

Ignorance is Bliss? Why Firms May Not Want to Monitor Their Workers

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Abstract

This paper considers the possible benefits to a principal from knowing less about the performance of workers when workers differ in their innate ability. Since Lazear and Rosen (1981) and Green and Stokey (1983) it has been known that, when common shocks to output are large, rank-order tournaments dominate individual contracts as a way to incentivize workers. We show that, when rank-order tournaments are used, and workers differ in ability, it is optimal to monitor workers imperfectly so that low ability workers can sometimes win the tournament. This is true even when monitoring is *costless* to the principal. Furthermore, the optimal level of monitoring is decreasing in the heterogeneity of the workers.

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1 Introduction

In a moral hazard setting, it is generally considered to be bad when a manager has a worse signal of a worker's effort. It has been shown, with increasing generality, by Holmström (1979), Kim (1995), Jewitt (1997) and Holden (2005) that when offering individual contracts a principal receives a higher payoff when she has a "better" signal of the agent's action. But, is it always better for a manager to be more informed about the effort of workers in more general settings? This paper argues that there are instances when ambiguity is useful to a manager trying to elicit effort from workers. In particular, if common shocks are large, so that a rank-order tournament dominates individual contracts, and if a manager can learn about the effort exerted by workers by monitoring them, she may not want to monitor them to the fullest extent possible, *even when monitoring is costless*.

Suppose a manager is unable to judge what it means to perform well in an absolute sense. This is particularly relevant for complex tasks, that are not entirely routine. For example, it is very hard for a manager to judge how long it should take a computer programmer to complete a complex programming task. The literature on the economics of tournaments has typically modeled such situations as ones where there are large "common shocks" to output. In such instances, the best way to incentivize workers is to pay based on relative performance instead of absolute performance. In particular, it may make sense for managers to use rank-order tournaments to elicit effort.

Let us further suppose that workers differ in their innate ability, so that some workers do not suffer as large a utility cost as others for a given level of effort. It may be difficult for the manager to figure out which workers are high ability and which are low ability. If she could, it might be possible to group high ability workers together and low ability workers together, or alternatively, she might be able to handicap low ability workers. If the manager is unable to do this, or if it is too costly, higher and lower ability workers will be forced to compete against one another in a tournament environment.

Suppose that, through monitoring, the manager perfectly observes effort. If a high ability worker competes against a low ability worker, it is always cheaper for the high ability worker to exert effort than the low ability worker. Because effort

is perfectly observed, the high ability worker will always win. This means that the low ability worker has no incentive to exert effort (she will always lose) and the high ability worker has no incentive to exert effort (she will always win).

If the manager imperfectly monitors, however, the low ability worker sometimes wins even when she exerts less effort. This means that additional effort exertion receives some reward. In this context, she is willing to exert some effort. Because the low ability worker exerts effort, the high ability worker is also forced to exert some effort. It therefore follows that ambiguity is useful to the manager in incentivizing workers in this context.

This idea is useful not only in understanding why workers are not more closely observed by managers, but also why managers do not prod workers for information about other workers (who often know a great deal about the effort of other workers.) In many contexts, high ability workers tend to protect low ability workers. Homans (1954) documents women doing a job called “cash posting.” He finds that higher performing workers help poorer performing workers to meet quotas when they have trouble. These ideas also form the basis for efficiency wage theory (see Akerlof (1982).) While Homans helps us to understand why these workers help each other (for reasons of gift exchange and social norms), it is not clear why the managers do not give incentives to workers with good performance to “rat out” workers with poor performance rather than help them.

This paper suggests a possible answer. If the manager is told too much about the effort of workers, overall incentives may be reduced. Consequently, the firm may actually benefit from such norms amongst workers. Paradoxically, collusion between workers may help the firm rather than hurt it.

Perhaps the paper most closely related to this one is O’Keefe, Viscusi and Zeckhauser (1984). They are largely concerned with the adverse selection aspect of tournaments, but also make the following conjecture, in the context of risk-neutral workers: “Appropriately imprecise incentives may be particularly helpful in motivating the most able workers.” Our results can in part be interpreted as confirmation of this conjecture in the richer setting where workers are risk-averse. Furthermore, it is both high and low ability workers who are motivated by ambiguity in our model - not merely the high types.

