Ec 476 Contracts and Organizations

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Topic 2: What to do when explicit incentives cannot be used much?

- In the first topic we saw that explicit incentives are unlikely to be useful in public organizations for a variety of reasons.

- The question is, what are the other methods that these organizations can use?

- We will examine the roles of
  - A. Competition and matching (Besley and Ghatak, 2005, 2006)
  - B. Hiring biased agents (Prendergast, 2007, 2008)
  - C. Status Incentives (Besley and Ghatak, 2008)
  - D. Worker Identity (Akerlof and Kranton, 2005 & 2008)

A. Competition and Matching (Besley and Ghatak, 2005, 2006)

- In general, two paradigms for competition

- Matching

  - There is heterogeneity in preferences

  - Value generated depends on quality of match

  - Competition is a process that leads to efficient matching in product & labour market

- Business stealing (goods are assumed to be substitutes)

  - Generates cost efficiency

  - Keeps prices low

  - Extreme form of business stealing - liquidation threats

- Corresponds to two different notions of markets or competition:

  - Horizontal: matching resources in an efficient way

- Vertical

  * "auctioning" off of a good to the highest bidder

  * all business goes to lowest cost seller through undercutting

- The first one is an ex post zero sum game, but the second one is not.

- In reality, we have a combination of both

- In the context of public goods, the first aspect is what draws political opposition

- The other aspect too can have an inequalizing effect (vertical sorting) but not always (horizontal sorting)

- Big debate in the context of public service provision.

- What is the effect of competition on productivity?

- Clear for private goods. Not clear for public goods.

- Does competition increase or reduce the role of incentive pay?

- Caroline Hoxby argues that school competition would cause public school administrators and teachers to minimize cost or raise quality if they are faced with the prospect of losing their students and funding

- Mixed evidence

  – Hoxby herself finds a positive effect ("Does Competition among Public Schools Benefit Students and Taxpayers?" American Economic Review, December 2000, 90(5), pp. 1209-38.)

  – However, this result has been questioned by Jesse Rothstein ("Does Competition Among Public Schools Benefit Students and Taxpayers? A Comment on Hoxby (2000)" forthcoming in the American Economic Review)

– Hsieh and Urquola study school competition through vouchers in Chile and find that there was no positive effect on average outcomes, although there was more sorting with private schools attracting the better students. (Forthcoming, Journal of Public Economics)

Competition As Matching: Effect on Incentives

- Based on Besley and Ghatak (2005)

- Do not model competitive process explicitly

- Focus on implications of stable matching: allocations that are immune to a deviation in which any principal & agent can negotiate a contract which makes at least one of them strictly better off without making the other worse off.

- Consider matching function μ that assigns each principal (agent) to at most one agent (principal) & allows for possibility that a principal (agent) remains unmatched, in which case he is described as "matched to himself"

- Let n_i^p & n_j^a denote no. of principals of type i & no. of agents of type j.

- Assume that $n_1^a = n_1^p$ & $n_2^a = n_2^p$ for simplicity.

- However, population of principals & agents of type 0 need not be balanced – we consider both unemployment ($n_0^a > n_0^p$) & full employment ($n_0^a < n_0^p$).

- A person on "long-side" of market gets none of the surplus. Pins down equilibrium reservation payoff of all types of agents.

- From previous analysis for a given value of $\overline{u}_j$ we can uniquely characterize optimal contracts.

- Result: Any stable matching must have agents matched with principals of the same type.

- Intuition

  - If all agents have same reservation payoff, an assortatively matched principal-agent pair can generate more surplus than one where principal & agent are of different types.

  - So if a type 1 principal wants to hire a type 2 agent, must be $\overline{u}_2 < \overline{u}_1$.

  - Given balanced population one poss. is that some type 2 principal wants to hire a type 1 agent. But that means $\overline{u}_2 > \overline{u}_1$, a contradiction.

- With full employment ($n_0^a < n_0^p$) agents receive all the surplus.

- As before, fixed wage is set at $\underline{w}$.

- Bonus payment is solved from principal's zero-profit constraint.

- In profit-oriented sector:

$$b_{00}^* = \frac{\pi_0 + \sqrt{\pi_0^2 - 4\underline{w}}}{2}.$$

- In mission-oriented sector, there will be assortative matching. Since $\pi_1 = \pi_2 = \hat{\pi}$, agents in both types of mission-oriented organizations ($i = 1, 2$) will receive the same bonus.

