Incentives and Status: A Complementary Result

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Using a moral hazard framework with limited liability with discrete effort levels the paper characterizes the structure of monetary incentives in an organization with varying differences in employee status. This paper finds that irrespective of the level of reservation utility of the agents, higher status agents induce high effort in exchange of high monetary bonus and vice versa. For agents with lower outside option optimal fixed wage is invariant with status holding of the agent, but for high outside option agents, the limited liability doesn’t bind such that the fixed payment is positive and exhibits complementary relation with status.

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1. Introduction

The study of incentive structures is central to the analysis of all economic activities. Specially, in contract theory, the optimal structure of incentives under different circumstances has been analyzed widely. Together with financial incentives, role of non-financial incentives (like status) in evoking correct level of effort has also gained importance in recent studies in economics. But very few studies have

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examined how the optimal incentive scheme changes for agents with differing status. In this paper, we explore how the optimal monetary incentive scheme varies with persons holding different status, in a discrete effort framework. Unlike the influential and growing literature which studies the importance of status as a non-pecuniary incentive to elicit the desired (see Frank, 1985, Moldovanu et al., 2007, Brown et al., 2007 Besley and Ghatak , 2008, Auriol and Renault, 2008, Dhillon and Herzog-Stein, 2009, Dubey and Geanakoplos, 2010, Dey and Banerjee, 2014), in this study ‘status’ is not conferred as an incentive, it arises out of rank holding of the employee within the firm and hence person’s status level is assumed to be exogenous. This is an important point of departure from the aforementioned papers, where status is bestowed as a non-monetary incentive. Therefore in this paper, given the hierarchical structure (positions or status) in a firm, we characterize the optimal monetary incentives when agents are status-conscious, in the sense that they value the same monetary payoff differently. To elaborate on this, when a flat monetary incentive payment is offered to agents across all status levels an agent of higher status might not value the incentive as highly as an agent holding low status. This is because comparison matters to human beings and it affects their well-being as well. Human beings are also concerned about their relative position vis-à-vis others around them in their workplace as well as in the social ladder. We incorporate this effect in our model.

Using a moral hazard framework with limited liability with discrete effort we derive the optimal contract scheme. Given a fixed incentive bonus, agents with higher status level value it less compared to agents with lower status and this is a crucial feature of this model. In this framework we show that increased status leads to higher

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2 See Dey and Banerjee (2011) for understanding how the optimal monetary incentive scheme varies with persons holding different status in a continuous effort framework.

3 Often the allocation of status in a formal hierarchy within a firm is constrained by production process (like technology) and creation of new level within the hierarchy is not always costless. Creation of new positions is often time consuming. As every organization has to abide by some human resource policy, creation of ranks cannot take place at any time point of the year. Hence it is costly in this respect. Status, therefore, cannot be always conferred as an incentive to motivate agents.


5 Though job titles, medals, etc. convey status on the agents but in this paper we have assumed that agent enjoys status only from the rank she holds in the organization

6 A lower grade staff might value a $1 bonus differently than a CEO of that firm and we assume that the $1 bonus is valued relatively highly by the lower grade staff than the CEO. This assumption seems straightforward and realistic.
incentive pay irrespective of the level of reservation utility of the agent. Though, for agents with high reservation utility the limited liability doesn’t bind and any exogenous increase in status level induces higher the optimal fixed payment, however, for low outside option the limited liability binds which ensures that the optimal fixed wage is not affected by change in status holding. Thus this paper makes an attempt to characterize how the optimal incentive scheme varies in response to exogenous change in the status level of agents. The point worth mentioning is that in essence, irrespective of the level of outside option of agents, our result is different from Besley and Ghatak (2008) where they show status incentives help in partially reducing the burden on monetary incentives. Whereas, our results echoes Auriol and Renault (2008) where they show that optimally high performance reward goes to the agent with higher status. But while analyzing the results one should also remember the fundamental difference is that in our paper status is not conferred as an incentive whereas in their paper status is conferred as a non-monetary incentive.