The paper proceeds as follows. Section 2 will lay out the basic model, and the result that in tournaments where workers have heterogeneous ability, it is optimal to receive a noisy signal of a worker’s effort (rather than observe it perfectly). A number of simplifying assumptions are made, which are discussed in Section 3. Section 4 discusses the possibility that the principal might be able to handicap workers to effectively eliminate heterogeneity. Section 5 concludes.

2 The Model

The model we will consider in this section makes a number of unrealistic assumptions. For example, we will consider shocks to output that take a particular form, and we will assume that, while the principal does not know the abilities of the two workers she hires, she knows that exactly one is high ability and exactly one is low ability. These assumptions are made in the spirit of parsimony. We believe that these assumptions are not critical to the main result, with one exception that will be discussed below. After going through the basic model, we will discuss these simplifications in turn.

We will assume that a principal would like to hire two workers. The principal knows that one of these workers is high ability (H) and the other is low ability (L), but unfortunately does not know which worker is high ability and which is low ability. Furthermore, a worker only learns her ability after she has been hired. Since neither worker knows her ability *ex ante*, they face the same outside option, which gives expected utility \bar{U} .

When the low ability worker exerts effort e_L at cost $c(e_L)$, the principal receives a signal of her productivity equal to $q_L = e_L + \epsilon_i + \eta$. η is a shock that is common to both workers and ϵ_i is an idiosyncratic shock faced only by this worker. We will slip into calling q_L “output,” but it should really be thought of as being a combination of the worker’s output and other signals the principal obtains of productivity through monitoring the worker. When the high ability worker exerts effort e_H at cost $c(e_H)$, the principal receives a signal of her productivity equal to $q_H = \theta + e_H + \epsilon_j + \eta$. It is assumed that the idiosyncratic shocks ϵ_i and ϵ_j are independent and identically distributed according to a distribution F . We will assume that F is a normal distribution with mean zero and standard deviation σ .

Furthermore, we will assume that the principal can costlessly set the standard deviation, σ , to whatever value she likes. It is a simplification, perhaps, to assume that the principal can set this costlessly. The value of σ is meant to correspond to how closely the principal monitors her workers, and it is natural to think that it is costly to monitor more. We will find, though, that even when monitoring is costless, the principal will choose to monitor imperfectly. Thus, we are biasing the case against ourselves by this assumption.

When the high and low ability workers exert the same level of effort (at the same utility cost), the expected output of the high ability worker is θ higher than the expected output of the low ability worker. Therefore, the high ability worker is more productive for a given level of effort exertion. Alternatively, one can think of $\theta + e_H$ as the effort exerted by the H worker rather than e_H , in which case one would think of the cost of effort exertion as being lower for the H worker.

We will assume that the variance of η , the common shock, is sufficiently large that the workers are better incentivized through a rank-order tournament (which filters out common shocks) than through an individual contract without a relative performance component (which does not filter out common shocks because it pays only based upon individual performance.) Ideally, the principal would like to incentivize the workers through an individual contract *with* a relative performance component. We will assume that it is not possible for the principal to pay workers in this way, making a rank-order tournament the optimal contract. This, unsurprisingly, turns out to be an important assumption, and it will be discussed further in the next section.

The timing of the game is therefore as follows. Time 0: The principal offers a contract to the two workers of the form (w_1, w_2) in which she agrees to pay a prize w_1 to the worker with the higher output and prize w_2 to the worker with lower output¹. Time 1: Workers accept or reject this contract. Time 2: Workers learn their abilities if they have accepted the contract. Time 3: Workers choose the amount of effort to exert. Time 4: Output is realized and prizes are awarded/payoffs are realized.

The principal is assumed to be risk neutral, and thus only cares about expected output. We will assume that her payoff function is of the following form: $\pi =$

¹Note that a tie is a zero probability event and can therefore be ignored.

