Using Buyout Options to Screen Employees for Fit

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Abstract

This study examines how buyout options may induce employees with a poor fit with a firm to leave as a means of enhancing the firm's screening efficiency and value. In many cases, neither employees nor the employing firm have information about their fit despite the fact that the fit may be an important determinant of employee performance. After joining a firm, employees learn their fit using various sources of information provided by the firm. Although the employee is the only party privy to such learning about the fit, the firm can design more efficient contracts and selectively motivate an employee with a signal of a high fit. Moreover, using the employee's private information about fit, a firm's buyout offer can screen an employee with a poor fit by providing an incentive for the employee with a low-fit signal to leave voluntarily. In particular, the firm can offer a buyout option to an employee at a given price, provided that the employee chooses to take that option. However, the buyout contract may be too aggressive and encourage even employees with a high fit to leave in response to an imperfect signal about the fit. Considering the overall trade-off, this research shows that a buyout contract can increase a firm's value as long as the precision of the fit signal is not too low.

Keywords: Adverse Selection; Compensation; Hidden Knowledge; Buyout Options.

1 Introduction

Human capital theory suggests that matching the right employee to the right firm creates significant economic value (Lazear and Oyer, 2013) and most of firms have devoted substantial efforts to hiring the right employee by screening job candidates. An employee's type is usually her private information at the contracting stage and most of previous research has focused on developing an effective screening mechanism to sort out the employee's type to alleviate the adverse selection problem.[1]But most of research has focused on sorting employees based on their ability among several dimensions of an employee's type and it has overlooked another important dimension, a match quality, i.e., a fit between an employee and a firm.

The fit between a firm and an employee is an important determinant of productivity because employees may be well suited to a certain job or a certain place (Jovanovic, 1979; Siegel and Simons, 2010). If an employee is placed in the right role at the right firm, a good quality of match leads to a better performance in the firm (Siegel and Simons, 2010). The examples of factors affecting the quality of fit with an organization are an employee's set of different skills, personality and cultural fit, or locational preference (Lazear and Gibbs, 2008). Thus, the match between an employee's attributes and a firm's attributes is another critical dimension of an employee's quality which a firm should screen.

In practice, however, it is often the case that an employee as well does not have a great sense of the fit before joining a firm: an employee and a firm are symmetrically uninformed at the contracting stage (Hermalin, 2005; Inderst and Muller, 2010). The quality of a fit between a firm and an employee is realized after an employee experiences a specific job after entering a firm (Jovanovic, 1979).[2]Because a firm (principal) and an employee (agent) are symmetrically uninformed of the fit at the contracting stage, this paper studies the hidden knowledge problem (Tirole, 1999). This post-hiring screening problem such as retention and discharge of employees

[1] For convenience, this paper uses her for an employee and him for an employer.

[2] The implications of fit are hard to tell from those of firm-specific human capital (Jovanovic, 1979). Therefore this paper regards a fit, a match quality and a firm-specific skill as a similar concept.

based on employees' attributes has received relatively less attention from researchers (Oyer and Shafer, 2011). In the presence of post-contractual screening problem, this paper examines the role of employee learning about fit and buyout options in screening employees using their private information about fit.

In particular, the late realization of the fit information prevents a firm from hiring the best-fit employee, and hired employees choose to stay in the position regardless of the level of fit until a more attractive outside opportunity becomes available. This retention is costly for the firm because without the fit information the firm must motivate both high- and low-fit employees to exert high effort despite the fact that the efforts of an employee with a low fit will not be as productive as the efforts of an employee with a high fit. In this case, a firm should help an employee create her private information about fit by providing various sources of information. For instance, the management accounting information system can provide detailed productivity information for an employee to gauge her fit while only summary of this local information is furnished to a firm and thereby information asymmetry about fit is caused (Baiman and Sivaramakrishnan, 1991).

The conventional wisdom is that an agent's private information harms a firm's welfare by causing information asymmetry. However, this paper shows the benefit of allowing for an agent's private information and thereby creating information asymmetry between an agent and a firm. That is, in an agent's early career in the firm, supplying intensive information such as firm-specific skills, a firm's unique culture, and a firm's long term vision helps the agent to gauge her fit and her prospects for success in the firm. Also, frequent performance reports and feedback through the internal accounting system is another source of private signals which allow an agent to realize her marginal productivity in the firm and thereby forming the private information about the fit. The fit learned by the employee is her private information and it does not have to be communicated to a firm but the firm still can use it by designing a selective incentive scheme which induces only an employee with a high-fit signal to exert high effort.

Thus, an agent's private information about fit allows a firm to design more efficient incentive scheme, which improves the firm's profit.

However, the acquisition of private information can create control problems because it allows agents to make decisions inconsistent with the interests of the owners (Bushman, Indjejikian, Penno, 2000). That is, even with the private signal of fit, an employee with a low-fit signal does not want to leave and instead exerts low effort because she can earn information rent by staying, which is a downside of the agent's private information. But the buyout option serves as an incentive device that induces employees with a low-fit signal to leave voluntarily. Hence, an employee observing a low-fit signal should take the buyout option and leave because the buyout price provides a greater payoff than expected compensation from staying. Despite these incentives granted to the leaving employee, a firm's expected profit improves because the firm can replace the low-fit employee with a new employee, who can be more productive *on average*. Because the signal about the fit is imperfect, however, the buyout option may also be too aggressive in removing employees who receive low-fit signals, which constitutes a type I error. The final result shows that the firm can increase its profit when the likelihood of a high-fit employee is not extremely high because the benefit from excluding employees with low-fit signals dominates the loss from type I error. In addition, it is shown that the benefit of an employee's private information about fit and buyout options is robust to an endogenous firm value.

The incentive for separation, labor buyouts are prevalent in practice. However, a firm's use of labor buyouts as a screening device has received surprisingly little attention from researchers. Nonetheless, the basic premise here has substantial support in practice. For instance, recently Amazon has started a pay-to-quit program which offers its employees \$2,000 as a buyout price when they want to leave. The buyout price increases by \$1,000 every year until the amount goes up to \$5,000. Amazon CEO Jeff Bezo mentioned that the idea of the program is "to bribe people who don't love working there, don't feel they're a fit for the culture, or don't really like what they're doing with money to head for the exits."(*The Washington Post,* April 14, 2014). Zappos, an online shoe retailer, new call center employees undergo a few weeks of intensive training and then receive an offer of $2,000, on top of what they have earned if they want to quit (*The Washington Post,* April 14, 2014; *The Wall Street Journal*, May 5, 2015). Netflix Inc. is another company which adopted the pay-to-quit program and it offers big bonuses for quitting employees (*LA Times*, April 11, 2014).

Early retirement is another form of labor buyouts. It is a tool that many firms rely on to eliminate unproductive employees. Firms grant compensation to leave, and employees with relatively less fit or commitment accept the compensation to leave before they are scheduled to retire. As an example, Intel has made use of buyout offers to new recruits. The chipmaker wanted to reduce the number of employees, and new hires could receive a bonus to quit if they decided not to join the firm (*Forbes.com*, April 26, 2001). New recruits who were committed to a job in the firm would have not taken the offer and instead would have taken the risk by joining the firm. Therefore, using an early buyout offer, the firm could jettison uncommitted employees while reducing their compensation costs. These very common practices have escaped the scrutiny of serious academic study. Therefore, this research sheds light on the use of the feature of labor buyout agreements as a screening tool.

This paper pertains to a stream of accounting literature (Christensen, 1981, 1982; Baiman and Evans III, 1983; Penno, 1984; Baiman and Sivaramakrishnan, 1991; Bushman, Indjejikian, and Penno, 2000; Rajan and Saouma, 2006) which investigates the effect of providing an agent with private pre-decision information. As one of the early works in the literature, Christensen (1981, 1982) analyzes situations in which an agent can hold private information before making an effort choice, showing that a principal can be worse off due to an agent's pre-decision information. On the other hand, Penno (1984) shows that allowing an agent to access to managerial accounting information before her effort choice makes the principal strictly better off. Bushman, Indjejikian, and Penno (2000) investigate the effect of performance measure on the relationship between private pre-decision information and the value of decentralization. In a similar setting, Rajan and Saouma (2006) examine the level of information asymmetry preferred by the principal and the agent. As in the previous literature, the current paper also examines the effect of an agent's private information before making an effort choice. However, the primary emphasis in the previous papers was on the moral hazard problem, whereas, the current paper focuses on the adverse selection problem, especially when the employee's private information is acquired after the contracting stage. Raith (2008) examines the post-contractual problem as in this paper. However, his model focuses on the specific knowledge and moral hazard problem while the current work concentrates on the role of buyout options in mitigating the adverse selection problem.