Different to our study, Huberman et al. (2004) through a psychological experiment have shown that individuals are willing to trade off some material gain to obtain status. Besley and Ghatak (2008) has asserted by providing a micro-theoretic explanation that to expend effort status incentive works as partial substitute of monetary incentive. Dhillon and Herzog-Stein (2009) also assumes a convexity in preference on status to show that it is optimal for the firm to offer ex-ante identical agents with discriminatory wage contract when agents are concerned about the rank of their wages. The basic intuition behind their result is that firms can exploit incentives from status to reduce its total wage cost. But sociologists enunciate that agents exhibit a taste for status congruence. It has also been empirically validated that there is a strong positive correlation between social status and material well-being (see Perrot (1999)). Belliveau, O'Reilly and Wade (1996) study how CEO compensation is affected by the CEO's status relative to that of the compensation committee chair. They find that high-status CEOs matched with low-status compensation chairs are significantly better paid than low-status CEOs matched with high-status compensation chairs. Thus, our paper contributes to this influential strand of literature to capture this complementarity between status and monetary incentive. Auriol and Renault (2008) shows that high-status agents are willing to exert more effort in exchange for additional income, whereas better-paid agents are willing to

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7 Convexity on preference indicates that an individual's ordering of various commodities is such that she would prefer choosing the averages (or combination of the commodities) rather than the extremes. In this context, it implies that agents’ prefer to a combination of status and monetary incentive.
exert more effort in exchange for improved status. Specifically, they find that young agents’ motivation are mainly driven by their zeal for building prospects for future promotion and hence it is optimal for the principal to offer the lowest possible status with zero monetary incentives. However, it is required to offer a combination of both status and money incentive only to the older generation. In this way, organization can exploits their complementarity between symbolic and material rewards, which is there in individuals’ preference function, to reduce the total wage bill. Yet unlike Auriol and Renault (2008), in our paper status is not captured ‘as’ an incentive but we focus on interplay between incentives ‘and’ status when the status reflects agents position in the hierarchical order, which is exogenous.

The rest of the paper is organized as follows. To start with in Section 2 we describe the model when the agents are status conscious and are intrinsically motivated. The corresponding optimal form of the contract is also analyzed in this section. Section 3 provides some concluding remarks and throws some light on intended future works.

2. The Model

Let us assume that a firm consists of risk-neutral principal and a risk-neutral status conscious agent. The principal hires the agent to carry out a project. The project can either succeed or fail. A contract is signed between the principal and the agent, which specifies that the agent will get a fixed wage, $F$, and a bonus, $b$, where the bonus is paid only if the project succeeds. The agent is ‘status conscious’ in the following way: agents of higher status value the same payment $b + F$ less than the agents of lower status. Put differently an agent of status level indexed by $\alpha$ values the monetary incentive by $\alpha (b + F)$, where $\alpha \in (0,1]$ and lower $\alpha$ means higher status and thus an agent with higher status values a same monetary incentive lesser. $\alpha$ is assumed to be common knowledge. Now the final outcome of the project is assumed to be verifiable by any third party and hence it is contractible. Outcome is high when the project succeeds and it yields a payoff of $\pi > 0$ to the principal. When the project fails the outcome is low for which principal gets 0 as payoff. The agent chooses an effort level $e_H$ or $e_L$. The private cost associated with the effort level $e_i$ is $c_i$ to the agent; $i = H, L$. It is assumed that $c_H > c_L = 0$. For simplicity we further assume that $c_H = c$. The project succeeds with probability $P_i$, where $P_H > P_L$. More

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8 The parameter $\alpha$ basically indicates that differing valuation of monetary incentive across status. One can also assume $\alpha$ to be greater than 1 but the interpretation will remain unchanged, i.e. higher $\alpha$ would mean lower status and the qualitative aspect of our paper will go through. Therefore, the current range of $\alpha$ is assumed without loss of generality.
precisely, when the agent elicits high effort then the probability of success of the project is high. We assume that the agent has no wealth, thus a limited liability constraint operates. This implies that agent has to be given at least a non negative amount of fixed wage of \( F = 0 \) every period, irrespective of the project outcome. The agent is assumed to have an outside option (reservation utility), \( u^0 \).