$e_L + e_H - w_1 - w_2$. Workers are assumed to have preferences that are additively separable in income and effort² with a utility function of the form: $u(w) - c(e)$ where $u' \geq 0$, $u'' \leq 0$, and $c', c'' \geq 0$. Ex-ante, workers do not know their abilities, so participation requires that:

$$\frac{u(w_1) + u(w_2)}{2} - \frac{c(e_H) + c(e_L)}{2} \geq \bar{U}.$$

We have thus defined the principal's payoff function and the participation constraints for the agents. Let us now determine the agents' incentive compatibility constraints. Define the function $\Psi(x) \equiv \Pr(x + \varepsilon_j \geq \varepsilon_i)$ where ε_i and ε_j are independent draws from F . The probability that the high ability worker wins the tournament is: $\Pr(\theta + e_H + \varepsilon_j \geq e_L + \varepsilon_i) = \Pr((\theta + e_H - e_L) + \varepsilon_j \geq e + \varepsilon_i) = \Psi(\theta + e_H - e_L)$. The high ability worker chooses e_H so that:

$$\begin{aligned} e_H \in \arg \max_e [\Psi(e - e_H + \theta) (u(w_1) - u(w_2)) + u(w_2) - c(e)] \\ \Psi'(e_H - e_L + \theta) (u(w_1) - u(w_2)) = c'(e_H) \end{aligned} \quad (\text{IC1})$$

The low ability worker chooses e_L so that:

$$\begin{aligned} e_L \in \arg \max_e [(1 - \Psi(e_H - e + \theta)) (u(w_1) - u(w_2)) + u(w_2) - c(e)] \\ \Psi'(e_H - e_L + \theta) (u(w_1) - u(w_2)) = c'(e_L) \end{aligned} \quad (\text{IC2})$$

In order for the first-order conditions of the agents' problems to be a valid statement of incentive compatibility (i.e. always equivalent), each agent's problem needs to be everywhere concave. Because the prizes, w_1 and w_2 are endogenous (they are chosen by the Principal) it turns out that the agent's objective function is not strictly concave for all distributions F , but when F is "sufficiently dispersed", the agents' objective functions will be concave (see Krishna and Morgan (1998)). For any normal distribution, the objective function is concave, so this approach is indeed valid in this instance.

From (IC1) and (IC2), it follows that $e_H = e_L = e$. We can therefore write a

²This implies that an agent's preference for income lotteries are independent of action and her preference for action lotteries are independent of income. See Pollak (1973) and Keeney (1973).

single incentive compatibility condition:

$$\Psi'(\theta) (u(w_1) - u(w_2)) = c'(e)$$

Furthermore, for the normal distribution, it is possible to calculate Ψ' explicitly. We find that:

$$\Psi'(x) = \frac{1}{2\sigma\sqrt{\pi}} e^{-\left(\frac{x}{2\sigma}\right)^2}$$

So, we can state the incentive compatibility constraint as:

$$\frac{1}{2\sigma\sqrt{\pi}} e^{-\left(\frac{\theta}{2\sigma}\right)^2} (u(w_1) - u(w_2)) = c'(e) \quad (\text{IC3})$$

Consider what happens when $\sigma \rightarrow \infty$. The LHS of IC3 approaches zero for any w_1 and w_2 . This implies that $e = 0$ for all w_1 and w_2 . More variance in the idiosyncratic shock means that the principal has a worse signal of an agent's effort exertion. When the idiosyncratic shock is infinitely noisy, output provides no information to the principal about an agent's effort exertion. Therefore, an agent has no incentive to exert any effort. This is the classic reason why we think of more noise as being harmful in a moral hazard setting.

Consider what happens, however, when $\sigma \rightarrow 0$. The LHS of IC3 approaches zero for any w_1 and w_2 in this case too. Therefore, it is impossible to get agents to exert effort when there is zero noise. Here is the logic. Suppose the principal observes output perfectly. The high ability worker can always produce higher output at a lower cost than the low ability worker. So, when output is perfectly observed, she will always win the tournament. This means that the low ability worker has no incentive to exert effort. If the low ability worker is not exerting effort, then the high ability worker does not have to exert any effort to win the tournament either. So, neither worker will exert effort in this context.