Labor buyouts are common in practice but their role as a screening device has not been closely examined in previous research. This paper is linked to the agency contracting literature which examines the buyout agreement between a principal and an agent. Demski and Sappington (1991) utilize labor buyouts as an incentive scheme as in this paper and they investigate a variation of labor buyouts and show that a labor buyout can resolve a double moral hazard problem. Unlike the employee's buyout in Demski and Sappington (1991), this paper focuses on a firm's labor buyout following common practices and posits that a buyout offer combined with an agent's private information about fit can be a natural screening mechanism in the presence of a hidden knowledge problem.

Furthermore, this research is in line with the literature that examines the hidden knowledge problem. Levitt and Snyder (1997) study incentive compensation to motivate a manager who has already exerted effort to report a private signal about eventual project outcomes. Although this study also considers incentive compensation in the presence of hidden knowledge, the focus is on an initial screening mechanism such that the employee is induced to reveal her private information before she exerts effort. Vaysman (2006) shows that paying managers shut-down bonuses can encourage privately informed managers to make the optimal abandonment decision for a project. On the other hand, this paper examines how employee learning about fit and buyout options encourage an employee to find her private information about fit and to leave voluntarily if she has a low fit with a firm. In terms of sorting employees after contracting stage, this paper is related to Arya and Mittendorf (2006). However, their focus is on the benefit of a job rotation program in matching compensation to an employee's truthful ability while this work aims to show the role of buyout options in inducing an employee's voluntary turnover. Inderst and Muller (2010) show that it can be best to reward CEOs through a steep contingent payment rather than simply using a severance payment when a firm replaces a badly matched CEO. On the other hand, this study focuses on the role of buyout options in screening employees.

The contribution of this paper is twofold. First, this research shows the benefit of employee learning about fit in the presence of the hidden knowledge problem. It is shown that even if information asymmetry is caused by the employee learning about fit, the employee's private information allows a firm to design more efficient compensation scheme. Second, it has long been recognized that a guaranteed payment in the form of a fixed payment cannot work as an incentive device, but this study suggests that a fixed buyout price can serve as a contracting tool when the hidden knowledge problem exists at the interim stage.

The remainder of this paper consists of seven sections. Section 2 describes the model and provides a benchmark case, while section 3 describes cases without and with private information about employee fit. Section 4 investigates the benefit of a buyout contract as an incentive device, and this is followed by a numerical example in section 5 to explain the main results. Section 6 considers endogenous firm value as an extension, while section 7 concludes the paper.

2 Setup

2.1 Model

A firm considers a pool of employees (agents) and hires each agent to generate additional firm value. The firm's value is a function of an agent's innate ability and her match quality with a firm (Lazear and Oyer, 2013). To focus on the hidden knowledge problem, the innate ability is assumed to be the same for all of agents and it is abstracted from the model; the firm value is determined mainly by the match quality, which is privately known to the agent after she experiences her job in the firm (Hermalin, 2005; Inderst and Muller, 2010).[3]This setting is differentiated from the usual adverse selection problem in that the agent's private information is generated after a contracting stage. The match quality is firm-specific by definition so that it does not affect the agent's outside option (i.e., reservation wages).

In particular, the match quality is denoted by $\theta \in (\theta_L, \theta_H)$ and θ_H is more productive than θ_L and the probability of the high match quality is equal to $\mu \in (0, 1)$. The match quality determines a firm's terminal value, $v \in \{v_L,\ v_H\}$ and the effect of the fit on the firm value is affected by the agent's effort level ($e \in \{e_L = 0, e_H = 1\}$). The costs of effort are $C(e = 0) = 0$ and $C(e = 1) = c > 0$. Then, the probability structure for an agent to generate each firm value is as follows:

$$\Pr(v_H|\theta, e) = \begin{Bmatrix} pe + q(1-e) \ if\ \theta = \theta_H \\ 0 \qquad\qquad\quad if\ \theta = \theta_L \end{Bmatrix};$$

$$\Pr(v_L|\theta, e) = 1 - \Pr(v_H|\theta, e),$$

$$where\ p,\ q \in \left(\frac{1}{2}, 1\right)\ and\ p > q.$$

Thus, the probability of generating each firm value is a function of an agent's match quality, that is, fit (θ) and effort (e).[4] That is, if an agent with a high fit (θ_H) exerts a high level of

[3]The match quality is affected by the factors such as a worker's portfolio of different skills, personality, or locational preference (Lazear and Oyer, 2010), which are mainly intangible so that a firm cannot precisely observe it while a worker recognizes it by experiencing her job.

[4]Hereafter, a match quality and a fit are used interchangeably for convenience.

effort ($e_H = 1$), the probability of a high firm value (v_H) is p. If the high-fit agent exerts a low level of effort ($e_L = 0$), the chance of a high firm value becomes lower from p to q. On the other hand, a low fit (θ_L) leads to a low firm value (v_L), regardless of the effort level. This is the main reason the firm prefers an agent with a high fit (θ_H).

The agent is provided with a private signal (σ) of fit in her job in the new firm. That is, informing the agent of firm-specific knowledge and skills and providing her with performance reports and feedback through the internal accounting system enable her to realize her marginal productivity in the firm and thereby to form her private information about the fit. The signal of fit has two realizations, $\sigma \in (\sigma_L, \sigma_H)$. The signal is informative but imperfect, such that

$$\Pr(\sigma_H|\theta_H) = \lambda \text{ and } \Pr(\sigma_L|\theta_H) = 1 - \lambda;$$
$$\Pr(\sigma_L|\theta_L) = \lambda \text{ and } \Pr(\sigma_H|\theta_L) = 1 - \lambda,$$

where $\lambda \in (\frac{1}{2}, 1]$. The signal is informative about the productivity of the agent's action and it is valuable because it allows an agent to make a better decision of choosing her effort.

Both a firm and an agent are risk-neutral: an agent's utility is $u(\theta) = t - c$, and a firm's profit is $\Pi = v - t$, where $t \in \{t_L, t_H\}$ and t_H (t_L) is compensation for a high (low) firm value. The buyout offer is made to an agent who joins a firm but it expires after an agent exerts effort. The agent may accept the buyout offer after observing a fit signal and before exerting effort. If an agent accepts the buyout offer, she leaves the firm with the predetermined buyout price K, as well as a reservation wage $\overline{U}$ in the outside job market. It is obvious that the reservation wage is not affected by the firm-specific match quality and it is normalized to zero for simplicity. Furthermore, with the buyout contract, after the fit is realized, the agent's interim expected utility is:

$$E[u|\sigma_H] = Max\{K, \Pr(\theta_H|\sigma_H)\,(pt_H + (1-p)t_L) + (1 - \Pr(\theta_H|\sigma_H))t_L - c\};$$
$$E[u|\sigma_L] = Max\{K, \Pr(\theta_L|\sigma_L)t_L + (1 - \Pr(\theta_L|\sigma_L))\,(qt_H + (1-q)t_L)\},$$

such that the agent prefers to exert high (low) effort if a high (low) fit signal is realized, which is true in equilibrium. The agent decides whether to accept the buyout offer by comparing the payoffs. If the agent does not accept the offer, the buyout option immediately expires and the agent receives t_i by exerting effort at the end of the period. If an agent leaves, the firm finds a new agent to realize its value, V, which is exogenously determined from a range between v_L and v_H, i.e., $V \in [v_L, v_H]$. This assumption for the exogenous value of V will be relaxed in the later section (Section 6.1) by endogenizing the value of V.

The time line is therefore as follows:

(1) An agent enters into a contract, $\Psi = \{t_H,\ t_L,\ K\}$ with a firm.

(2) A signal (σ) of fit (θ) between the agent and the firm is realized.

(3) The agent decides whether to take the buyout option or not.

(5) If the agent takes the buyout option, she leaves the firm with K.

(6) If the agent leaves, the firm finds a new agent to realize its value, V.

(7) If the agent does not take the buyout option, she stays with the firm and decides whether or not to exert effort.

(8) The firm's value (v) is realized, and the agent receives compensation, t.

To avoid a trivial result, it is assumed that the firm wants a high-fit agent to exert high effort. The sufficient condition for this assumption is that the difference between v_H and v_L is sufficiently large.

