Productive Low Morale

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Abstract

This paper models employment relationship as a repeated principal-agent problem with private evaluation. The efficient contracts exhibit correlated movements between lagged wage and current effort that are consistent with the positive feedback between pay and morale in practice. Low morale therefore is an integral part of a well-functioning relationship. (JEL: C73, D82, J41, L14)

1 Introduction

A common phenomenon in employment compensation is that wage cuts can result in lost productivity due to "low morale." For instance, Bewley (1995, 1999) documents that employers generally regard good morale as highly desirable and resist cutting wages for fear that they may antagonize employees. Such a positive link between past pay and current effort is at odds with traditional incentive theory. In traditional theory pay depends upon *verifiable* performance measures; past pay simply reflects past performance and should have no bearing on a rational agent's current effort except through wealth effects. This paper constructs a model to show that low morale indeed can be part of a productive relationship.

This study builds on recent work by Levin (2003) and MacLeod (2003), who consider subjective and *private* evaluations to capture the possible dissonance in performance evaluations between principal and agent. This as Prendergast (1999) points out is more in line with most compensation practices. They show that private evaluation necessarily results in efficiency loss: due to two-sided private information, surplus has to be destroyed in some states in order to provide appropriate incentives.[1] What is particularly interesting is how surplus destruction gets implemented. Levin constructs optimal self-enforcing contracts that take the form of termination: when the employee's performance falls below a threshold the relationship is terminated; termination provides incentives both for the employee to perform and for the principal to honestly report the agent's performance.[2] Fuchs (2006) extends the analysis of Levin and MacLeod to allow the principal to evaluate performance infrequently and also considers termination contracts. Their models therefore can explain quits and firings of workers in the event of a dispute over low evaluation.

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[1] If evaluation is nonverifiable but mutually observable, self-enforcing contracts based on reputation and reciprocal promises results in no efficiency loss (Bull 1987; MacLeod and Malcomson 1989): though pay varies with performance the agent always chooses the efficient effort.

[2] MacLeod considers a static model and analyzes how the correlation between the principal's and agent's beliefs over performance evaluation affects optimal contracts; he sketches a way to implement the optimal contracts through termination and, without giving explicit construction, hints at the possibility of implementation through repeated interaction.

Despite its simplicity, termination seems to occur infrequently considering the wide use of subjective evaluation and discretionary compensation. More importantly, it does not explain low morale in *ongoing* relationships. I show that endogenous low morale can be a way to implement the surplus destruction needed for incentive provision in ongoing relationships. This analysis is particularly relevant in the light of the fact that many employment contracts are structured to *prevent* termination. For instance, employment protection such as union contracts and tenure systems prevents employers from dismissing their employees; measures such as no-compete clauses and (non-)free agency systems in professional sports contracting prevent employees from "firing" their employers. This paper shows that these types of contracts can make cooperation easier to sustain if punishment for noncooperation can be implemented more easily within the relationship. Thus if the principal relies mostly on subjective evaluation as an incentive device employment protection can enhance efficiency.

The methodology of this paper builds upon theory of repeated games with imperfect monitoring developed by Green and Porter (1984), Abreu, Pearce, and Stacchetti (1990), and Fudenberg, Levine, and Maskin (1994). The main difference is that I take a mechanism design perspective: in our model monetary transfers are used as the *only* public signals and are designed *endogenously*.

2 The Results

A principal hires an agent for periods $t = 0, 1, \ldots$ In each period t, first the agent chooses a hidden effort level e_t from a finite set $\mathbb{E} \subset \Re_+$. By suitable normalization, effort level also represents its utility cost. Efforts produce some stochastic output; only the principal can observe the realized output. This formulation captures the dissonance between the principal and agent in performance evaluation.[3] Output level takes on values in a finite set $Y = \{0 \leq y_1 < \cdots y_k \cdots < y_K\}$ with $K \geq 2$. Given effort $e \in \mathbb{E}$, output y_k occurs with probability $p_k(e)$. Assume that $p_k(e) \in (0,\ 1)$, $\forall k = 1, \ldots, K$ and $\forall e \in \mathbb{E}$, and that $E(y|e) > E(y|e')$ for $e > e'$, where $E(y|e)$ is the expected output given e.