We can ask the question: for a given choice of w_1 and w_2 , what choice of σ results in the highest level of effort exertion? By assumption, $c'' \geq 0$, so this is equivalent to maximizing the LHS of IC3. We note that the maximizing value of σ does not depend upon w_1 and w_2 . Let us call this value σ^* . It is clear that σ^* is the choice of σ that will lead to the highest profits for the principal. It is easily shown that:

$$\sigma^*(\theta) = \frac{\sqrt{2}}{2}\theta$$

We see that the optimal standard deviation is proportional to the amount of heterogeneity. When the population is homogeneous, it is optimal to observe effort perfectly. When the population is more heterogeneous, however, it is optimal to observe a noisier signal of output. We have thus proved:

Proposition 1 *Suppose that monitoring is costless. Then: (1) the optimal precision of the signal, σ^* is decreasing in the heterogeneity of the agents θ , (2) $\lim_{\theta \rightarrow 0} \sigma^* = 0$, and (3) the optimal amount of noise is given by:*

$$\sigma^*(\theta) = \frac{\sqrt{2}}{2}\theta.$$

3 Assumptions of the Model

We now turn our attention to a number of assumptions made by the model of the previous section, and examine each in turn. One of these assumptions—the inability to use individual contracts with a relative performance component—turns out to be important to the conclusions of the model. The other assumptions have little impact, however.

1. The choice of a normal noise distribution. No special properties of the normal distribution are necessary to obtain the result that the optimal amount of variance of the idiosyncratic shock is nonzero. When the idiosyncratic shock has zero variance, the H worker will always win for the same level of effort as the L worker. This means that the only equilibrium is for both workers to exert zero effort, regardless of the prizes. No matter what class of distributions is looked at, zero variance will never be the optimal variance for the idiosyncratic shock.

Furthermore, it appears to be a relatively general result that the optimal standard deviation is proportional to the parameter θ . This result at least holds for classes of distributions in the exponential family. For example, for the class of double exponential distributions ($f(x) = \frac{1}{2\sigma}e^{-\frac{|x|}{\sigma}}$), we find that $\sigma^* = \left(\frac{\sqrt{5}-1}{2}\right)\theta$.

2. The assumption that there is always one high ability worker and one low ability worker. It is convenient to assume that the principal will always get one high ability worker and one low ability worker, but this is not a critical assumption. Suppose, instead, the principal draws a high ability worker half of the

time and a low ability worker half of the time. Half of the time, the principal will have two workers of the same ability, in which case the optimal standard deviation of the noise is zero. Half of the time, the principal will have two workers of different ability, in which case the optimal standard deviation is $\bar{\sigma} > 0$. The principal can choose only one standard deviation, σ , for both types of tournaments.

By Proposition 1, the loss in profit in the heterogeneous tournament from a small movement in σ away from $\bar{\sigma}$ is second-order, whereas the gain from such a movement in the homogenous tournament is first-order. Similarly, the loss in profit in the homogeneous tournament from a small movement in σ away from 0 is second-order, but the gain from this movement is first-order in the heterogeneous tournament. Together, these statements imply that the optimal σ lies in between 0 and $\bar{\sigma}$ and does not lie at either extreme. We find, therefore, that even when the principal simply draws workers of mixed ability randomly from some distribution, it is optimal to have positive variance in the idiosyncratic shock.