As a benchmark, at first we consider the first- best case where effort is observable and hence contractible. When outcome is high then the agent is offered payoff of \( F + b \) and \( F \) otherwise. To find out the first best optimal contract when the principal intends to implement high effort the optimization problem becomes as follows:

\[
\max_{F, b} U^H|\varepsilon_H = P_H[\pi - b] - F
\]

Subject to the following constraints:

a) **Limited liability constraint (LL)** requiring that the agent be left with a non negative level of wealth:

\[
F \geq 0
\]

b) **Individual Rationality constraint (IR)** stating that for participation in the job it is necessary that the agent is offered at least her outside option (reservation utility)

\[
IR: \alpha b P_H + \alpha F - c \geq u^0
\]

When the effort level is verifiable by the principal, she would offer just the minimum level of monetary incentive (which would maximize her expected utility) for which the agent accepts to participate in the job. Thus, any combination of \((F, b)\) for which the participation constraint is satisfied yields the ‘first best’ monetary incentive for the principal. Since the agent is risk neutral she would accept any non-negative monetary bonus which satisfies her participation constraint. The monetary bonus satisfying the participation constraint is

\[
b^{fb} = \max \left\{ \frac{c + u^0 - \alpha F}{\alpha P_H}, 0 \right\}
\]
The *first best* bonus exhibits that there is an inverse relation between $\alpha$ and $b$, indicating a complementary relation between status and monetary incentive. For the agents holding high status (lower $\alpha$) the valuation of the bonus is low. Therefore, to make them accept the contract the principal has to offer higher monetary incentive. Similarly, for low status agents it is optimal to offer low monetary bonus. Also, there is a substitution between $b$ and $F$. The cost for participating in the job is $u^0$ and $c$ is the cost of putting high effort. So if the fixed wage is high enough to overcome this cost of $c + u^0$, then the principal need no further incentive to enforce high effort. Put differently, high fixed wage can completely substitute for monetary incentive.

We can write the one of the *first best* contracts as follows:

$$b_{FB}^{FB} \frac{c + u^0}{\alpha P_H}, \quad F_{FB} = 0$$

This first best contract is such that the limited liability constraint is binding. Hence the principal has to offer non-zero monetary incentive so as to make the agent accept to participate in the job.

Now we analyze the more interesting case, where effort is unobservable and hence not enforceable. To obtain the optimal contract under unobservability we have to perform the following optimization exercise when the principal wants to enforce high effort over low effort.

$$\max_{F, b} U^P | x_H = P_H[x - b] - F \quad (4)$$

Subject to the following constraints:

a) *Limited liability constraint* (*LL*) requiring that the agent be left with a non-negative level of wealth:

$$F \geq 0 \quad (5)$$

b) *Individual Rationality constraint* (*IR*) stating that for participation in the job it is necessary that the agent is offered at least her outside option (reservation utility)
c) Incentive compatibility constraint (IC) which ensures that the agent does not have the incentive to deviate from high effort to low effort:

\[ IC: (P_H - P_L) \alpha b \geq c \]  

Now, if the first best incentive contract \( \{ b^{FB}, F^{FB} \} \) satisfies the IC then it is the overall best contract to be offered. Thus, substituting \( \left\{ \frac{c + u^0}{\alpha P_H}, 0 \right\} \) in (7) we find that if

\[ u^0 < \frac{c P_L}{(P_H - P_L)} \]

then first best is not implementable. Notice that, in line with standard moral hazard results, here also first best is always implementable for the agents with very high reservation utility even when effort is unobservable. So, if the outside option is as low as zero then first best is never achievable.

Figure 1
If effort was verifiable then any combination of \((b, F)\) on the binding (IR) border line would yield a *'first-best'*, for any non-binding limited liability. Suppose the limited liability constraint (5) is binding, which is the vertical axis in the figure 1, and the reservation utility is sufficiently low such that (IRA) is the relevant participation constraint then the *‘first best’* is achieved at point E. At that point E the expected payment made by the principal is minimum at \(w_0\). Now, when effort is unobservable then any combination of \((b, F)\) for which both (IR) and (IC) are satisfied with the expected payment made to the agent being minimum, constitutes an optimal *‘second-best’* wage contract.

2.1. Optimal Contract: Agent with Low Outside Option

When the outside option is low such that

\[
\mu^0 \leq \tilde{u} = \frac{c_{P_L}}{\left(P_H - P_L\right)}
\]

then the (IR) lies below the (IC) as the vertical intercept of (IR) is less than that of the (IC). To elicit high effort it is optimal for the principal to offer a contract for which the incentive compatibility constraint just binds and it would also ensure agent’s participation in the job. Hence, at the optimum (IC) binds and (IR) is satisfied. Figure 1 shows that the area above the IC is the feasible zone and given (LL) the expected cost contour \(w_1\) is lowest at point A. Thus, the (IC) and (LL) binds but (IRA) does not bind. The optimization problem under this situation can written as below

\[
\text{Max} U^P_{F, b} e_H = P_H \left[\tilde{u} - b\right] - F
\]