2.2 Benchmark

Consider a setting in which the fit between an agent and a firm is publicly observed after entering a firm. That is, at the contracting stage, both an agent and a firm do not know the fit. However, the agent is provided with a fit signal after accepting a contract, and a perfect signal ($\lambda = 1$) of the fit can be observed by both the agent and the firm. Also, in this benchmark setting, it is assumed that firing cost is so low that a firm does not have any restriction in firing an agent whenever it needs to. If the firm observes a low-fit signal, the agent is asked to leave, and only agents with a high fit remain. In this case, a firm designs a contract which induces a high level of effort from an agent. The firm's contracting problem is presented as follows:

$$\underset{t_H,\ t_L}{Max}\ \mu\,(p(v_H - t_H) + (1-p)(v_L - t_L)) + (1-\mu)V$$

$$s.t.$$

$$\mu(pt_H + (1-p)t_L - c) \geq 0 \tag{EIR}$$

$$pt_H + (1-p)t_L - c \geq 0 \tag{IIR}$$

$$pt_H + (1-p)t_L - c \geq qt_H + (1-q)t_L \tag{IC}$$

$$t_H,\ t_L \geq 0 \tag{LL}$$

In the objective function, the probability that an agent has a high fit is μ. The firm can generate the expected value, $pv_H + (1-p)v_L$ by motivating a high-fit agent to exert high effort. However, a firm hires an agent with a low fit with a probability $(1-\mu)$, and the firm's value of replacing this agent with another agent is V. When the fit between the firm and the agent is public information, the firm's sole objective is to motivate the agent to exert high effort to increase the chances of generating a high firm value, v_H.

The ex ante individual rationality constraint (EIR) ensures that the contract provides an agent with at least a reservation wage ($\overline{U}$). Ex ante, neither the firm nor the agent knows whether the agent has a high or low fit. Because a low fit makes the agent leave without exerting effort and receiving compensation, the (EIR) includes an agent's expected compensation only for a high fit. Unless the firm provides enough expected compensation to offset the agent's concern about a realization of a low fit, the agent will not enter into a contract, as she still may be asked to leave after a fit signal is generated. The reservation wage does not change with her fit level because the fit represents a firm-specific productivity; it is normalized to zero for simplicity. The interim individual rationality constraint, the (IIR) confirms that an employee with a high fit stays in the firm and it is satisfied if (EIR) is satisfied.

Moreover, the incentive compatibility constraint (IC) motivates a high-fit agent to exert high effort. The (LL) constraint reflects the agent's limited liability. In this program, the (IC) constraint is binding to induce an agent's high effort and the optimal values for t_H and t_L can be derived from the (IC) constraint. The optimal values satisfy the (EIR) constraint and the (IIR) constraint. This process yields a benchmark result, as summarized in Lemma 1. (All proofs appear in the Appendix.)

Lemma 1 *When the fit between an agent and a firm is public information, the equilibrium outcomes are as follows:*

$$t_L^* = 0;\ t_H^* = \frac{c}{p-q};\ \Pi_F = \mu\left(pv_H + (1-p)v_L - \frac{c}{p-q}\right) + (1-\mu)V$$

and the first-best solution is obtained.

3 Private Information about Employee Fit

This section examines the benefits and costs of an agent's private information about fit. That is, consider a setting in which an agent's fit is not publicly observable, but instead is the agent's private information. The agent receives an imperfect signal of her own fit, and the firm designs a contract to screen out low-fit-signal agents and to motivate high-fit-signal agents to stay and exert high effort.

3.1 No Private Information about Employee Fit

Before investigating this role of private information about employee fit, consider a case without the private information, which helps make the incremental benefit of the private information more explicit in the following sections. Without the private information about the fit, both high- and low-fit agents exert efforts without leaving the firm, and the firm must motivate all of agents to exert high effort, even if it realizes that efforts by a low-fit agent will be fruitless. Technically, in the absence of the agent's private information about the fit, a firm cannot design a contract with the interim signal (fit signal), which leaves no interim constraints. In this situation, the firm's contracting problem is as follows:

$$\underset{t_H,\, t_L}{Max}\ \mu(p(v_H - t_H) + (1-p)(v_L - t_L)) + (1-\mu)(v_L - t_L)$$

$$s.t.$$

$$\mu E\left[u\left(\theta_H, e_H\right)\right] + (1-\mu) E\left[u\left(\theta_L, e_H\right)\right] \geq 0 \quad \text{(IR)}$$

$$\mu E\left[u\left(\theta_H, e_H\right)\right] + (1-\mu) E\left[u\left(\theta_L, e_H\right)\right] \geq \mu E\left[u\left(\theta_H, e_L\right)\right] + (1-\mu) E\left[u\left(\theta_L, e_L\right)\right] \quad \text{(IC-ALL)}$$

$$t_H,\ t_L \geq 0, \quad \text{(LL)}$$

where $E\left[u\left(\theta_H, e_H\right)\right] = pt_H + (1-p)t_L - c$ and $E\left[u\left(\theta_L, e_H\right)\right] = t_L - c$.

In the objective function, the firm's probability of having a low terminal value (v_L) increases from $\mu(1-p)$ in the previous first-best case to $\mu(1-p)+(1-\mu)$ here because it cannot discourage a low-fit agent from exerting high effort, which is costly to the firm. That is, the effort of the low-fit agent provides a firm with a value of only v_L; note also that $\Pr\left(v_L \middle|\ \theta_L,\ \cdot\right) = 1$.

Because neither a firm nor an agent knows the fit until the agent exerts effort and outcome is realized, the firm has to motivate all of agents through the contract. This constraint (IC-ALL) motivates both types of agents to choose a high effort level. Based on the program, we obtain the following result in Proposition 1.

Proposition 1 *(1) Without private information about employee fit, the equilibrium outcomes are as follows:*

$$t_L^* = 0;\ t_H = \frac{c}{\mu(p-q)};\ \Pi_N = \mu(pv_H + (1-p)v_L) + (1-\mu)v_L - \frac{cp}{p-q}.$$

(2) Without private information about employee fit, the firm's expected profit is always lower than the benchmark profit, i.e.,

$$\Pi_N - \Pi_F = -\frac{(1-\mu)((p-q)(V-v_L) + cp)}{p-q} < 0.$$

The absence of the private information about employee fit does not allow either the agent or the firm to know the fit before the agent exerts efforts, which creates two types of costs. First, the firm has a higher likelihood of generating a low firm value (v_L), as a low-fit agent does not leave but instead remains and exerts efforts leading only to the firm value of v_L. Second, without the private information about fit, the firm must commit more expenditures to motivating all of agents instead of designing a selective contract that motivates only high-fit agents. The firm thus compensates even the fruitless efforts of low-fit agents ex ante, which increases its compensation costs. These two costs lower the firm's profit, as stated in Proposition 1. The next section shows that the private information about employee fit can improve the firm's profit by reducing compensation costs.

3.2 Private Information about Employee Fit

Consider private information about employee fit. The agent joins the firm and receives the fit signal from the various source of information such as continuous productivity information and feedback from detailed local information. The various types of information generates the signal (σ) of the fit (θ) with precision $\lambda \in (\frac{1}{2}, 1]$. However, the fit signal can be observed only by the agent and it is her private information. This section shows that the agent's private information about the fit can improve a firm's profit while not offering a screening purpose at this point because both a high-fit agent and a low-fit agent remain in the firm. The low-fit agent does not want to leave a firm without any incentive for her exit.

In particular, in the presence of the private information about employee fit, the compensation schemes, t_H and t_L are chosen as follows:

$$\underset{t_H,\, t_L}{Max}\; \mu\,(\lambda\,(p(v_H - t_H) + (1-p)(v_L - t_L)) + (1-\lambda)(q(v_H - t_H) + (1-q)(v_L - t_L))) + (1-\mu)(v_L - t_L)$$

$s.t.$

$$\mu\left(\lambda\left(pt_H + (1-p)t_L - c\right) + (1-\lambda)(qt_H + (1-q)t_L)\right) + (1-\mu)t_L \geq 0 \tag{EIR}$$

$$E\left[u|\sigma_H, e_H\right] \geq 0 \tag{IIR-H}$$

$$E\left[u|\sigma_H, e_H\right] \geq E\left[u|\sigma_H, e_L\right] \tag{IC-H}$$

$$t_H,\ t_L \geq 0, \tag{LL}$$

where $E\left[u|\sigma_H, e_H\right] = \Pr(\theta_H|\ \sigma_H)\left(pt_H + (1-p)t_L\right) + (1-\Pr(\theta_H|\ \sigma_H))t_L - c$ and $E\left[u|\sigma_H, e_L\right] = \Pr(\theta_H|\ \sigma_H)\left(qt_H + (1-q)t_L\right) + (1-\Pr(\theta_H|\ \sigma_H))t_L$. $\Pr(\theta_H|\sigma_H)$ is the agent's posterior belief that she has a high fit when σ_H is realized and the posterior belief structure for each signal is as follows:

$$\Pr(\theta_H|\sigma_H) = \frac{\mu\lambda}{\mu\lambda + (1-\mu)(1-\lambda)};\ \Pr(\theta_L|\sigma_H) = \frac{(1-\mu)(1-\lambda)}{\mu\lambda + (1-\mu)(1-\lambda)};$$
$$\Pr(\theta_L|\sigma_L) = \frac{(1-\mu)\lambda}{(1-\mu)\lambda + \mu(1-\lambda)};\ \Pr(\theta_H|\sigma_L) = \frac{\mu(1-\lambda)}{(1-\mu)\lambda + \mu(1-\lambda)}.$$

Similar to the case without private information case, the (EIR) constraint considers both high and low fits because, ex ante, an agent cannot know her fit. An agent who receives a signal of a low fit (σ_L) prefers to exert low effort as it is very likely that this effort will be useless, which is true in equilibrium (see the Appendix).