3. The particular form that ability takes in the model. An assumption that seems less innocuous than the previous two concerns the exact form that ability takes in the model presented above. In particular, one might imagine that ability affects effort multiplicatively rather than additively: $q_H = \theta e_H + \epsilon_j + \eta$ with $\theta > 1$. This case was not chosen for the basic model because it is not possible to solve for the optimal amount of noise explicitly. It is easy to see, however, that the optimal amount of noise is nonzero. In this case, we do not have $e_H = e_L$, and are thus left with two incentive compatibility constraints:

$$\theta \Psi'(\theta e_H - e_L) (u(w_1) - u(w_2)) = c'(e_H) \quad (\text{IC1}')$$

$$\Psi'(\theta e_H - e_L) (u(w_1) - u(w_2)) = c'(e_L) \quad (\text{IC2}')$$

When the noise distribution has zero variance, $\Psi'(x) = 0$ for $x > 0$. The incentive compatibility constraints therefore imply that $e_H = e_L = 0$ for any choice of w_1 and w_2 by the principal. It is clear that $\Psi'(x) > 0$ when the noise distribution has positive variance, and thus higher effort can be elicited through more noise. It does not appear, therefore, that the particular form that ability takes in the model is critical to the main result.

4. The assumption that workers do not know their types ex ante. This is a key assumption of the model because it eliminates the adverse selection element of the principal's problem. It is probably not unrealistic, however, to assume that at least some portion of a person's ability is unknown ex-ante. Workers may only learn how good they are at a particular job once they begin to do it. Even if only part of a person's ability is realized ex-post, this strongly suggests that it is optimal to have nonzero variance in the idiosyncratic shock. Furthermore, it is not clear that knowing one's ability entirely ex-ante destroys the result. If it is optimal for the principal to hire workers of multiple abilities in the adverse selection setting, then at least ex post, she has a very strong incentive to have idiosyncratic shocks with positive variance.

5. The restriction to two-player tournaments The model above only considered the possibility of tournaments with two players. Suppose, instead, that the principal hires more than two workers and can set up tournaments of larger size. If all of the participants in a tournament have different abilities and there are no idiosyncratic shocks, then, for any tournament size, the equilibrium will be zero effort exertion from every participant. When tournaments have more than two participants, and some (but not all) of the participants have equal ability, it is not clear that it is not optimal to have no idiosyncratic shocks. This, however, is a very special case.

The addition of more players to the tournament does not eliminate the result, but it may weaken it. When larger tournaments are used by the principal, the optimal amount of noise differs from the optimal amount of noise in the two-player case. In fact, we can show that the optimal amount of noise is unambiguously reduced by having more participants in the tournament, when one holds the amount of heterogeneity constant.

In a striking result, Green and Stokey (1983) have shown that, when the number of participants in a tournament becomes large, the tournament approximates the optimal individual contract *with the common shock observable*. This suggests that individual contracts with a relative performance component may be a superior contract. We take this up next.

6. The inability to use individual contracts with a relative performance component to incentivize workers. If the principal is able to implement an individual contract with a relative performance component, it does appear that it would be optimal to eliminate idiosyncratic shocks. Suppose, for example, workers were paid according to the following scheme (which is unlikely to be the optimal one): $w_i(q_i, q_j) = w_0 + c(q_i - q_j)$. This scheme eliminates the impact of common shocks on pay. Unlike a tournament, however, even when there are no idiosyncratic shocks, low ability workers have an incentive to exert effort. The prize here is continuous in a worker’s effort choice, unlike a tournament. It is the discontinuity introduced by a rank-order tournament which leads to the optimality of nonzero noise.

This is an important qualification to our results, but it is unlikely to make our results irrelevant. In practice, rank order tournaments are common in the workplace. We do not see many explicit individual contract pay systems in the real world, and it is even rarer to see explicit individual contract systems with a relative performance component. One major reason why explicit individual contract systems are rare is that it is difficult for principals to commit not to re-price jobs when workers are exceptionally productive on them. Workers tend to respond to the threat of re-pricing by limiting their productivity on jobs that pay well (see, for example, Roy (1952).) This does not mean that we do not see implicit individual contract systems in the real world. For example, pay raises or bonuses are often decided in a subjective way but are certainly influenced by a worker’s relative performance.

But it is also likely that a large part of the reward for exceptional performance in the workplace takes the form of a tournament. Job promotions are frequently set up as implicit tournaments between a set of workers. A practice known as “ranking and yanking” that, by some estimates, it is practiced by twenty percent of US firms, indicates that rank order tournaments are common in the workplace (see Grote (2005)). It involves periodically ranking workers in three categories: “poor performers” (typically the bottom ten percent), “average performers” (typically the middle seventy percent), and “stars” (typically the top twenty percent). After ranking workers, the poor performers are fired, and the stars are promoted or given bonuses and raises.