The principal's and agent's payoffs at period t are respectively given by

$$V_t = (1-\delta)E\{\sum_{s=t}^{\infty} \delta^{s-t}[y_s - w_s]\}$$

$$U_t = (1-\delta)E\{\sum_{s=t}^{\infty} \delta^{s-t}[c_s - e_s]\},$$

where w_s is what the principal pays and c_s is what the agent receives in period s. Risk neutrality allows us to ignore consumption smoothing and focus on dynamics purely due to incentive reasons.

At any date the principal and agent may walk away and take their outside options, valued at v_0 and u_0 per period, respectively. The relationship then ends for good. To make the incentive problem interesting, assume that taking outside options is jointly more efficient than exerting minimum effort.

Assumption 1. $E(y|\underline{e}) - \underline{e} < u_0 + v_0$.

I shall focus on *full review* contracts as described by Levin (2003), which require the principal to report the agent's performance truthfully in every period subject to incentive compatibility. The analysis extends to more complex review strategies. In each period t, the principal is asked to publicly report

[3] Another plausible explanation would be that the principal can divert profits before the agent sees it.

realized output y_t. The public information at the start of period t includes the principal's past reports $y^t = (y_0, ..., y_{t-1})$ and wage payments $w^t = (w_0, ..., w_{t-1})$. Let $h^t = (y^t, w^t)$. For each t and h^t, a contract specifies (i) the agent's effort choice; (ii) the principal's wage payments $w_t(y_t)$ conditional on current report y_t; (iii) the payment the agent will receive $c_t(y_t) \leq w_t(y_t)$.[4] Explicit money burning ($c_t < w_t$) is permitted at this point.

To identify the maximum surplus attainable by contracts, consider first the one-period problem of maximizing surplus subject to incentive constraints. To induce the principal to report the agent's performance truthfully her payment $\overline{w}$ should be independent of her report; the agent then is paid according to some schedule $c(y_k) \leqslant \overline{w}$, $\forall y_k$. To provide incentive for the agent, part of the output $\varphi(y_k) = \overline{w} - c(y_k)$ may need be destroyed at some states. Thus the one-period problem is as follows.

Program P:

$$\max_{\alpha(\cdot),\, \varphi(\cdot)} \sum_e \alpha(e) \left\{ \sum_k [y_k - \varphi(y_k)] p_k(e) - e \right\}$$

$$s.t. \quad \varphi(y_k) \geq 0 \, \forall y_k, \quad \alpha \in \Delta(\mathbb{E}) \equiv \{\tilde{\alpha} : \mathbb{E} \to \Re_+ \text{ with } \sum_e \tilde{\alpha}(e) = 1\}, \text{ and}$$

$$\alpha(e) > 0 \implies e \in \arg\max_{e'} \sum_k (-\varphi(y_k)) p_k(e') - e'.$$

Remark. If $(\alpha^*, \varphi(\cdot))$ solves Program P then α^* assigns probability one to the most productive incentive compatible effort given $\varphi(\cdot)$. Allowing mixed actions is for consistency with the repeated formulation.

Let ξ be the value of Program P. To avoid the trivial case, assume $\xi > u_0 + v_0$.

Proposition 1. *The least upper bound on total surplus achievable by full-review contracts equals ξ.*

Evidently this efficiency bound can be achieved using a sequence of one-period contracts that solve Program P. However, it is of practical interest to find mechanisms without involving a money-burning planner. The previous studies consider termination. This paper focuses on the "low morale" mechanism.

I show that the maximum surplus ξ can be implemented using simple repeated games defined by stationary wage menus. Specifically, at $t = 0$ the parties negotiate a wage menu $W = \{w_1 < w_2 < ... < w_n\}$. Assuming the relationship never ends, menu W defines a repeated game, $\Gamma(W)$, as follows. In every period t, the agent chooses some mixed effort and the principal, after observing realized output, randomly chooses a wage payment from W. I focus on *perfect public equilibria (PPE)*, particularly on *efficient* equilibria that attain surplus ξ.[5] The key question is what wage menus can achieve this goal.

The history of wage payments $w^t = (w_0, ..., w_{t-1})$ are the *only* public "signals" at the start of date t. For every w^t the agent's strategy specifies a mixed effort $\alpha_t(w^t) \in \Delta(\mathbb{E})$ and the principal's strategy specifies a vector of wage lotteries $\beta(w^t) : Y \to \Delta(W)$.