Subject to

\[
\text{IC}: (P_H - P_L) \alpha b = c
\]
\[
\text{LL}: F = 0
\]

The principal will maximize her expected utility to determine the optimal payoffs. We can state these results in the following proposition.
**PROPOSITION 1:**
When reservation utility of the agent is sufficiently low such that $u^0 \leq \tilde{u}$ then the optimal payments $(b^*, F^*)$ are characterized as follows:

$$b^* = \frac{c}{(P_H - P_L)\varepsilon}, \quad F^* = 0$$

**Proof:** Follows from the above discussion. QED.

Interestingly increased status (lower $\alpha$) leads to an increased optimal monetary incentive. The first part of the proposition provides the optimal contract when the principal wants to implement high effort, $e_H$. Here, $(b^*, F^*)$ is the unique optimal contract. It is optimal for the principal to offer the minimum fixed wage when the output is bad since for any other contract, satisfying the IC, say, $(b, F > 0)$, the corresponding expected cost of the principal is $P_H b + F (> 0)$, which is greater than the optimal expected cost $P_H b$. Thus, the optimal fixed wage is such that it is unaffected by exogenous change in status holding. When the outcome of the project is good the optimal bonus is such that it increases with increase in status level. This is due to the fact that with an exogenous increase in status the effective valuation of bonus $\alpha b$ falls. Now, given that the binding limited liability constraint $F$ remains fixed at zero and thus, increasing $b$ is the only instrument by which the principal can make the contract incentive compatible and elicit high effort. Therefore, at the optimal, status and monetary incentive exhibits a complementary relation. We can easily verify that when effort is unobservable the principal has to offer higher monetary incentive, i.e., ‘second best’ $b^*$ is greater than $b^{FB}$.

### 2.2 Optimal Contract: Agent with High Outside Option

Now, when the reservation utility is high enough such that

$$u^0 > \tilde{u} = \frac{cP_L}{(P_H - P_L)}$$

then the vertical intercept of participation constraint is greater than that of the incentive compatibility constraint. Thus, $u^0 > \tilde{u}$ ensures that the relevant participation constraint is (IRB) which lies above (IC). The area above the line BG is the feasible area for the principal to minimize her expected payment. Observe, since
the absolute slope of (IR), which is \( \frac{1}{\alpha P_H} \), is greater than the slope of expected payment line \( \frac{1}{P_H} \), therefore, we get a unique contract at point B, where both the incentive compatibility constraint and the participation constraint binds but the limited liability does not bind. Therefore, under this situation the optimization problem becomes,

\[
\begin{align*}
\text{Maximize } & \quad \mathbb{E}[\pi_t] = P_H [\pi - b] - F \\
\text{Subject to } & \quad IC: (P_H - P_L) \alpha b = c \\
& \quad IR: \alpha bP_H + \alpha F - c = u^0 \\
& \quad LL : F \geq 0
\end{align*}
\]

The principal will maximize her expected utility or minimize her expected cost to determine the optimal payoffs. On the basis of this discussion we can state the following proposition which states the optimal contract when \( u^0 > \tilde{u} \)

**PROPOSITION 2:** If the outside option of the agent is high such that \( u^0 > \tilde{u} \) then the optimal contract \((b^{**}, F^{**})\) are as follows

\[
\begin{align*}
b^{**} = & \quad \frac{c}{(P_H - P_L)\alpha} = b^*; \quad F^{**} = \frac{1}{\alpha} \left[ u^0 - \frac{cP_L}{(P_H - P_L)} \right]
\end{align*}
\]

**Proof:** Follows from the above discussion. QED.

The first part of the proposition reveals that for any value of \( u^0 \) the optimal monetary bonus remains the same, exhibiting a direct relation between status and monetary incentive. The intuition behind this result is: under both the situations (reservation utility is ‘high’ and ‘low’) (IC) binds at the optimum and hence to ensure that the agent takes high effort the principal has to offer high status agents with high monetary pay to compensate their lower valuation for the incentive pay. Unlike the ‘first best’ case, here there is no substitution between the fixed wage and the
pecuniary incentive. Thus, to enforce high effort the principal has to pay monetary bonus together with the fixed wage. However, from the second part of the proposition we observe that there a complementary relation between status and fixed wage. Thus, when the outside option of the agent is high then the principal must provide high fixed wage as well as high bonus to agents holding high position. Also observe that, the optimal fixed wages increases with the increase in outside option. Since, the optimal bonus is fixed at \( b^{**} = \frac{c}{(P_H - P_L)^\alpha} \), therefore to make the agent participate in the job the principal has to provide a higher fixed wage. Also, observe that with the increase in cost of putting high effort \( F^{**} \) falls whereas \( b^{**} \) increases. When the cost of putting high effort increases then the principal should increase the monetary incentive. But since the limited liability constraint does not bind under this situation, she can optimally reduce \( F \) such that participation constraint still binds.