The solutions have the (IC-H) constraint binding and the optimal solutions are as follows:

$$t_L^* = 0;\ t_H^* = \frac{c}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{c(\mu\lambda + (1-\mu)(1-\lambda))}{\mu\lambda(p-q)}.$$

The agent's private information about fit provides the firm with the means to selectively motivate agents. This selective motivation also enables the firm to reduce its compensation costs because it does not compensate the fruitless efforts of low-fit agents. Comparing the expected compensation under the private information about fit (C_P) with that in the absence of the private information about the fit (C_N) indicates:

$$C_N - C_P = \Delta C = \frac{cp}{p-q} - \frac{c(\lambda(p-q)+q)(1-\mu+\lambda(2\mu-1))}{\lambda(p-q)} > 0,$$

which implies that the compensation cost is lower with the private information. ΔC is always positive because ΔC is positive when $\mu = 1$; it increases as μ decreases. In particular, μ

represents the likelihood that an agent has a high fit; as μ decreases, the chance that an agent has a low fit increases and screening becomes more important. The comparison reveals that as the importance of screening increases and the signal becomes more precise, the benefit of private information about fit, in terms of lowering compensation costs, increases.

However, even in the presence of private information about fit, an agent with a low-fit signal remains with the firm to receive information rents for the following reason. The fit signal is imperfect according to the precision $\lambda \in (\frac{1}{2}, 1]$; thus, there is a chance that an agent who receives a low-fit signal actually has a high fit. Thus, an agent who receives a low-fit signal prefers to stay with the firm but does not exert high effort, which provides her with the expected compensation, as follows:

$$\begin{aligned} E\left[u|\sigma_L\right] &= \Pr(\theta_L|\sigma_L)t_L + (1 - \Pr(\theta_L|\sigma_L))\left(qt_H + (1-q)t_L\right) \\ &= \frac{cq(1 - \Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{cq(1-\lambda)(\mu\lambda + (1-\mu)(1-\lambda))}{(p-q)\lambda(1 - \mu\lambda - (1-\mu)(1-\lambda))} > 0. \end{aligned}$$

If the signal is perfect ($\lambda = 1$), any agent receiving a low-fit signal leaves. The imperfect signal instead causes low-fit agents to wait for a final outcome to confirm the fit and thus a firm cannot screen out agents by the private information about fit only.

Even if an agent with a low-fit signal actually has a high fit, retaining this agent has a limited effect on a firm's value because any agent with a low-fit signal prefers not to exert high effort. The firm's chance of generating a high terminal value (v_H) is thus lower ($q < p$), even if the agent has a high fit. This efficiency loss due to an imperfect signal represents a downside of the private information about fit. Proposition 2 therefore reflects the trade-off associated with the private information about fit to determine the equilibrium outcomes and results.

Proposition 2 *(1) With private information about employee fit, the equilibrium outcomes are as follows:*

$$\begin{aligned} &t_L^* = 0;\ t_H^* = \frac{c(\mu\lambda + (1-\mu)(1-\lambda))}{\mu\lambda(p-q)}; \\ &\Pi_P = \mu(\lambda p + (1-\lambda)q)(v_H - v_L) + v_L - \frac{c(\lambda p + (1-\lambda)q)(\mu\lambda + (1-\mu)(1-\lambda))}{\lambda(p-q)}. \end{aligned}$$

(2) Private information about employee fit improves a firm's expected profit when screening becomes more important, i.e.,

$$\Pi_P - \Pi_N \geq 0 \ if \ \mu \leq \mu^P,$$
$$where \ \mu^P = \frac{c(p\lambda^2 - q(1-\lambda)^2)}{(p-q)^2(v_H - v_L)(1-\lambda)\lambda + c(2\lambda - 1)(p\lambda + q(1-\lambda)}.$$

(3) No agent voluntarily leaves a firm regardless of the signal of employee fit.

According to Proposition 2, the firm's profit is greater with the private information about employee fit when the likelihood that an agent has a high fit is not exceedingly high. That is, because the fit signal is not perfect, an agent with a low-fit signal may have a high fit. This type I error represents the cost of private information about fit because this agent exerts low effort. The trade-off between saving of compensation costs and the cost caused by the type I error determines the net benefit of the private information about employee fit.

The precision of the fit signal also affects the size of the information rent for agents who receive a low-fit signal. When the signal becomes more precise, the agent gains confidence in her fit level and ex ante, the agent's compensation risk then decreases. The agent worries less about receiving low compensation even after exerting a high effort, which may occur if the agent obtains a high-fit signal but actually has a low fit. As the signal becomes more precise, the risk becomes even smaller, and the firm can pay less t_H^*, which also decreases the information rent for a low-fit agent. Note that $\frac{\partial E[u|\sigma_L]}{\partial \lambda} = -\frac{cq(1-\mu)(\mu+2\lambda(1-\lambda)(1-2\mu))}{(p-q)\lambda^2(\mu+\lambda-2\mu\lambda)^2} < 0$. Therefore, as the signal of fit becomes more precise, the agent's information rent decreases. This result is confirmed in Corollary 1.

Corollary 1 *As a signal of fit becomes more precise, the agent's information rent decreases, i.e.,* $\frac{\partial E[u|\sigma_L]}{\partial \lambda} < 0$.

Thus, the private information about employee fit improves the firm's profit under some conditions but still does not achieve the screening purpose because the signal of fit remains the agent's private information. The next section details how a buyout option can extract the agent's private information and screen out low-fit agents.

4 Buyout Options

This section considers a buyout option offered to an agent and examines how a labor buyout can screen agents with a poor fit. As the previous section shows, an agent does not voluntarily leave a firm, even after receiving a signal of low fit, because she still can earn information rents by staying. However, the buyout option may encourage her to leave voluntarily upon the receipt of a low signal; hence, the buyout option eventually enhances the sorting efficiency using an agent's private information about fit.

Buyout options are offered to any agent who joins a firm, but they expire before an agent exerts her effort. The agent may take the buyout options after observing a fit signal and before exerting effort. If an agent takes the buyout option, she receives a predetermined buyout price (K) and leaves. If the agent decides to stay, the buyout option expires, and the agent exerts effort and receives compensation.

In this sense, the buyout options as a form of interim compensation serves as an additional incentive for an agent to leave voluntarily because the buyout price is greater than the expected compensation that an agent with a low-fit signal would receive by staying. The buyout option thus demands careful design, because an extremely high buyout price may induce even an agent with a high-fit signal to leave. The following contracting problem reflects the combined effect of the buyout option and an agent's private information about fit:

$$\underset{t_H,\, t_L,\, K}{Max}\ \mu\left(\lambda\left(p(v_H - t_H) + (1-p)(v_L - t_L)\right) + (1-\lambda)(V-K)\right) + (1-\mu)(\lambda(V-K) + (1-\lambda)(v_L - t_L))$$

$s.t.$

$$\mu E_\sigma\left[u(\theta_H)\right] + (1-\mu)E_\sigma\left[u(\theta_L)\right] \geq 0 \tag{EIR}$$

$$E\left[u|\sigma_H, e_H\right] \geq 0 \tag{IIR-H}$$

$$E\left[u|\sigma_H, e_H\right] \geq E\left[u|\sigma_H, e_L\right] \tag{IC-H}$$

$$E\left[u|\sigma_H, e_H\right] \geq K \tag{NoEXIT-H}$$

$$K \geq E\left[u|\sigma_L, e_L\right] \tag{EXIT-L}$$

$$t_H,\ t_L \geq 0, \tag{LL}$$

where

$$E_\sigma\left[u(\theta_H)\right] = \lambda\left(pt_H + (1-p)t_L - c\right) + (1-\lambda)K;$$

$$E_\sigma\left[u(\theta_L)\right] = \lambda K + (1-\lambda)(t_L - c);$$

$$E\left[u|\sigma_H, e_H\right] = \Pr(\theta_H|\sigma_H)\left(pt_H + (1-p)t_L\right) + (1 - \Pr(\theta_H|\sigma_H))t_L - c;$$

$$E\left[u|\sigma_H, e_L\right] = \Pr(\theta_H|\sigma_H)\left(qt_H + (1-q)t_L\right) + (1 - \Pr(\theta_H|\sigma_H))t_L;$$

$$E\left[u|\sigma_L, e_L\right] = \Pr(\theta_L|\sigma_L)t_L + (1 - \Pr(\theta_L|\sigma_L))\left(qt_H + (1-q)t_L\right).$$

This contracting problem contains two new constraints: (EXIT-L) and (NoEXIT-H). The (EXIT-L) constraint encourages an agent who receives a low-fit signal to leave by promising the buyout price K. To induce the agent to leave, the buyout price should be greater than the expected compensation that an agent with a low-fit signal could receive by staying. This amount determines the lower bound of the buyout price.