Let $(e^*, \varphi(\cdot))$ solve Program *P*; let $\overline{\varphi} = \max_{y_k} \varphi(y_k)$ be the maximum money burning required.

I show that the efficient surplus can be achieved using a menu of two wages, $w_1 < w_2$, with the following PPE strategies that involve two phases. The game starts with a normal phase.

a. *Normal Phase.* The agent chooses effort e^*. For $i = 1, 2$, the principal pays the agent wage w_i with some probability β_{ki} if the realized output is y_k. If wage payment turns out to be w_2, continue with normal phase; otherwise, switch to *low-morale* phase specified below.

[4] There is no need to include c_t in information set h^{t+1}, as it is determined by the rule $c_t(h^t, y_t)$ and public information.

[5] It can be shown that a common class of belief-free *private* equilibria cannot improve on PPEs in this model.

b. *Low-Morale Phase.* The agent chooses minimum effort $\underline{e}$ and the principal pays w_1 for $J \geq 1$ periods regardless of history. In period $J+1$, switch back to normal phase.

The parameters $\beta = (\beta_{ki})$, J and the bonus $b \equiv w_2 - w_1$ need be determined; base wage w_1 is indeterminate. I give a heuristic account of the construction of the parameters; details are in the appendix.

Let (U_j, V_j) be the payoffs of the agent and principal respectively after $j = 0, 1, ..., J$ periods into the low-morale phase. Thus the parties receive (U_J, V_J) in a normal phase and (U_0, V_0) at the start of a low-morale phase. The sufficient conditions for the strategies to form a PPE are the following (Abreu et al., 1990; Fudenberg et al., 1994):[6]

(i). For $j = 0, ..., J-1$, (U_j, V_j) equal current payoffs plus discounted continuation payoffs:

$$U_j = (1-\delta)(w_1 - \underline{e}) + \delta U_{j+1} \tag{1}$$

$$V_j = (1-\delta)(E(y|\underline{e}) - w_1) + \delta V_{j+1}. \tag{2}$$

(ii). Payoffs (U_J, V_J) in the normal phase can be achieved by strategies e^* and (β_{ki}):

$$U_J = \sum_k p_k(e^*) \left[(1-\delta)(\beta_{k2} w_2 + \beta_{k1} w_1 - e^*) + \beta_{k2} \delta U_J + \beta_{k1} \delta U_0 \right] \tag{3}$$

$$V_J = \sum_k p_k(e^*) \left[(1-\delta)(y_k - \beta_{k2} w_2 - \beta_{k1} w_1) + \beta_{k2} \delta V_J + \beta_{k1} \delta V_0 \right]. \tag{4}$$

(iii). Given the principal's strategy (β_{ki}) and continuation payoffs (U_J, U_0), the agent finds e^* optimal:

$$e^* \in \arg\max_e \sum_k p_k(e) \left[(1-\delta)(\beta_{k2} w_2 + \beta_{k1} w_1 - e) + \beta_{k2} \delta U_J + \beta_{k1} \delta U_0 \right]. \tag{5}$$

(iv). The principal is indifferent between paying w_2 or w_1:

$$(1-\delta)(w_2 - w_1) = \delta V_J - \delta V_0. \tag{6}$$

Let $S_j = U_i + V_j$ be the total surplus after j periods into a low-morale phase, for $j = 0, ..., J$. Hence S_J is the surplus generated in a normal phase. For the equilibrium to be efficient one need $S_J = \xi$. Let

$$B = E(y|\underline{e}) - \underline{e}$$

be the surplus generated by the minimum effort $\underline{e}$. Then adding up (1) and (2) yields

$$S_j = (1-\delta^{J-j})B + \delta^{J-j}\xi, \quad \forall j = 0, ..., J. \tag{7}$$

Since $\xi > B$, it follows that $S_0 < \cdots < S_J$. The length J is chosen so that

$$\xi - \frac{1-\delta}{\delta}\overline{\varphi} > S_0 > u_0 + v_0. \tag{8}$$

where u_0, v_0 are the default payoffs. The reason of choosing J in this way is the following. By incentive compatibility the principal has to be indifferent between paying w_2 and w_1, so *any incentive pay to the agent must come from variations in continuation surpluses* (also see Fudenberg and Levine, 1994). To

