"CAREER CONCERNS AND THE ACQUISITION OF FIRM-SPECIFIC SKILLS"

by

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Abstract

This paper studies compensation schemes which can motivate a manager to acquire firm-specific skills, when the acquisition process is also one of learning about managerial talent. The context is a two-period employment relationship with promotion. In the first-period, the manager may expend effort into collecting firm-specific skills. More effort increases the firm's rent from promoting the manager in the second period. However, increased effort also triggers nonverifiable events which bring more information about the manager's talent. It is shown that in this setting first-best firm-specific skills collection by the manager cannot be achieved. It is argued that appropriate sharing of the manager's cost of effort can alleviate this kind of behavior.

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I. INTRODUCTION

Managers entering a new job are often expected to invest into firm-specific skills. Examples of such skills are a thorough understanding of the firm's accounting system and procedures, mastery of present and upcoming routines, communication and decision making styles in line with corporate culture, and access to an informal network of valuable colleagues. These skills are typically not verifiable by someone outside the firm, so rewards that are explicitly based on their acquisition are difficult to enforce. In addition, the skills acquisition process is often one of learning about managerial talent. While enhancing her firm-specific human capital, the manager triggers a chain of events which reveal something about her ability and future performance. The manager then trades off the benefits of increasing her human capital with the (monetary and reputational) costs of learning about managerial talent. This paper focuses on compensation schemes that motivate managers who face such a trade-off to invest into nonverifiable firm-specific human capital.

Our analysis builds on the work by Holmström [1982] and Holmström and Costa [1986] on managerial career concerns. The manager is assumed to care about the impact of her current training decisions on her reputation. In the present context, however, the manager experiences a lower return to specific skills collection

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2 Talent may be interpreted as match to the firm, creativity, judgment, charisma, tenacity, business flair, or any intrinsic and intangible quality which matters when a manager holds a key position.
than the firm. We find that this cannot be offset through promotions and wages, for the required second-period wage would then exhaust all the firm's rent and is not credible. It is this feature - a ceiling on the manager's second-period payment - rather than risk aversion which causes the incongruity between the firm's and the manager's preferences concerning specific human capital.\(^3\)

In a recent paper, Prendergast [1993] argues that promotion can be used by firms to motivate employees to collect firm-specific skills. Her model resembles ours in many ways. A single manager with uncertain ability is employed by a firm. Information concerning the manager's talent is symmetric throughout the employment relationship. To be compensated for skill collection, the manager cannot rely on the firm's desire to maintain a reputation. On the other hand, the firm can commit to a labor contract which attaches wages to different tasks. What constitutes the main point of departure from our paper is the assumption that the manager's talent is revealed independently of her decision to collect firm-specific skills. We do not make this assumption. We suppose instead that the manager controls the information generating process; more is learned about her talent depending on whether or not she decides to get more involved into the firm.\(^4\)

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\(^3\) The manager exhibits in fact a kind of behavior which is frequently observed among politicians [see Cadot and Sinclair-Desgagné, 1992]. This behavior is harder to grasp in a managerial context, however, because firms have more powerful incentives at their disposal than the electorate.

\(^4\) In addition to being more realistic, such an information generating process is of a type which is increasingly considered in the economic literature. See Aghion et al. [1991].
We then obtain that promotions alone do not guarantee that managers would invest into firm-specific skills; the firm must also share part of the manager's cost of acquiring those skills.

The idea that investment in firm-specific human capital might be shared dates back at least to Becker [1962]'s seminal work. In a formal setting, Hashimoto [1981] argued that one reason such investment sharing might occur is to minimize the loss from non-optimal separation due to the costs of evaluating and agreeing on post-investment returns. Here, the cost linked to the acquisition of firm-specific skills is shared because this induces the manager to collect a larger amount of firm-specific skills. We obtain that the manager then undertakes actions which bring much information about managerial talent and this actually leads to more, not less, promotion denials.

The paper is organized as follows. Section 2 contains a description of the model. Section 3 shows that first-best firm-specific skills collection cannot be implemented by using only wages and promotion. Section 4 demonstrates, however, that the addition of appropriate cost sharing is sufficient in order to motivate the manager to acquire the optimal amount of specific skills. Section 5 concludes.
II. THE MODEL

Consider a two-period employment relationship involving a manager and a firm. Both parties are supposed to be risk neutral and to not discount the future. Information is assumed to be symmetric at the beginning and throughout the relationship. It is not known initially whether the manager is (highly) talented (h) or not (l). Denote the prior probability of her being talented as q.

At the start of the first period, a contract is signed which specifies the manager's first-period task a (> 0) and wage w, together with what would be second-period task A (> a) and wage W if the manager were promoted after the first period. Wages are assumed to be paid at the beginning of each period.