In contrast, the (NoEXIT-H) constraint affects an agent with a high-fit signal by encouraging her to remain with the firm. Therefore, the buyout price must be smaller than the expected compensation that a high-fit signal agent could earn by exerting high effort, which determines the upper bound of the exercise price. Thus, the two constraints determine the range of the buyout price the firm should use to screen an agent with a poor fit. The binding (IC) constraint and (LL) constraint again thus yield following optimal solutions:

$$t_L^* = 0;\ t_H^* = \frac{c}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{c(\mu\lambda + (1-\mu)(1-\lambda))}{\mu\lambda(p-q)}.$$

With regard to the firm's objective function, as K becomes lower, the firm's profit increases. The optimal value for the buyout price, K then depends on the lower bound of the range, $\Pr(\theta_L|\sigma_L)t_L + (1 - \Pr(\theta_L|\sigma_L))\,(qt_H + (1-q)t_L)$, which maximizes the firm's profit while satisfying both the (EXIT-L) and (NoEXIT-H) constraints. Using t_L^* and t_H^* yields the optimal buyout price:

$$K^* = \frac{cq(1 - \Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{cq(1-\lambda)(\mu\lambda + (1-\mu)(1-\lambda))}{(p-q)\lambda(1-\mu\lambda-(1-\mu)(1-\lambda))},$$

which is the lower bound of the range. In addition, the optimal solutions and buyout price satisfy all other constraints. The main results from this section can therefore be summarized as shown in Proposition 3.

Proposition 3 *(1) When the firm offers buyout options, the equilibrium outcomes are:*

$$t_L^* = 0;\; t_H^* = \frac{c(\mu\lambda + (1-\mu)(1-\lambda))}{\mu\lambda(p-q)};$$

$$\Pi_B = \mu p\lambda(v_H - v_L) + (\mu\lambda + (1-\mu)(1-\lambda))v_L + V(1-\mu\lambda-(1-\mu)(1-\lambda)) - \frac{c(\lambda p + (1-\lambda)q)(\mu\lambda + (1-\mu)(1-\lambda))}{\lambda\,(p-q)}.$$

(2) With buyout options, the optimal buyout price is $K^* = \frac{cq(1-\Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{cq(1-\lambda)(\mu\lambda+(1-\mu)(1-\lambda))}{(p-q)\lambda(1-\mu\lambda-(1-\mu)(1-\lambda))}$.

(3) With buyout options, an agent with a low-fit signal ($\sigma = \sigma_L$) voluntarily leaves the firm by taking the buyout option; an agent with a high-fit signal ($\sigma = \sigma_H$) stays with the firm and exerts high effort.

As Proposition 3 indicates, buyout options serve as an incentive device for a low-fit-signal agent to leave. Without buyout options, the agent will stay, regardless of the signal of fit, and wait for a final signal, which comes from the firm's terminal value when the agent does not exert high effort and thus an efficiency loss is caused. The buyout options instead induce an agent who receives a low-fit signal to leave, implying that the firm enjoys a lower probability of a low terminal value, as (1) the remaining agents who received a high-fit signal are more likely to have a high fit and exert high effort, and (2) a low-fit-signal agent is replaced with a new agent who is more productive *on average* because she may have a high fit with probability μ.

The conventional belief is that a guaranteed payment in the form of a fixed payment cannot be used as an incentive scheme because a certain level of payment is guaranteed for an agent. Despite this conventional belief, as Proposition 3 shows, when an agent's private information arrives during the interim stage, a guaranteed payment based on the buyout price induces low-fit agents to leave. Thus, the buyout option can screen agents as an incentive device at the interim stage.

In addition, as shown in Proposition 3, the optimal buyout price (K^*) varies according to the change of the effort cost (c), the productivity (p and q), and the signal precision level (λ). The comparative static is summarized in Corollary 2.

Corollary 2 *(1) The optimal buyout price decreases as the signal of fit becomes more precise, i.e.,* $\frac{\partial K^*}{\partial \lambda} < 0$.

(2) The optimal buyout price decreases as the productivity of a high effort (p) increases, i.e., $\frac{\partial K^*}{\partial p} < 0$.

(3) The optimal buyout price increases as the productivity of a low effort (q) increases, i.e., $\frac{\partial K^*}{\partial q} > 0$.

(4) The optimal buyout price increases as the cost of effort (c) increases, i.e., $\frac{\partial K^*}{\partial c} > 0$.

Thus, according to Corollary 2 (1), the optimal buyout price decreases as the signal of fit becomes more precise (λ increases). If the fit signal becomes more precise, the agent who receives a low-fit signal anticipates lower information rent. Thus, the firm can induce her to leave with a lower buyout price. In Corollary 2 (2), the optimal buyout price decreases as the productivity of a high effort (p) increases because higher productivity from a high effort decreases the expected compensation for an agent with a low-fit signal in that the firm may pay a lower incentive to induce a high effort and still obtain a high firm value. Corollary 2 (3) states that the optimal buyout price increases as the productivity of a low effort (q) increases, as does the expected compensation of an agent with a low-fit signal when such an agent stays. Therefore, the firm should increase the buyout price to make leaving more attractive to these agents. Finally, Corollary 2 (4) shows that the buyout price increases as the cost of effort (c) increases. A higher cost of effort increases the agent's compensation with a high firm value, $t_H^* = \frac{c(\mu\lambda+(1-\mu)(1-\lambda))}{\mu\lambda(p-q)}$. Therefore, staying with the firm becomes more attractive to an agent with a low-fit signal, and the firm should increase the buyout price to induce such agents to leave.

In line with Proposition 3, we confirm that the use of buyout options induces an agent who receives a low-fit signal to leave a firm; only agents with high-fit signals remain and exert high effort. However, these agents are sorted according to an imperfect signal rather than by their true fit with the firm, which implies that the buyout options may exclude an agent who has a high fit but receives an incorrect signal. In this case, the firm suffers an efficiency loss, because it loses a high-fit agent. The buyout option provides a trade-off between the endogenous sorting and type I and II errors, which result from the imperfect signal. With regard to this trade-off, Proposition 4 identifies the conditions in which buyout options improve a firm's expected profit.

Proposition 4 *(1) The use of buyout options improves a firm's expected profit compared with the case with no private information about employee fit when screening becomes more important, i.e.,*

$$\Pi_B \geq \Pi_N \; if \; \mu \leq \mu^B,$$

$$where \; \mu^B = \frac{\lambda^2(p-q)(V-v_L+c)+cq(2\lambda-1)}{c(2\lambda-1)(\lambda p+(1-\lambda)q)+\lambda(p-q)((1-\lambda)p(v_H-v_L)+(2\lambda-1)(V-v_L))}.$$

(2) The use of buyout options improves a firm's expected profit compared with the case with only private information about employee fit when the precision of the signal of fit is relatively high, i.e.,

$$\Pi_B \geq \Pi_P \; if \; \lambda \geq \lambda^* = \frac{\mu(qv_H+(1-q)v_L-V)}{\mu(qv_H+(1-q)v_L-V)+(V-v_L)(1-\mu)}.$$

(3) $\mu^B \geq \mu^P$ *if* $\lambda \geq \lambda^*$.

A comparison of the case with no private information to that with buyout options shows that the firm's profit improves with the use of buyout options when the likelihood of a high-fit agent (μ) is lower. The type I and II errors are the costs of buyout options, but the buyout options also enable the firm to increase the chances of sorting out an agent who has a low fit, in which case it generates firm value V by hiring a new agent. As μ decreases, screening becomes more important, and the benefit of buyout options dominates the costs with regard to excluding agents incorrectly. Therefore, the buyout options improve the firm's profit.

The incremental benefit of buyout options from the case with private information only also shows that the firm's profit is greater with buyout options as long as $\lambda \geq \lambda^* = \frac{\mu(qv_H+(1-q)v_L-V)}{\mu(qv_H+(1-q)v_L-V)+(V-v_L)(1-\mu)}$. In this case, λ refers to the precision of the signal of fit. If the signal is more precise than a certain threshold, buyout options improve the firm's profit by excluding low-fit agents. If the fit signal is less precise, however, buyout options can be too aggressive in excluding agents and thereby increase the likelihood of error. Therefore, only when the precision of fit signal is not too low does the firm's profit increase with the use of buyout options.

As Proposition 4(2) indicates, the cutoff value, λ^* is endogenously determined by the productivity of a low effort (q), the firm's value for replacing an agent (V), a high firm value (v_H), and a low firm value (v_L). When λ^* decreases, the attractiveness of the buyout option increases; the comparative statics with regard to λ^* appear in Corollary 3.