[6] Here continuation payoffs are not necessarily extreme points of the feasible payoff set, i.e. J need not be infinity. The bang-bang result of Abreu et al. (1990) does not apply to games with *finite* signal spaces.

provide sufficient incentive, total surplus needs to vary sufficiently between the normal and low-morale phases, which requires a sufficiently long low-morale phase. On the other hand, for the parties to stay in the relationship the lowest surplus on the equilibrium path, S_0, should not fall below the default surplus. These conditions lead to (8).

Once a length J of low-morale phase is determined, the low surplus S_0 is determined by (7). Then the principal's wage paying strategy is defined as follows:

$$\beta_{k1} = \frac{\varphi(y_k)}{\phi}, \quad \forall k \tag{9}$$

where

$$\phi \equiv \frac{\delta}{1-\delta}(S_J - S_0) = \frac{\delta(1-\delta^J)}{1-\delta}(\xi - B). \tag{10}$$

This strategy replicates the incentive effect of schedule $\varphi(\cdot)$.

Finally, we choose $b = w_2 - w_1$ to simultaneously satisfy the principal's incentive constraint and the payoff equations of the two parties, as explained in the appendix. The result is to set

$$b = \frac{\delta(1-\delta^J)}{1-\delta^{J+1}}(E(y|e^*) - E(y|\underline{e})). \tag{11}$$

For intuition, note that if the principal withholds the bonus b then a low-morale phase will follow. During the low-morale phase the principal saves wage payment

$$b(1+\delta+\cdots+\delta^J) = \frac{1-\delta^{J+1}}{1-\delta}b$$

but also loses revenue

$$(\delta+\cdots+\delta^J)(E(y^*|e^*) - E(y|\underline{e})) = \frac{\delta(1-\delta^J)}{1-\delta}(E(y^*|e^*) - E(y|\underline{e})).$$

Eq. (11) simply says the benefit of not paying the bonus equals the cost.

Proposition 2. *There exists some $\delta^* \in (0,1)$ such that for all $\delta \in [\delta^*, 1)$, the pair of strategies with the parameters J, β_{ki}, $b = w_2 - w_1$, determined by* (8), (9)*, and* (11) *and an appropriately chosen $w_1 \in \Re$ form an efficient perfect public equilibrium.*

The equilibrium has the feature that if the agent disputes a low evaluation, he responds by having low morale, i.e. choosing low effort. This is "useful" because low morale imposes a cost on the principal and therefore discourages the principal from falsely reporting a low evaluation unless the agent's performance truly merits it. The low-morale episodes therefore are an integral part of an *efficient* equilibrium.

The low morale mechanism has an advantage over termination. Under Assumption 1 low morale generates a surplus strictly lower than the default surplus. This means that the parties can be punished more severely within the relationship if termination is not possible, which makes cooperation easier to support. Essentially, efficiency can be increased if the parties are committed to the relationship. In fact, one-sided commitment suffices. For instance, if the principal can commit to not terminate the agent (or if there is employment protection) but the agent is free to walk away, then surplus in the low-morale phase can be as low as the minimum level $E(y|\underline{e}) - \underline{e}$ without forcing the agent to leave, as long as the base wage w_1 is set high enough so that the agent receives at least his default payoff u_0.

In conclusion, though low morale is often considered a sign of ill-functioning of an organization this paper *explicitly* shows it can be an integral part of a productive ongoing relationship if there is asymmetric information in performance evaluation. The model perhaps can also provide a rationality-based explanation for the fair wage-effort hypothesis of Akerlof and Yellen (1990).

Appendix:

Proof of Proposition 1. Let $\overline{S}$ be the least upper bound, which exists because surplus is bounded from above. Let $\varepsilon > 0$ and σ be a contract that delivers payoffs (U,V) and surplus $S = U + V \in [\overline{S} - \varepsilon, \overline{S}]$.