- Suppose π_0 is high so that the outside option of motivated agents to find a job in the profit-oriented sector binds. Then their bonuses will be:

$$b_{11}^* = b_{22}^* = \frac{\pi_0 + \sqrt{\pi_0^2 - 4\underline{w}}}{2} - \overline{\theta}$$

- As before, they work for a lower bonus due to their motivation.

- If π_0 is not high, then

$$b_{11}^* = b_{22}^* = \frac{\max\{\overline{\theta}, \hat{\pi}\} - \overline{\theta}}{2}$$

- Effort level: $e_{jj}^* = b_{jj}^* + \overline{\theta}$ for $j = 1, 2$ & $e_{00}^* = b_{00}^*$.

- Illustrates how competition & incentives interact. Two effects:

  - Matching

    * Reduces heterogeneity in contracts observed in mission-oriented sector relative to before

    * Ignoring effect of outside option bonuses are lower.

    * Raises organizational productivity

  - Outside option

* Competition among principals pins down equilibrium value of outside option (highest poss. as agents are on short side)

* If PC binding in mission oriented sector, bonuses go up.

* Productivity goes up, but due to higher incentive pay.

- The result that incentives are more high powered in profit-oriented sector may not hold:

  – If PC binds level of incentive pay in mission-oriented sector is less than in private sector by an amount $\overline{\theta}$

– Otherwise:

  * If $\overline{\theta} > \hat{\pi}$ $b^*_{11} = b^*_{22} = 0 < b^*_{00}$

  * But if $\hat{\pi} > \overline{\theta}$ & the gap is high enough, possible to have $b^*_{11} = b^*_{22} > b^*_{00}$.

- With unemployment ($n_0^a > n_0^p$)

  – Principals in profit-oriented sector receive all the surplus

  – Some agents of type 0 are unemployed.

  – Outside option of agents of types 1 & 2 is 0 (so PC does not bind)

- Now

$$
\begin{aligned}
b_{00}^* &= \frac{\pi_0}{2} \\
b_{11}^* &= b_{22}^* = \frac{\max\{\overline{\theta}, \hat{\pi}\} - \overline{\theta}}{2}.
\end{aligned}
$$

- Competition works only through the matching effect.

- Unemployment unhinges incentives in mission-oriented & profit-oriented sectors.

Application to School Competition

- Based on Besley and Ghatak, JEEA, 2006.

- Same as above but allow for both horizontal and vertical matching

- Assumption 1: $\pi_{11} \geq \pi_{22}$ and $\theta_{11} \geq \theta_{22}$ and $\pi_{12} = \pi_{21} = \underline{\pi}$ and $\theta_{12} = \theta_{21} = \underline{\theta}$.

- To ensure an interior solution for effort we assume $\pi_{11} + \theta_{11} < 1$.

- We concentrate on the case of vertical matching where:

$$\begin{aligned} \pi_{11} &> \underline{\pi} > \pi_{22} \\ \theta_{11} &> \underline{\theta} > \theta_{22}. \end{aligned}$$

- This says that type 2 principals and agents are inferior in a well-defined sense.

- Moreover, these lower types would rather be matched with type 1's if they could.

- Here, the interpretation is in terms of good and bad schools/teachers.

- Vertical matching occurs where good teachers are more motivated when they teach good students.

- Let $Y_{ij} = \max\left\{\frac{\pi_{ij}+\theta_{ij}}{2}, \theta_{ij}\right\}$.

- Then the bonus payment is characterized by

$$b_{ij}^{*} = \begin{cases} \max\{0, \frac{\pi_{ij}-\theta_{ij}}{2}\} & \text{if } \overline{u}_j < \frac{1}{2}\left\{Y_{ij}\right\}^2 \\ \sqrt{2\overline{u}_j} - \theta_{ij} & \text{if } \frac{1}{8}\left\{Y_{ij}\right\}^2 \le \overline{u}_j \le \frac{(\pi_{ij}+\theta_{ij})^2}{2}. \end{cases}$$

- The optimal effort level is given by: $e_{ij}^{*} = b_{ij}^{*} + \theta_{ij}$.