If the principal wants to enforce \( e_L \) then the optimal monetary incentive scheme is \( \left\{ b^* = \left( \frac{u^0 - F}{\alpha P_L} \right), \quad F^* = 0 \right\} \). The corresponding expected utility of the principal is \( P_L \left( \pi - \frac{u^0}{\alpha P_L} \right) \). The principal would like to enforce high effort only when \( U^P \big|_{e_H} > U^P \big|_{e_L} \). For agents with low outside option, it should be noted that the principal wants to implement \( e_H \) over \( e_L \) since it is implicitly assumed that \( \pi \geq \pi^* = \frac{1}{\alpha(P_H - P_L)} \left[ \frac{cP_H}{P_H - P_L} - u^0 \right] \) which ensures that \( U^P \big|_{e_H} > U^P \big|_{e_L} \). Therefore, the principal wants to implement \( e_H \) only when the return of the firm is sufficiently high. We can easily verify that \( \frac{\partial \pi^*}{\partial \alpha} < 0 \), indicating that it is easier for the principal to implement high effort when the agent is of low status. For agents with high reservation utility it is assumed that
$\pi \geq \pi^{**} = \frac{c}{(P_H - P_L)} \left[ \frac{P_H}{\alpha(P_H - P_L)} - P_L \right] + \frac{u^0}{\alpha} \left[ 1 - \frac{1}{(P_H - P_L)} \right].$

3. Conclusion:

In this paper we have made an attempt to analyze and interpret the interplay between status ‘and’ monetary incentives. Specifically we have shown how the optimal monetary incentive differs for persons with varying differences in status in a discrete effort framework. Using a moral hazard model with limited liability we have shown that irrespective of the level of outside option of the agents it is optimal to pay higher incentive to agent with high status. Though, for group of agents with low outside option, limited liability binds and the optimal fixed payment is set at zero, but for group of agents with high outside option the optimal fixed income structure remains independent of the status of the agent and the limited liability is non-binding such that fixed wage is positive. It is observed that incentive is always required for the agent to enforce high effort.

This paper is a discrete effort analysis of the optimal incentive contract given the differing variations in the hierarchical positions (status) within an organization. Dey and Banerjee (2011) has addressed this problem in a continuous effort framework. In the continuous effort framework we find that for agents with lower outside option increased status leads to lower incentive pay whereas exactly the opposite happens for agents with higher outside option. For agents with very high status such that the limited liability doesn’t bind, an exogenous increase in status level leads to an unambiguous decrease in optimal incentive payment. A continuous effort framework considers interior solutions in the effort space, however this paper obtains corner solutions as the effort space is discrete. Such discretization of effort produces substantially different and intriguing results.

An emerging literature on contract theory has focused on the importance of status as a non-pecuniary incentive and how status might relax the burden on monetary incentives to elicit the desired outcome (see Frank (1985), Dubey and Geanakoplos (June, 2004), Moldovanu et al. (2007), Besley and Ghatak (2008), Dhillon and Herzog-Stein (2009) Dey and Banerjee (2014)). But according to our knowledge the role of monetary incentive in an organization with varying differences in status has
not been studied much\textsuperscript{9}. This paper provides an analytical framework to address this issue when effort level is discrete (i.e., ‘high’ or ‘low’).

There are other several issues which are to be addressed in the future. In this framework we can introduce some sort of intrinsic motivation of the agents. Social norms, dimension of relationship with the principal, etc. can act as a proxy instrument to generate motivation among the agent. Thus endogenously motivation can affect the optimal contract to an extent. Again, the notion of fairness, while incentivizing the agents has remained unaddressed in this paper. In future we intend to introduce motivation as an endogenous variable and analyze the associated changes on the optimal contract. We also plan to analyze the structure when the incentive is not reached to the deserving agent due to favoritism of the principal or assessment problem of the performance of the agent.

References:


\textsuperscript{9} Exception is Dey and Banerjee (2011) where this problem has been analyzed in continuous effort framework to yield different results.