It is unlikely that pay in the real world approximates or could approximate a smooth individual contract, particularly because of promotion and firing. As long as rank order tournaments are a well-used tool in the workplace, the result remains important. This is true even if individual contracts with a relative performance component can be used to some extent.

4 Why not handicap the workers?

A natural question to ask in examining the model above is why it is not optimal to handicap workers? If the principal knew every worker's ability, then she could run a tournament as if the workers were of equal ability. The principal would compare $q_H - \theta$ to q_L . The ability of a worker is private information, however. This means that the principal must find a mechanism to get workers to reveal their types. The natural mechanism is to make a payment to H workers for revealing this information. If an H worker reveals her type, then she participates in a tournament in which she is handicapped. Furthermore, we will make the assumption that the principal has perfect control over the variance of idiosyncratic shocks. When she is able to handicap, she will choose to eliminate idiosyncratic shocks completely. This will allow her to elicit any effort level that she desires from a worker and make any payment that she desires to that worker.

Suppose the principal has entered into a contract with two workers of heterogeneous ability to run the optimal tournament, when she cannot handicap them. Assume that this involves paying prizes w_1 and w_2 and the workers exert effort \bar{e} , and let $u_1 = u(w_1)$ and $u_2 = u(w_2)$. Is it profitable for the principal to renegotiate with the workers to get them to reveal their types and run the optimal handicapped tournament?

Assume that the H worker, if she reveals herself, receives a prize of w_H when she exerts effort e_H and the L worker receives a prize w_L when she exerts effort e_L in this handicapped tournament (with no idiosyncratic shocks). In the handicapped tournament, the workers expect to receive utilities U_H and U_L where:

$$\begin{aligned} U_H &= \Psi(\theta)(u_1 - u_2) + u_2 - c(\bar{e}) \\ U_L &= (1 - \Psi(\theta))(u_1 - u_2) + u_2 + c(e_L) - c(\bar{e}) \end{aligned}$$

The new tournament must ensure payoffs to the workers that make them at least as well off. This implies:

$$\begin{aligned} U_H &\leq u(w_H) - c(e_H) \\ w_H &\geq u^{-1}(\Psi(\theta)(u_1 - u_2) + u_2 + c(e_H) - c(\bar{e})) \end{aligned}$$

$$\begin{aligned} U_L &\leq u(w_L) - c(e_L) \\ w_L &\geq u^{-1}((1 - \Psi(\theta))(u_1 - u_2) + u_2 + c(e_L) - c(\bar{e})) \end{aligned}$$

Is it incentive compatible to make both individual rationality constraints tight? If both types claim to be L workers or both claim to be H workers, then the heterogeneous tournament is run, which ensures the same payoffs as truth-telling does. Thus, no worker can profitably deviate. If they form a coalition, there is also no profitable deviation, since it is not simultaneously beneficial for the H worker to report being an L worker and the L worker to report being an H worker. The profits to the principal under the old scheme are given by:

$$\begin{aligned} \bar{\pi} &= 2\bar{e} - w_1 - w_2 \\ &= 2\bar{e} - u^{-1}(u_1) - u^{-1}(u_2) \end{aligned}$$

Under the new scheme, the profits to the principal are given by:

$$\begin{aligned} \pi_{new} &= e_H + e_L - w_H - w_L \\ &= e_H + e_L \\ &\quad - u^{-1}(\Psi(\theta)(u_1 - u_2) + u_2 + c(e_H) - c(\bar{e})) \\ &\quad - u^{-1}((1 - \Psi(\theta))(u_1 - u_2) + u_2 + c(e_L) - c(\bar{e})) \end{aligned}$$

Suppose the principal choose to set $e_L = e_H = \bar{e}$ (which is suboptimal). Because of the concavity of the utility function, it follows that this choice makes $\pi_{new} \geq \bar{\pi}$. Therefore, for the optimal choice of e_L and e_H , the principal's profits will be higher. So, there is a profitable renegotiation.