Since the continuation contracts $\sigma|(w,y_k)$ at the start of $t = 1$ are also self-enforcing, the payoffs (U,V) delivered by σ can be decomposed into sums of the current payoffs and the continuation payoffs $(U(w,y_k),V(w,y_k))$. At $t = 0$, σ specifies a random effort $\alpha \in \Delta(\mathbb{E})$ for the agent, and for each y_k, probabilities $\beta_k(w)$ with which the principal pays wages w and the agent's receipts $c(w,y_k) \leq w$. Then U,V,α, $c(\cdot,\cdot)$ and $(\beta_k(\cdot))$ satisfy

$$U = \sum_e \alpha(e) \left\{ \sum_k p_k(e) \sum_w \beta_k(w) \left[(1-\delta)(c(w,y_k) - e) + \delta U(w,y_k)\right] \right\},$$

$$V = \sum_e \alpha(e) \left\{ \sum_k p_k(e) \sum_w \beta_k(w) \left[(1-\delta)(y_k - w) + \delta V(w,y_k)\right] \right\},$$

$$\alpha(e) > 0 \implies e \in \arg\max_{e'} \sum_k p_k(e') \sum_w \beta_k(w) \left[(1-\delta)(c(w,y_k) - e') + \delta U(w,y_k)\right], \tag{12}$$

$$\sum_w \beta_k(w)(\delta V(w,y_k) - (1-\delta)w) = C, \ \forall y_k, \text{for some } C. \tag{13}$$

Eqs. (12) and (13) are the incentive constraints of the agent and the principal respectively. In particular, the principal is indifferent between reporting any output realization y_k.

The total surplus $S = U + V$ equals

$$S = \sum_e \alpha(e) \left\{ \sum_k p_k(e) \sum_w \beta_k(w) \left[(1-\delta)(y_k - w + c(w,y_k) - e) + \delta S(w,y_k)\right] \right\}$$

where $S(w,y_k) \equiv V(w,y_k) + U(w,y_k) \leq \overline{S}$. Subtracting $\delta \overline{S}$ from each side and then dividing by $1-\delta$ gives

$$\frac{S - \delta \overline{S}}{1-\delta} = \sum_e \alpha(e) \left\{ \sum_k p_k(e) \left[y_k + \sum_w \left(c(w,y_k) - w + \frac{\delta}{1-\delta} \beta_k(w)((S(w) - \overline{S}) \right) \right] - e \right\}. \tag{14}$$

Similarly, adding the constant $C - \overline{S}$ to the agent's objective in (12), dividing it by $(1-\delta)$, then by (13) we obtain

$$\alpha(e) > 0 \implies e \in \arg\max_{e'} \sum_k p_k(e') \sum_w \left(c(w,y_k) - w + \frac{\delta}{1-\delta} \beta_k(w) \left[S(w) - \overline{S}\right] \right) - e'. \tag{15}$$

$$\text{Now define} \quad \varphi(y_k) = -\sum_w \left(c(w,y_k) - w + \frac{\delta}{1-\delta} \beta_k(w) \left[S(w,y_k) - \overline{S}\right] \right), \ \forall y_k$$

as the sum of current money burning and future surplus destruction. Since $c(w,y_k) \leq w$ and $S(w,y_k) \leq \overline{S}$, $\varphi(y_k) \geq 0$, $\forall y_k$. Then the right-hand side of (14) becomes the objective function of Program P and (15) is exactly the agent's incentive constraint in the program. It follows that $\frac{S - \delta \overline{S}}{1-\delta} \leq \xi$, the value of Program P. Given $\overline{S} - \varepsilon \leq S$, we have $\overline{S} - \frac{\varepsilon}{1-\delta} \leqslant \xi$. Since $\varepsilon > 0$ is arbitrary, $\overline{S} \leq \xi$. Finally, $\overline{S} = \xi$ because a sequence of one-period optimal contracts attains ξ. □

Proof of Proposition 2. First, I show that the parameters J, β, b are well defined for δ close to 1. Recall $B = E(y|\underline{e}) - \underline{e}$. For $I = 0, 1, ...,$ define

$$A(I) = (1-\delta^I)B + \delta^I \xi.$$

Note that $A(I) - A(I+1) = \delta^I(1-\delta)(\xi - B) > 0$.