Corollary 3 *(1) The incremental benefit of buyout options decreases as the productivity of a low effort (q) increases, i.e.,* $\frac{\partial \lambda^*}{\partial q} > 0$.

(2) The incremental benefit of buyout options increases as the firm's value under replacement (V) increases, i.e., $\frac{\partial \lambda^*}{\partial V} < 0$.

(3) The incremental benefit of buyout options decreases as v_H *increases, i.e.,* $\frac{\partial \lambda^*}{\partial v_H} > 0$.

(4) The incremental benefit of buyout options decreases as v_L *increases, i.e.,* $\frac{\partial \lambda^*}{\partial v_L} > 0$.

As Corollary 3(1) shows, buyout options become less attractive when productivity associated with a low effort (q) increases. As q increases, the value lost due to the type I error increases and a more precise signal is required to offset it. Therefore, the incremental benefit of buyout options decreases as q increases. In Corollary 3(2), the buyout option becomes more attractive as the firm's value under replacement (V) increases because the benefit from screening increases as well. Therefore, the required precision of a signal can decline as V becomes larger. Finally, in Corollary 3(3) and Corollary 3(4), as v_H and v_L increase, the loss of firm value due to agent replacement, based on an incorrect signal, increases. The required precision of a signal then increases and the buyout option becomes less attractive as a result.

Given the result that a buyout contract can improve the firm's screening performance, one may wonder whether a buyout contract is optimal. To examine whether a buyout contract can be optimal, consider a direct revelation mechanism in which an agent is asked to send a report about a signal (σ) which she receives and compare the performance with the result under the buyout contract.

The contract $\{I(\sigma_H),\ I(\sigma_L),\ t_S(\sigma_L),\ t_H(\sigma_H),\ t_L(\sigma_H)\}$ specifies the exit decision and the compensation. The exit decision $I \in \{0,1\}$ is an indicator variable: $I(\sigma_H) = 0$ if an agent stays; otherwise, $I(\sigma_L) = 1$. The agent's compensation is $t_S(\sigma_L)$ if an agent reports σ_L, and $t_H(\sigma_H)$ and $t_L(\sigma_H)$ if an agent reports σ_H. Under the direct revelation mechanism, the firm's contracting problem can be expressed as follows:

$$\underset{t_S,\, t_H,\, t_L}{Max}\ \mu(\lambda(p(v_H - t_H) + (1-p)(v_L - t_L)) + (1-\lambda)(V - t_S)) + (1-\mu)(\lambda(V - t_S) + (1-\lambda)(v_L - t_L))$$

$s.t.$

$$\mu(\lambda(pt_H + (1-p)t_L - c) + (1-\lambda)t_S) + (1-\mu)(\lambda t_S + (1-\lambda)(t_L - c)) \geq 0 \qquad \text{(EIR)}$$

$$t_S(\widehat{\sigma}_L|\sigma_L) \geq E[u(\widehat{\sigma}_H, e_L)|\sigma_L] \tag{TT-L}$$

$$E[u(\widehat{\sigma}_H, e_H)|\sigma_H] \geq t_S(\widehat{\sigma}_L|\sigma_H) \tag{TT-H}$$

$$E[u(\widehat{\sigma}_H, e_H)|\sigma_H] \geq E[u(\widehat{\sigma}_H, e_L)|\sigma_H] \tag{IC-H}$$

$$t_S,\ t_H,\ t_L\ \geq 0, \tag{LL}$$

where $\widehat{\sigma}$ denotes a reported message and

$$E[u(\widehat{\sigma}_H, e_L)|\sigma_L] = \Pr(\theta_L|\sigma_L)t_L + (1 - \Pr(\theta_L|\sigma_L))(qt_H + (1-q)t_L)$$

$$E[u(\widehat{\sigma}_H, e_H)|\sigma_H] = \Pr(\theta_H|\sigma_H)(pt_H + (1-p)t_L) + (1 - \Pr(\theta_H|\sigma_H))t_L - c$$

$$E[u(\widehat{\sigma}_H, e_L)|\sigma_H] = \Pr(\theta_H|\sigma_H)(qt_H + (1-q)t_L) + (1 - \Pr(\theta_H|\sigma_H))t_{L.}$$

(TT-L) is a truth-telling constraint which ensures that an agent who receives a low-fit signal reports a low-fit signal. Additionally, (TT-H) induces an agent who receives a high-fit signal to report a message for a high-fit signal. According to (LL), it is optimal to set t_L to zero again. In (TT-L), it is clear that $t_S(\widehat{\sigma}_L|\sigma_L) = E[u(\widehat{\sigma}_H, c_L)|\sigma_L]$ should hold to induce an agent to report a low-fit signal. In addition, to motivate an agent who receives a high-fit signal, (IC-H) should be binding, too. Given that $t_L^* = 0$ and (TT-L) and (IC-H) constraints are binding, the optimal solutions are as follows:

$$t_L^* = 0;\ t_H^* = \frac{c}{\Pr(\theta_H|\sigma_H)(p-q)};\ t_S^* = \frac{(1 - \Pr(\theta_L|\sigma_L))cq}{\Pr(\theta_H|\sigma_H)(p-q)}.$$

Accordingly, the firm's profit is

$$\begin{aligned}\Pi_D = {} & \mu p\lambda(v_H - v_L) + (\mu\lambda + (1-\mu)(1-\lambda))v_L + V(1 - \mu\lambda - (1-\mu)(1-\lambda)) \\ & - \frac{c(\lambda p + (1-\lambda)q)(\mu\lambda + (1-\mu)(1-\lambda))}{\lambda\,(p-q)},\end{aligned}$$

where D denotes a direct revelation mechanism. If we compare the outcomes with the result under the buyout option contract (Proposition 3), it is true that this equilibrium outcome under a direct revelation mechanism can be replicated by the buyout option contract. This result confirms that the buyout option contract is optimal because it replicates the result in the direct revelation and thereby it cannot be outperformed by any other mechanisms. This result also implies that the result of communication in a centralized mechanism can be replicated by decentralization of the retention decision to an agent using the buyout option. Proposition 5 summarizes this result.

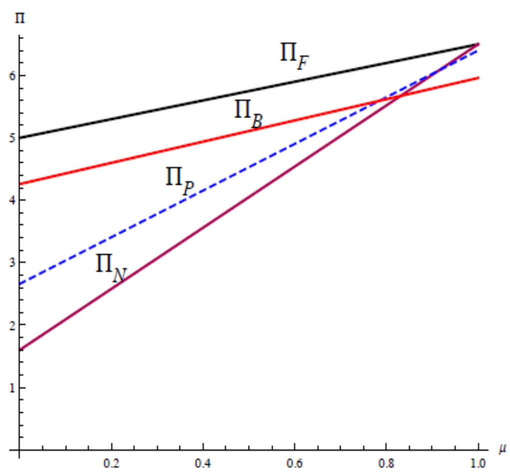
Proposition 5 *The use of buyout options with private information about employee fit is optimal in that it cannot be outperformed by any other mechanism.*

5 Example

This section provides a simple example to compare the preceding cases: benchmark (the first-best), no private information about employee fit, private information about employee fit, and buyout options with private information about fit.

Figure 1 compares a firm's expected profit in each case, with $v_H = 10$, $v_L = 3$, $V = 5$, $c = 0.2$, $p = 0.7$, $q = 0.6$, and $\lambda = 0.8$. This example delineates how a firm's value changes as the likelihood that an agent has a high fit (μ) varies. As shown in Figure 1, the firm's profit is always highest under the first-best case (Π_F) when an agent's fit is observable. If we compare the case with no private information about fit (Π_N) with the case with private information about fit (Π_P), the firm's value, as suggested previously, increases with the private information about fit when the likelihood of a high fit (μ) is not extremely high. As this likelihood decreases, screening becomes more important and the case with private information about fit (Π_P) thus generates a higher profit because it reduces the compensation cost.

Furthermore, the buyout option excludes agents with low-fit signals and increases screening efficiency; the use of buyout options improves a firm's profit (Π_B) when $\mu < 0.79$, compared with private information only (Π_P). However, this strong result for the buyout option assumes relatively high precision of the signal of fit. As Proposition 4 shows, the buyout option generates a higher firm's profit with more precise signals; otherwise, private information about fit alone provides a firm with greater profit. However, when the likelihood of a high fit is great enough, the firm does not have to worry about screening, and the case with no private information (Π_N) can be better than the case with private information about fit.