During the first period, while performing task a, the manager may expend effort e, e ∈ [0,1], in trying to acquire some firm-specific skills. This may be observable by the firm but it is not verifiable, hence it cannot be made part of the contract, and the acquired skills have no value outside the firm. Effort e costs the manager an amount c(e); it triggers a binary event ω which may be good (g) or bad (b), the probability of the former being fh(g;e) if the manager is talented or fl(g;e) if she is not. Observation of this event leads the firm to update its prior assessment of the manager's ability; according to Bayes's rule the new probability that the manager is talented enough is

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5 Assuming that the firm and the manager have the same discount factor would not change the results. Dropping the assumption of risk neutrality, however, would.
\[
Q(\omega; e) = \frac{q \cdot f^h(\omega; e)}{q \cdot f^h(\omega; e) + (1-q) \cdot f^i(\omega; e)}
\]  

At the beginning of the second period, the firm decides whether to promote the manager (\(\alpha = 1\)) or not (\(\alpha = 0\)). The outcome of this decision is observed by the market. The manager who is not promoted stays with the firm and gets a wage equal to her first-period marginal product \(a\) (which is also her outside wage). The manager who is promoted gets the contracted wage \(W\). When the period ends and the manager has been promoted, the firm earns a benefit equal to the manager's nonspecific marginal product \(A\), plus a rent \(B(e)\) coming from the manager's marginal product in the firm, plus a random term \(\Omega\) whose realization is linked to the manager's talent. If the manager was not promoted, the firm must then rely on an outsider to perform task \(A\), so it gets a benefit equal to \(A + \Omega\).\(^6\) The term \(\Omega\) follows a cumulative probability distribution \(J^h(\Omega)\) if the manager is talented or \(J^i(\Omega)\) otherwise. The former distribution dominates the latter one in the first order. Let us denote these distributions' respective means as \(H (>0)\) and \(L (<0)\).

Thus, at the time the promotion decision is made, the firm solves

\[
\max_{\alpha} \alpha \cdot (A + E(\Omega \mid Q) - W + B(e))
\]

where \(E\) denotes the expectation operator. Note that the optimal \(\alpha\) is contingent on \(Q(\omega; e)\) and therefore on the realization of the

\(^6\) The assumptions below imply that the firm's net expected payoff will be 0 in this case.
random variable $\omega$.

Taking this into account, the manager previously sets her specific effort in order to solve

$$\max_e E[\alpha \cdot W + (1-\alpha) \cdot a] - c(e) .$$  \hspace{2cm} (3)

The contract is then designed at the beginning of the first period so that it is a solution to

$$\max_{w, W} a - w + E[\alpha (A + E(Q | Q) - W + B(e))]$$

subject to:

$$\alpha \text{ solves } (2)$$

$$e \text{ solves } (3)$$

$$w + E[\alpha \cdot W + (1-\alpha) \cdot a] - c(e) \geq 2a$$

$$W \geq A .$$

The first two constraints mean that the contract must be incentive compatible for both parties. The third one is the manager's participation constraint before entering the employment relationship; the manager compares the actual contract and career path with the alternative of staying on the spot market for jobs of type $a$. The last constraint implies that the manager would not quit after being promoted.

We shall make the following assumptions concerning the manager's cost of effort, the firm's rent, and the probability distribution functions.

ASSUMPTIONS:

(A.1) $E(\Omega | q) = q \cdot H + (1-q) \cdot L = 0$ .
(A.2) $B$ is concave increasing, $c$ is convex increasing.
\[ B(0) = c(0) = 0 \quad B'(e) > c'(e) \]

(A.3) $A + B(1) + L < a$.

(A.4) $f^h(g;e)$ is increasing in $e$, with $f^h(g;0) = 0.5$ and $f^h(g;1) = 1$.
On the other hand, $f^l(g;e)$ is decreasing in $e$, with $f^l(g;0) = 0.5$ and $f^l(g;1) = 0$.

(A.5) $f(g;e) = q \cdot f^h(g;e) + (1-q) \cdot f^l(g;e)$ is concave increasing in $e$.

(A.6) $f^h(g;e)/f(g;e)$ is concave in $e$.

The first assumption implies that, with no firm-specific skills collection and no additional information on the manager's talent, the stipulated marginal product (and market wage) $A$ is an unbiased estimate of her performance if promoted. Assumption (A.2) states that skills collection by the manager adds positive but diminishing social returns. Assumption (A.3) says that sorting under complete information is efficient: the social payoff from promoting a manager who is known not to have enough talent is always dominated. Assumption (A.4) now brings up the manager's dilemma. A higher effort $e$ implies that more is learned about her talent: when effort is maximal, i.e. when $e = 1$, it becomes known with certainty whether she is highly talented or not. Assumptions (A.5) and (A.6), finally, are technical; together with the previous assumptions they guarantee the existence and uniqueness of an
optimum.?