Since $\xi > u_0 + v_0$, there exists $\delta^* \in (0,1)$ such that for all $\delta \in [\delta^*, 1)$,

$$\left(\xi - \frac{1-\delta}{\delta}\overline{\varphi}\right) - (u_0 + v_0) \;>\; (1-\delta)(\xi - B) \;\geq\; A(I) - A(I+1),\ \forall I.$$

Since $A(0) > \xi - \frac{1-\delta}{\delta}\overline{\varphi}$ and $A(I) < u_0 + v_0$ for large I, there exists $J(\delta) \geq 1, \forall \delta \in [\delta^*, 1)$, such that

$$\xi - \frac{1-\delta}{\delta}\overline{\varphi} \;>\; A(J(\delta)) \;>\; u_0 + v_0,$$

same as (8) with $A(J) = S_0$. Therefore, the parameters J, β_{ki} and b are well defined for $\delta \in [\delta^*, 1)$.

I next construct the payoffs U_0, U_J, V_0, V_J and show that the strategies and payoffs satisfy the equilibrium conditions *(i) - (iv)*. Start with the principal, whose incentive constraint (6) requires her net present payoff remains constant regardless of her wage payment. By plugging (6) into (4) one has

$$V_J = E(y|e^*) - w_1 - b. \tag{16}$$

Then for all $j = 0, .., J-1$, V_j is determined recursively by (2). In particular,

$$V_0 = (1-\delta^J)(E(y|\underline{e}) - w_1) + \delta^J V_J \;=\; E(y|\underline{e}) - w_1 + \delta^J(E(y|e^*) - E(y|\underline{e}) - b).$$

Now, using the definition of b in (11) one can verify that the payoffs V_J and V_0 satisfy the principal's incentive constraint, $\delta(V_J - V_0) = (1-\delta)(w_2 - w_1)$.

Next consider the agent. Let the agent's payoffs be $U_j = S_j - V_j$ for $j = 0, ..., J$. By the construction of S_j and V_j, U_j satisfy Eq. (1). To show that the agent's incentive constraint is satisfied in the normal phase, let $C \equiv \delta V_J - (1-\delta)w_2 = \delta V_0 - (1-\delta)w_1$, by the principal's incentive constraint. Then the agent's contingent payoff in state y_k is given by

$$\begin{aligned}
u_k &\equiv (1-\delta)(\beta_{k2}w_2 + \beta_{k1}w_1) + \beta_{k2}\delta U_J + \beta_{k1}\delta U_0 \\
&= (1-\delta)(\beta_{k2}w_2 + \beta_{k1}w_1) + \beta_{k2}\delta(S_J - V_J) + \beta_{k1}\delta(S_0 - V_0) \\
&= \delta S_J - C - \beta_{k1}(\delta S_J - \delta S_0) \\
&= \delta S_J - C - (1-\delta)\varphi(y_k).
\end{aligned} \tag{17}$$

The last equality follows from the definition of β_{ki} in Eqs. (9) and (10). This payoff vector (u_k) clearly has the same incentive effect as $-\varphi(\cdot)$ and hence e^* is optimal for the agent. Moreover, given the continuation payoffs $U_j = S_j - V_j$ for $j = 0, J$, the agent's payoff from choosing strategy e^* equals

$$\begin{aligned}
\sum_k p_k(e^*)u_k - (1-\delta)e^* &= \sum_k p_k(e^*)(\delta S_J - C - (1-\delta)\varphi(y_k)) - (1-\delta)e^* \\
&= \delta\xi + (1-\delta)w_2 - \delta V_J - (1-\delta)E(\varphi|e^*) - (1-\delta)e^* \\
&= \xi - V_J + (1-\delta)(-\xi + V_J + w_2 - E(\varphi|e^*) - e^*) \\
&= \xi - V_J + (1-\delta)(-\xi + E(y|e^*) - E(\varphi|e^*) - e^*) \\
&= S_J - V_J
\end{aligned}$$

which exactly equals U_J as defined in the above. The second line of the above equation follows from the definition of C; the penultimate equality follows from the value of V_J in Eq. (16); and the last one follows from $\xi = E(y|e^*) - E(\varphi|e^*) - e^*$. All equilibrium conditions thus are satisfied.

Moreover, since $U_0 + V_0 > u_0 + v_0$, one can choose base wage w_1 so that $U_0 \geq u_0$, $V_0 \geq v_0$. □

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