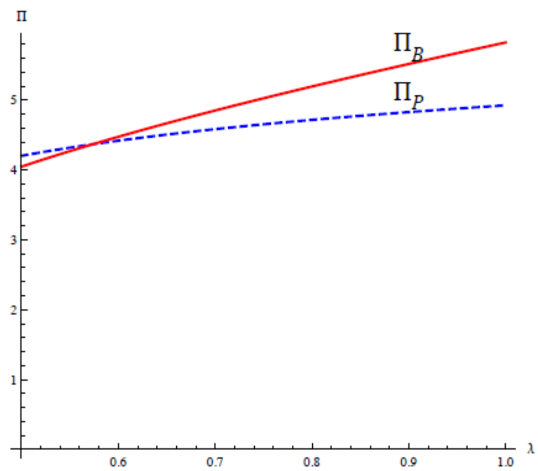


Figure 1. A Firm's Expected Profit

Fig. 2. The Comparison between Π_B and Π_P

Figure 2 focuses on a comparison between the case with private information alone and the case with buyout options. This example maintains the same parameter values and lets μ take a value of 0.55. The comparison centers on how the two cases generate different expected profits as the precision of the signal (λ) changes. As the graph shows, if the signal precision is not too low, the buyout options always generate a higher expected profit by excluding low-fit agents. However, if the signal precision is too low, the buyout options can be too aggressive in screening and eliminate even agents with a high fit, such that type I error increases. In this case, as Figure 2 shows, the case with only private information about fit performs better than the case with buyout options with private information about fit.

6 Extension

6.1 Endogenous V

In the main setup, if an agent leaves, the firm finds a new agent and thus realizes an exogenous firm value $V \in [v_L, v_H]$. For simplicity, the firm value is set to V exogenously in the main setup. One may wonder whether the benefit of buyout options continues to exist even after the exogenous firm value is endogenized. This section considers the endogenous firm value generated by a replaced agent and examines whether the main result of private information about fit and buyout options still holds.

For the replacement, the firm finds a new agent from the same pool of agents, and the likelihood that a replaced agent has a high fit is μ, as it was before. In this case, the expected firm value from the replacement is $V_E = \mu(p(v_H - t_H) + (1-p)(v_L - t_L)) + (1-\mu)(v_L - t_L)$, where E denotes the endogenous firm value. By substituting V_E for V in the firm's objective function under the buyout option, the optimal solutions are derived. This result is summarized in Corollary 4.

Corollary 4 *Under the endogenous V, when $\mu \leq \mu_E = \frac{p+q}{2p}$, the use of buyout options improves a firm's expected profit compared to the case with only private information about employee fit if $\lambda \geq \lambda_E$.*

As shown in the result, the benefit of buyout options still holds even when we consider the endogenous firm value generated by a replaced agent. When the firm replaces an agent, it has an expectation for the new agent's productivity based on the pool of agents. As long as the precision of the signal of fit is not too low, the expected (average) productivity is higher than a low-fit-signal agent's productivity and the buyout option is a profitable strategy for a firm. The result based on the endogenous firm value emphasizes again that the common concern among practitioners that losing skilled agents by labor buyouts may lead to a firm's lower productivity in the long run may be mitigated, as ousting agents through buyouts can be accompanied by the "acquisition of more productive new agents *on average*" compared to the sure “low fit” agents who left because the new agents may have a high fit with some probability. Thus Corollary 4 confirms that the main benefit of buyout options is robust to an endogenous V.

7 Conclusion

This study examines how buyout options combined with employee learning fit may enhance a firm’s screening efficiency when an agent’s fit with a firm is not observable at the contracting stage. Without private information about employee fit, neither the agent nor the firm can learn about the fit and the firm must design an inefficient contract that motivates both high- and low-fit agents. The private information about fit offers an opportunity for an agent to learn about her fit before exerting effort in the firm. The knowledge of fit is an agent’s private information and it is not communicated to a firm. But the firm can still improve its contracting efficiency with this private information because it can design a selective compensation scheme that motivates only an agent with a high-fit signal and thus minimize expected compensation costs.

Even with the private information about fit, an agent with a low-fit signal does not want to leave because she can earn information rent by staying and exerting no effort, but the buyout option serves as an incentive device that induces agents with a low-fit signal to leave voluntarily. Hence, an agent observing a low-fit signal should take the buyout option and leave because the buyout price provides a greater payoff than expected compensation from staying. Despite these incentives granted to the leaving agent, a firm’s expected profit improves because the firm can replace the low-fit agent with a more productive new agent *on average*. Because the signal of fit is imperfect, however, the buyout option may also be too aggressive in removing agents who receive low-fit signals, which constitutes a type I error. The final result shows that the firm can increase its profit when the likelihood of a high-fit agent is not extremely high because the benefit from excluding agents with a low-fit signal dominates the loss from type I error. In addition, it is shown that the benefit of private information about fit and buyout options is robust to consideration of an endogenous firm value.

This study offers two novel results. The conventional wisdom is that an agent's private information causes a disadvantage to a firm by causing information asymmetry. However, this paper shows that a firm needs to help an agent learn her private information about fit by providing detailed local information such as continuous productivity information and feedback because the agent's private information about fit allows a firm to design a more efficient compensation scheme. In addition, it has long been recognized that a guaranteed payment in the form of a fixed payment cannot work as an incentive device, but this study suggests that a fixed buyout price can serve as a contracting tool when the hidden knowledge problem exists at the interim stage. Additionally, in practice, it is hard for a firm to fire a certain group of employees because it is more likely for a firm to face litigation (Oyer and Shaefer, 2000). As shown in this paper, the well-designed buyout options are a way of inducing a poor-fit employee's voluntary turnover without any litigation cost.

As a caveat, the research setting does not consider cost of providing various sources of information to an agent to gauge her own fit. In practice, setting up information system to provide frequent performance feedback requires investment costs. Therefore, when providing various sources of information to help an agent learn and acquire her fit signal is more costly, the benefit of private information about fit and buyout options will decline. Further extension of this research as regards this topic could consider this feature.

8 Appendix

Proof of Lemma 1

In equilibrium, the (IC) constraint should be binding as follows:

$$(p-q)t_L = (p-q)t_H - c$$
$$\Leftrightarrow t_H = t_L + \frac{c}{p-q}.$$

Due to the limited liability assumption, it is always optimal to set $t_L^* = 0$. Therefore, $t_L^* = 0$ and $t_H^* = \frac{c}{p-q}$. All constraints are satisfied by the equilibrium solutions and the firm's profit is as follows:

$$\Pi_F = \mu\left(pv_H + (1-p)v_L - \frac{c}{p-q}\right) + (1-\mu)V \quad Q.E.D.$$

Proof of Proposition 1

(1) By the binding (IC) constraint and the (LL) constraint,

$$t_L^* = 0;\ t_H = \frac{c}{\mu(p-q)}.$$

which also satisfy the (EIR) constraint.

The solutions yield a following firm's profit:

$$\Pi_N = \mu(pv_H + (1-p)v_L) + (1-\mu)v_L - \frac{cp}{p-q}.$$

(2) If we compare Π_N with Π_F,

$$\Pi_N - \Pi_F = -\frac{(1-\mu)((p-q)(V-v_L)+cp)}{p-q} < 0. \quad Q.E.D.$$

Proof of Proposition 2

(1) First, it is shown that a low-fit signal agent with σ_L always exerts low effort in equilibrium. The low-fit signal agent's expected payoff based on the chosen effort level is as follows:

$$E\left[u|\sigma_L, c_H\right] = \Pr(\theta_L|\sigma_L)t_L + (1-\Pr(\theta_L|\sigma_L))\left(pt_H + (1-p)t_L\right) - c$$

$$E\left[u|\sigma_L, c_L\right] = \Pr(\theta_L|\sigma_L)t_L + (1-\Pr(\theta_L|\sigma_L))\left(qt_H + (1-q)t_L\right).$$

For the low-fit signal agent to exert high effort, a following condition should be satisfied:

$$E\left[u|\sigma_L, c_H\right] - E\left[u|\sigma_L, c_L\right] = \left(1 - \Pr(\theta_L|\sigma_L)\right)(p-q)(t_H - t_L) - c > 0$$
$$t_H - t_L > \frac{c}{(1-\Pr(\theta_L|\sigma_L))(p-q)}(*).$$

By the binding (IC-H) and the limited liability assumption,

$$t_L^* = 0;\ t_H^* = \frac{c}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{c(\mu\lambda + (1-\mu)(1-\lambda))}{\mu\lambda(p-q)}.$$

Then,

$$t_H^* - t_L^* = \frac{c}{\Pr(\theta_H|\sigma_H)(p-q)} \ < \frac{c}{(1-\Pr(\theta_L|\sigma_L))(p-q)}(*),$$

which implies that the condition $(*)$ for the low fit signal agent to exert high effort is not satisfied in equilibrium and she always exerts low effort in equilibrium.