- To study matching, we write down the pay-off of the principal at the optimal contract.

- Then define as the surplus of a principal whose motivation is π_{ij} when he employs an agent whose motivation is θ_{ij} at reservation utility level z

$$S\left(\pi_{ij}, \theta_{ij}, z\right) =$$

$$\begin{aligned}
\pi_{ij}\theta_{ij} \text{ for } \pi_{ij} &< \theta_{ij}, z < \frac{1}{2}\left\{Y_{ij}\right\}^2 \\
\frac{\left(\pi_{ij}+\theta_{ij}\right)^2}{4} \text{ for } \pi_{ij} &\geq \theta_{ij}, z < \frac{1}{2}\left\{Y_{ij}\right\}^2 \\
\sqrt{2z}(\pi_{ij}+\theta_{ij}-\sqrt{2z}) \text{ for } \frac{1}{8}\left\{Y_{ij}\right\}^2 &\leq z \leq \frac{\left(\pi_{ij}+\theta_{ij}\right)^2}{2}
\end{aligned}$$

- Observe first that $S(\pi, \theta, z)$ defined above is increasing in π and θ with $\partial^2 S/\partial\theta\partial\pi > 0$.

- More specifically, it satisfies the differentiable version of the generalized increasing differences condition of Legros and Newman (2003, Proposition 3).

- Specifically:

$$
\begin{aligned}
& \frac{\partial^2 S\left(\pi, \theta, S\left(\pi, \theta', z\right)\right)}{\partial \pi \partial \theta} \\
& + \frac{\partial^2 S\left(\pi, \theta, S\left(\pi, \theta', z\right)\right)}{\partial \pi \partial z} \cdot \frac{\partial S\left(\pi, \theta', z\right)}{\partial y} \\
\geq \; & 0 \text{ for } \theta' \leq \theta
\end{aligned}
$$

- This implies that all matches will be assortative.

- We will work with the following example: Assumption 2: (i) $n_j^a > n_j^p$ for $j \in \{1, 2\}$ (ii) $n_1^a < n_1^p + n_2^p$.

- This says that there is a surplus of agents of both kinds relative to principals, but there are less type 1 agents overall than there are principals.

- We will also focus on the case where the agents of all varieties are strongly motivated: Assumption 3: $\theta_{22} \geq \pi_{11}$

- Thus $\theta_{11} > \underline{\theta} > \theta_{22}$ and $\pi_{11} > \underline{\pi} > \pi_{22}$.

- We will refer to type 1 principals and agents as “good” and those of type 2 as “bad”.

- Every school now wants to hire a good teacher.

- However, there are not enough such teachers to go around.

- The competition among bad schools for good teachers will bid up their utility.

- Since there is under-supply of effort in the model due to contractible effort, this will come in the form of higher bonuses paid to good teachers in bad schools.

- Good teachers (who are scarce overall) are the beneficiaries of this.

- The utility level of a good teacher in a bad school is given by solving:

$$S(\pi_{22}, \theta_{22}, 0) = S(\pi_{21}, \theta_{21}, \hat{u}).$$

- Using the expression for the principal's expected payoff we get:

$$\hat{u} = \frac{\left(\underline{\pi} + \underline{\theta} + \sqrt{(\underline{\pi} + \underline{\theta})^2 - 4\pi_{22}\theta_{22}}\right)^2}{8}.$$

- From Proposition 1, since bad teachers in bad schools face an outside option of zero we know that

$$b_{22} = 0$$

- Correspondingly, $e_{22} = \theta_{22}$.

- Proposition 1 also tells that the bonus pay of good teachers in bad schools will be:

$$b_{12} = \sqrt{2\hat{u}} - \theta_{12} > 0.$$

- Bonus pay here is used to clear the market for good teachers.

- However, given the underlying incentive problem, it also boosts effort which would not be the case in a standard competitive model where fixed wages are used to clear the market.

- Correspondingly $e_{12} = \sqrt{2\hat{u}} > \theta_{12} > \theta_{22}$.

- Therefore, the productivity gap between bad schools with bad teachers compared to bad schools with good teachers is now greater.

- The model allows us to think about the implications of different ways of allocating teachers to schools.

- Suppose that a bureaucrat were to randomly match teachers to schools and that there is no scope for rematching.