The description of the model is now complete. Let us first show that in this setting the manager cannot be motivated to collect the optimal amount of firm-specific skills.

III. INCONGRUITY OF PREFERENCES FOR SKILLS COLLECTION

Suppose that the firm could dictate the amount of effort the manager puts into acquiring firm-specific skills. Given that the participation constraint is always binding and that

\[ E[\Omega|Q] = (1 - Q(w;e)/q) \cdot L \]

by assumption (A.1), the firm's problem is now

\[
\max_{\varepsilon, a} E[\alpha (A - a + B(e) + (1 - \frac{Q}{q}) L)] - c(e) \quad .
\]

That is, the firm maximizes total expected surplus.

Clearly, in order to solve problem (5), \( \alpha \) must be set equal to 1 if and only if \( A - a + B(e) + (1 - Q(w;e)/q) L \) is nonnegative. This means that this problem is in fact equivalent to

\[
\max_{\varepsilon} E[\max(0, A - a + B(e) + (1 - \frac{Q}{q}) L)] - c(e) \quad .
\]

Writing the objective function at length, one gets

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Assumptions (A.4), (A.5), and (A.6) are fulfilled by the following simple distributions:

\[ f^h(g;e) = .5(1 + e) \quad , \quad f^l(g;e) = .5(1 - e) \quad , \quad q > .5 \quad . \]
\[ f(g;e) (A-a+B(e) + (1- \frac{f^h(g;e)}{f(g;e)}) L) \]
\[ + f(b;e) \max [0, A-a+B(e) + (1- \frac{f^h(b;e)}{f(b;e)}) L] - c(e), \]

since \( A > a, L < 0, f^h(g;e) > f(g;e) \) and \( f^h(b;e) < f(b;e) \).

This expression is not smaller than
\[ A - a + B(e) - c(e) \] (8)

which is the objective function of (5) when \( a \) is fixed at 1. The inequality must be strict when \( e = 1 \), for the second term of (7) is then strictly negative by assumption (A.3). Expression (8) being an increasing function of \( e \) by assumptions (A.2), one must then admit that (7) reaches its maximum at an effort level \( e^* \) where it is equal to
\[ f(g;e^*) (A-a+B(e^*) + (1- \frac{f^h(g;e^*)}{f(g;e^*)}) L) - c(e^*) \] (9)

This proves the following result.

**PROPOSITION 1.** At the first-best level of firm-specific skills collection, sorting occurs. A manager is promoted only if the probability that she is talented increases. In the first period, the probability of promotion is then \( f(g;e^*) \).

Let us now see whether \( e^* \) can be implemented through the initial contract. When there is sorting, the manager's objective function in problem (3) is of the form
\[ (W-a) \cdot f(g;e) - c(e) \] (10)

Considering expression (9), it is clear that \( e^* \) maximizes (10) if
and only if the second-period wage is set to

\[ W^* = \frac{\frac{d}{de} (A + B(e^*) + (1 - \frac{f^h(g; e^*)}{f(g; e^*)}) \cdot L) \cdot f(g; e^*)}{\frac{d}{de} f(g; e^*)} \]

\[ = [A + B(e^*) + (1 - \frac{f^h(g; e^*)}{f(g; e^*)}) \cdot L] \]

\[ + [(B'(e^*) - \frac{d}{de} \frac{f^h(g; e^*)}{f(g; e^*)} \cdot L) \cdot \frac{f(g; e^*)}{\frac{d}{de} f(g; e^*)} \] .

That is, \( W^* \) is equal to the firm's expected payoff at \( e^* \) if the manager is promoted, plus a second term which is bigger than 0 by assumptions (A.2), (A.4) and (A.5). A positive probability of promotion is not credible with such a high wage: when \( W = W^* \), the only solution to problem (2) if \( e = e^* \) is \( \alpha = 0 \). And with no chances of being promoted, the manager would certainly not expend effort \( e^* \). This demonstrates the next statement.

**PROPOSITION 2.** Using only promotion and a contracted wage schedule, the firm cannot motivate the manager to put first-best effort \( e^* \) into firm-specific skills acquisition.

The above argument suggests that the second-period wage \( W \) must not be higher than the firm's expected payoff if the manager is promoted. This limits the power of contracts as tools to implement optimal specific skills collection.
IV. THE ROLE OF COST SHARING

We have assumed so far that the firm has only two instruments - wages and promotion - to motivate the manager to acquire firm-specific skills. Suppose now that it can also commit to share the cost of collecting those skills. For example, it may promote mentorship, finance in-house training, or create physical facilities that enhance socializing. The manager's cost of effort would then be \((1-s) \cdot c(e)\), where \(s\) is the fraction of the total cost born by the firm.\(^8\)

The first-order condition for a solution to problem (3) with the new cost function implies that the coefficient \(s\) must be set to

\[
 s^* = \frac{-(W-a) \frac{df(g;e^*)}{de} + c'(e^*)}{c'(e^*)},
\]

in order to implement the first-best effort level \(e^*\).

