.

can sometimes get even the satisfactory copy clause deleted from the contract, thus tying the publisher's hands completely (Beil: 149).

D. Tenure

In significant respects, the institution of academic tenure parallels the contractual guarantees accorded to established authors. In this case, the "project" is a scholar's long-term research agenda. Both a scholar (the agent in our model) and the university with which he is affiliated (the principal) benefit from successful research undertaken by the scholar: the scholar gains an enhanced reputation, income, and the opportunity to obtain further research grants; the institution, in turn, gains a reputation that channels to it financial resources, talented faculty, and able students.

The returns, however, are asymmetrically shared. The university bears most of the costs of supporting a scholar whose work turns out to be of little value, while the scholar is able to appropriate a substantial share of the gains from successful research (in part because of the university's inability to commit the scholar to a long-term employment contract). Consequently, the university has an excessive incentive to dismiss a researcher with a controversial or uncertain research agenda in mid-career, before his agenda can be fully developed or tested. Tenure is a way of tying the university's hands in this respect.

There are, of course, other strong reasons for the tenure system. For example, faculty members without tenure might have an incentive to hoard knowledge at the expense of their students or withhold information about suitable job candidates in order to avoid training or selecting their own replacements, and this incentive could seriously cripple the educational enterprise.[17/] Further, tenure may serve a risk-sharing function: young faculty invest their careers in avenues of research that all look equally promising ex ante, but only a few of which are likely to pay off in the long run; tenure assures that there will be a lower bound on the fate of those who are unlucky (e.g., Freeman, 1977). The incentive for hands-tying described here, therefore, is simply an additional motivation for the system.

IV. CONCLUSION

It might at first seem implausible that a principal would find it in his interest to enter into a contract whereby he agrees to discard subsequent information about the prospects for a project he is financing. Nevertheless, contracts of this type appear to be relatively common. We have tried to suggest here some circumstances under which such contracts might be efficient.

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17. Most recently, Carmichael (1988) has proposed that the tenure system functions chiefly to maintain the hiring incentives of senior faculty members, who are presumed to be the most capable judges of job candidates. This model, however, would not seem to explain why tenure extends beyond small numbers of specialized hiring agents.

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