What is the logic for the profitability of this renegotiation, even when the same effort level is elicited? The reason that payoffs improve is that the principal is able to give each worker a more certain return once they know their types. Rather than

facing a lottery, each player receives the certainty equivalent, and the principal is able to reap the extra return.

In this special case, where there are exactly two types of workers and θ is known to the principal, it is easy to get workers to reveal their types. As we showed above, incentive compatibility is not a major issue in this case. Imagine we complicate this setting only slightly, however. Suppose the principal knows one worker to have $\theta = 0$ but the other worker has θ drawn randomly according to some continuous distribution (with $\theta \geq 0$.) In this case, the high ability worker might have incentives to report a slightly higher or slightly lower ability than she actually has. The trade-off is as follows: if she reports a higher ability, she gets a bigger bonus, but is expected to supply more effort. Now, incentive compatibility is a real issue, and there are rents that go to the high ability worker for reporting her type. With this generalization, we believe that it becomes ambiguous whether the principal can profitably renegotiate.

There is at least one other way to eliminate the possibility of handicapping. Even if a worker has a sense of her ability, it may be a much more complicated object than we have indicated. It may not be possible for a worker to simply report a value θ to her boss. In other words, it may be that θ is non-contractible even if it is known. There is also the possibility that θ is unknown to the worker, even after she has started working at the firm. Suppose neither worker knows her type, but they do know that one is the H worker and the other is the L worker. Suppose further that there are no idiosyncratic shocks. It is still an equilibrium for neither party to exert any effort.

Another possibility would be to use repeated observations of output over time to get a sense of a worker's ability, and use this as a way of handicapping. This, of course, distorts a worker's incentives to exert effort early on because they know that this will lead to a lower handicap. This is the classic ratchet effect. So, while handicapping has some attraction for the principal, it may be very difficult to accomplish. Workers may demand rents for revealing the information that the principal is unwilling to pay; it may be difficult for the worker to convey her type to the principal even if she knows it; and, the worker may not be fully aware of her own type.

5 Concluding Remarks

This paper has argued that there may be incentive benefits to managers from knowing less about the effort exerted by workers. The basic idea is that ambiguity allows the principal to smooth out incentives and eliminate discontinuities that might lead to low effort exertion. This idea is related to a recent paper by Lazear (2005). He draws an analogy between ambiguity and incentives for reducing speeding on a highway. He asks whether it is better to have a policeman stationed with uniform probability along a large stretch of road or with uniform probability over a small stretch. Drivers only have an incentive to slow down on the stretch of road they know to be policed. If the chance of being caught is sufficiently low, though, they will not slow down even on road that is policed. The optimal length of road for the policeman to cover is the maximal length that gets drivers to slow down. This is related to the major result of this paper, which also obtains a trade-off as noise is increased.

If it is possible to implement perfectly smooth incentives for workers (therefore, offer workers a individual contract with a relative performance component), ambiguity would not be necessary or beneficial. It does not seem that continuous incentives are easy to offer, however, especially when there is a need to promote and dismiss workers. As long as some discontinuities exist in incentive schemes, the arguments of this paper are pertinent.

Such discontinuities arise naturally in many employment settings. For instance, promotion tournaments necessarily involve a discontinuous reward to the winner. The difference in the present value of discounted future earnings between the winner and loser of such a promotion tournament could be large. Furthermore, it is often not possible for the firm to smooth out this kind of discontinuity because doing so would require the existence of some market in which future labor earnings can be traded. It is well understood that such markets may not exist because of moral hazard.

Put more generally, hierarchies within firms typically lead to discontinuous rewards to winners of labor market tournaments which are difficult - or impossible - for firms to smooth out.

We have also shown that it may be difficult to handicap workers based on their

ability, which would also eliminate the value of ambiguity. Handicapping is difficult because high ability workers require a rent for revealing their type to the principal. It may also be difficult to handicap because ability may be difficult to contract upon, or because workers are not sufficiently aware of their own ability.

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