That \(s^*\) is well defined, i.e. that there exists a feasible wage \(W\) such that \(0 < s^* < 1\), can easily be seen. First, note that \(s^*\) decreases with \(W\). When \(W = a\), \(s^* = 1\); when \(W = W^*\), \(s^* = 0\). Hence, for any wage \(W\) where

\(^8\) It should be noted that direct monetary transfers from the firm to the manager are not workable unless the firm has to maintain a reputation, which we assumed it could not. The manager who receives a subsidy beforehand has no incentives to put in the required effort, for the firm cannot credibly retaliate against her cheating. Similarly, effort being nonverifiable, at the end of the first period the firm may well renege on a promise to compensate the manager; anticipating this the latter would again not collect the expected amount of skills. We therefore assume that the firm can only commit to reduce the manager's marginal cost of collecting firm-specific skills.
As \( W \leq A + B(e^*) + (1 - \frac{f^h(g; e^*)}{f(g; e^*)}) \cdot L - c(e^*) \) ,
\[
A \leq W \leq A + B(e^*) + (1 - \frac{f^h(g; e^*)}{f(g; e^*)}) \cdot L - c(e^*) ,
\]
\( s^* \) must strictly be between 0 and 1.

PROPOSITION 3. The firm implements the first-best effort level \( e^* \) by using promotion and a second-period wage satisfying (13), whilst also committing to share a fraction \( s^* \) of the manager's cost, where \( s^* \) is defined by (12).

Let us finally consider the wage structure. The participation constraint of problem (4) determines the first-period salary
\[
w = a + (1-s^*) \cdot c(e^*) - f(g; e^*) (W-a)
\]
\[
= a + (W-a) \left( \frac{df(g; e^*)}{de} \cdot c'(e^*) - f(g; e^*) \right).
\]
Hence, this wage is smaller than the market wage \( a \) if
\[
\frac{df(g; e)}{de} < \frac{c'(e)}{c(e)} .
\]
Condition (15) has an interesting interpretation. It means that an increase in effort aimed at specific skills collection contributes more (in percentage) to augment effort cost than to raise the probability of promotion. If this is indeed the case, the firm needs to provide stronger monetary incentives to the manager. It will then adopt an ascending wage schedule where
\[
w < a < A \leq W .
\]
Such a wage schedule is consistent with the one predicted in the human resources management literature [see, for instance, Becker, 1962, and Lazear, 1981]. It is worth noting that in this literature the manager's effort level has no influence on the firm's inference about her talent, so \( df(g;e^*)/de = 0 \) and condition (14) is automatically fulfilled.

V. CONCLUDING REMARKS

Central to all employment relationships is the interaction between sorting and incentives. On this matter, two approaches can be distinguished in the literature. One [see for instance MacLeod and Malcomson, 1988, and references therein] focuses on the simultaneous occurrence of adverse selection and moral hazard, stressing problems of asymmetric information. A key insight is that pay is tied to performance rather than task, as is frequently the case in large Japanese firms. Another approach, originating in Holmström [1982]'s seminal work on managerial incentive contracts, assumes symmetry of beliefs about individual ability and therefore rules out adverse selection. In this approach, represented most recently by Prendergast [1993], pay is tied to jobs rather than performance and promotion can be used to induce optimal investment in firm-specific human capital.

The latter approach, in spite of its appeal, often suffers from a gap with an important body of literature in statistics and economics on experimentation with strategically-minded subjects. The present paper was an attempt to bridge this gap. We explored
a context where the manager's decision to invest in human capital impacts on her and the firm's information. We showed that promotion alone is then insufficient to induce optimal investment in human capital. The firm therefore needs to share the cost of investment.

As investment in firm-specific human capital is a nonverifiable action, however, cost sharing raises a double moral hazard issue: the firm cannot commit to pay a fixed amount, nor can the manager commit to put in the effort. This double moral hazard can be resolved if the firm invests in facilities reducing the manager's marginal cost of investment without otherwise affecting her utility and her outside opportunities. For example, the firm may set up an internal executive training center. The quality of the education provided by such centers being unobservable to outsiders, the market tends to discount its value heavily compared to education provided by business schools. Why firms do not subcontract such education, preferring to perform it themselves inefficiently is clear in the context of our model. A "degree" from the home school has no value outside, while senior executives who do most of the teaching have a useful standpoint to observe junior ones.
REFERENCES