The optimal solutions, t_L^* and t_H^*, satisfy the (EIR) and (IIR-H) constraints and

$$E\left[u|\sigma_L\right] = \frac{cq(1-\lambda)(\mu\lambda + (1-\mu)(1-\lambda))}{(p-q)\lambda(1-\mu\lambda-(1-\mu)(1-\lambda))} > 0,$$

which implies that a low-fit signal agent does not leave a firm because she can earn more than the reservation utility (zero) by staying in a firm.

The equilibrium outcomes yield a following firm's profit:

$$\begin{aligned}\Pi_P &= \mu\left(\lambda\left(p(v_H - t_H) + (1-p)(v_L - t_L)\right) + (1-\lambda)(q(v_H - t_H) + (1-q)(v_L - t_L))\right) + (1-\mu)t_L \\ &= \mu(\lambda p + (1-\lambda)q)(v_H - v_L) + v_L - \frac{c(\lambda p + (1-\lambda)q)(\mu\lambda + (1-\mu)(1-\lambda))}{\lambda(p-q)}.\end{aligned}$$

(2) If we compare Π_P with Π_N, $\Pi_P > \Pi_N$

$$if\ \mu \leq \mu^P = \frac{c(p\lambda^2 - q(1-\lambda)^2)}{(p-q)^2(v_H - v_L)(1-\lambda)\lambda + c(2\lambda-1)(p\lambda + q(1-\lambda)}. \quad Q.E.D.$$

Proof of Corollary 1

$$\frac{\partial E\left[u|\sigma_L\right]}{\partial\lambda} = -\frac{cq(1-\mu)(\mu + 2\lambda(1-\lambda)(1-2\mu))}{(p-q)\lambda^2(\mu+\lambda-2\mu\lambda)^2} < 0. \quad Q.E.D.$$

Proof of Proposition 3

By the (IC) constraint and the (LL) constraint, the optimal solutions are:

$$t_L^* = 0;\ t_H^* = \frac{c(\mu\lambda + (1-\mu)(1-\lambda))}{\mu\lambda(p-q)}.$$

As shown in the objective function, as K becomes smaller, a firm's profit becomes greater. Then, the optimal value for the buyout price, K^* is $E\left[u|\sigma_L, c_L\right] = \Pr(\theta_L|\sigma_L)t_L + (1-\Pr(\theta_L|\sigma_L))\left(qt_H + (1-q)t_L\right)$ because it maximizes a firm's profit while satisfying both the (EXIT-L) and the (NoEXIT-H) constraints. Then, the optimal buyout price is

$$K^* = \frac{cq(1-\Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{cq(1-\lambda)(\mu\lambda + (1-\mu)(1-\lambda))}{(p-q)\lambda(1-\mu\lambda-(1-\mu)(1-\lambda))}.$$

If we put t_L^* and t_H^* in the following constraints,

$$\frac{cq(1-\mu+\lambda(2\mu-1))}{p-q} > 0 \quad \text{(EIR)}$$

$$\frac{cq}{p-q} > 0 \quad \text{(IIR-H)}$$

$$\frac{cq}{p-q} > K^* = \frac{cq(1-\Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{cq(1-\lambda)(\mu\lambda + (1-\mu)(1-\lambda))}{(p-q)\lambda(1-\mu\lambda-(1-\mu)(1-\lambda))} \quad \text{(NoEXIT-H)},$$

which imply that all the constraints are satisfied by the optimal solutions. The optimal solutions yield a following firm's profit:

$$\Pi_B = \mu p\lambda(v_H - v_L) + (\mu\lambda + (1-\mu)(1-\lambda))v_L + V(1-\mu\lambda-(1-\mu)(1-\lambda)) - \frac{c(\lambda p + (1-\lambda)q)(\mu\lambda + (1-\mu)(1-\lambda))}{\lambda\,(p-q)}. \quad Q.E.D.$$

Proof of Corollary 2

As shown above, $K^* = \frac{cq(1-\Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)} = \frac{cq(1-\lambda)(\mu\lambda+(1-\mu)(1-\lambda))}{(p-q)\lambda(1-\mu\lambda-(1-\mu)(1-\lambda))}$. Also, $\Pr(\theta_L|\sigma_L)$ and $\Pr(\theta_H|\sigma_H)$ are a function of only μ and λ.

(1) λ

$$\frac{\partial K^*}{\partial\lambda} = -\frac{cq(1-\mu)(\mu + 2(1-\lambda)\lambda(1-2\mu))}{\lambda^2(p-q)(\mu+\lambda-2\mu\lambda)^2} < 0.$$

(2) p

$$\frac{\partial K^*}{\partial p} = \frac{-cq(1-\Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)^2} < 0.$$

(3) q

$$\frac{\partial K^*}{\partial q} = \frac{cp(1-\Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)^2} > 0.$$

(4) c

$$\frac{\partial K^*}{\partial c} = \frac{q(1-\Pr(\theta_L|\sigma_L))}{\Pr(\theta_H|\sigma_H)(p-q)} > 0. \;\; Q.E.D.$$

Proof of Proposition 4

(1) The comparison between a firm's expected profit with buyout options (Π_B) and a firm's expected profit without private information about fit (Π_N) is as follows:

$$\Pi_B - \Pi_N$$
$$= (V-v_L)\lambda-(p(1-\lambda)(v_H-v_L)+(2\lambda-1)(V-v_L))\mu+\frac{c(\lambda p(\lambda+\mu-2\mu\lambda)-q(1-\lambda)(1-\mu-\lambda+2\mu\lambda)}{\lambda(p-q)} \geq 0$$
$$if\ \mu \leq \mu^B = \frac{\lambda^2(p-q)(V-v_L+c)+cq(2\lambda-1)}{c(2\lambda-1)(\lambda p+(1-\lambda)q)+\lambda(p-q)((1-\lambda)p(v_H-v_L)+(2\lambda-1)(V-v_L))}.$$

(2) The comparison between a firm's expected profit with buyout options (Π_B) and a firm's expected profit with private information about fit only (Π_P) is as follows:

$$\Pi_B - \Pi_P = V((1-\mu)\lambda+\mu(1-\lambda)) - (\mu(1-\lambda)q(v_H-v_L)+((1-\mu)\lambda+\mu(1-\lambda))v_L)$$
$$if\ \lambda > \lambda^* = \frac{\mu(qv_H+(1-q)v_L-V)}{\mu(qv_H+(1-q)v_L-V)+(V-v_L)(1-\mu)}.$$

(3) If we compare μ^B with μ^P

$$\mu^B - \mu^P \geq 0\ if\ \lambda > \lambda^* = \frac{\mu(qv_H+(1-q)v_L-V)}{\mu(qv_H+(1-q)v_L-V)+(V-v_L)(1-\mu)}.$$

Proof of Corollary 3

(1) q

$$\frac{\partial \lambda^*}{\partial q} = \frac{(1-\mu)\mu(V-v_L)(v_H-v_L)}{(\mu(qv_H+(1-q)v_L-V)+(V-v_L)(1-\mu))^2} > 0.$$

(2) λ

$$\frac{\partial \lambda^*}{\partial V} = -\frac{(1-\mu)\mu q(v_H-v_L)}{(\mu(qv_H+(1-q)v_L-V)+(V-v_L)(1-\mu))^2} < 0.$$

(3) v_H

$$\frac{\partial \lambda^*}{\partial v_H} = \frac{(1-\mu)\mu q(V-v_L)}{(\mu(qv_H+(1-q)v_L-V)+(V-v_L)(1-\mu))^2} > 0.$$

(4) v_L

$$\frac{\partial\lambda^*}{\partial v_L} = \frac{(1-\mu)\mu(v_H - V)}{(\mu(qv_H + (1-q)v_L - V) + (V - v_L)(1-\mu))^2} > 0. \quad Q.E.D.$$

Proof of Corollary 4

$$\begin{aligned}\Pi_B - \Pi_P &= \frac{-(p-q)(v_H - v_L)\lambda\mu(q(1-\lambda) + 2p\lambda\mu - p(\lambda+\mu))}{(p-q)\lambda} \\ &\quad - \frac{cp(\mu + \lambda(1-2\mu))(1-\mu+\lambda(-1+2\mu))}{(p-q)\lambda}. \\ \frac{\partial(\Pi_B - \Pi_P)}{\partial\lambda} &= \frac{(v_H - v_L)\lambda^2\mu(p^2 - q^2 - 2p(p-q)\mu) + cp(\lambda^2(1-2\mu)^2 + \mu - \mu^2)}{(p-q)\lambda^2} > 0 \ if \ \mu \geq \frac{p+q}{2p}.\end{aligned}$$

When $\lambda = 1$,

$$\Pi_B - \Pi_P = \frac{p((p-q)(v_H - v_L) - c)(1-\mu)\mu}{p-q} > 0.$$

Then there exists λ_E which makes Π_B equal to Π_J. $Q.E.D.$

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