- A teacher can refuse to work for a school in which case her outside option is to be unemployed (i.e., $\overline{u}_j = 0$ for $j = 1, 2$).

- Because we focus on the case of strongly motivated agents all teachers get $w_{ij} = \underline{w}$ and $b_{ij} = 0$.

- Now consider what happens if we allow schools to recruit teachers freely and offer any compensation package (subject to voluntary participation).

- First, observe that this will not affect the pay or productivity of bad teachers in bad schools.

- Good teachers in bad schools will now get paid a bonus and the productivity of these schools will be higher than before.

- Also, keenness of bad schools to hire good teachers will result in good teachers in good schools getting paid a bonus and will raise productivity compared to the case with random matching.

- Under assortative matching average pay and productivity will be higher.

- However, free matching of teachers and schools will raise pay inequality among teachers compared to before.

- Also, inequality in terms of school productivity will go up.

- However, the productivity of bad schools with bad teachers will not change and so if one uses a maximin social welfare criterion, assortative matching will be preferable.

- Sorting will be horizontal if $\pi_{11} = \pi_{22}$ and $\theta_{11} = \theta_{22}$.

- In this case, the principal agent pairs are equally productive under efficient matching.

- With horizontal sorting the objectives of both efficiency and equity will be furthered relative to random matching.

B. Hiring Biased Agents (Prendergast, 2007, 2008)

- If performance is particularly noisy, it might make sense to hire very motivated agents

- In the earlier model this was costless

- But even if it is costly, it might be worthwhile

- In particular, motivated agents might be biased

- Preferences not fully aligned with the principal

- The principal might still want to hire such an agent

- Can balance this off by hiring another agent who is biased in the opposite direction

- Social work departments hire workers who are very motivated to provide benefits to clients but ignore cost-cutting

- The model below is based on Prendergast (2008).

- Organizations has two activities A and B (say research, and administration divisions)

- An agent performs two tasks, 1 and 2

- Effort exerted is e_1 and e_2

- Quadratic cost of effort: $\frac{1}{2}e_1^2 + \frac{1}{2}e_2^2$

- Task 1 effort benefits activity A only (e.g., pure research)

- Task 2 effort benefits activity A and B in proportion x and $1-x$ (e.g., running the lab efficiently)

- The output in the two divisions are, therefore:

$$
\begin{aligned}
y_A &= e_1 + xe_2 \\
y_B &= (1-x)e_2.
\end{aligned}
$$

- Principal gives equal weight to both activities A and B

- Principal's payoff or surplus is

$$y = y_A + y_B = e_1 + e_2.$$

- The principal's desired effort levels are $\hat{e}_1 = \hat{e}_2 = 1$

- Suppose only a noisy measure of surplus is available

$$\tilde{y} = (1 + d)e_1 + (1 - d)e_2.$$

- d takes the value δ or $-\delta$ where $\delta > 0$ with equal probability

- This is an unbiased measure of surplus as $E(d) = E(-d) = 0$

- If $\delta = 0$ then no noise, and if δ is large then very noisy

- For example, when $\delta < 0$ and large, what this means is that the principal can primarily observe the consequence of e_2 (how well the lab is run)

- This is similar to standard multi-tasking model

- Suppose now agent is biased between activity A and B

- Suppose agent's preference is (ignoring incentive pay) $\mu_A y_A + \mu_B y_B$

- Notice that this means agents are motivated

- Assume μ_A and μ_B are observable (no adverse selection)

- Assume $\mu_A + \mu_B = M < 2$

- Otherwise, agent is very motivated and will choose effort levels that are desired by the principal

- Left to his own devices (no incentive pay) agent will choose $e_1 = \mu_A$ and $e_2 = x\mu_A + (1-x)\mu_B$

- Notice that the paper defines the first-best incorrectly: it should be maximize the sum of the principal and the agent's payoff

$$\begin{aligned} & (\mu_A + 1)\, y_A + (\mu_B + 1)\, y_B \\ = \; & (\mu_A + 1)\, e_1 + \{(\mu_A + 1)\, x + (\mu_B + 1)\, (1 - x)\}\, e_2 \end{aligned}$$

- In particular, the first best is

$$\begin{aligned} e_1^{**} &= \mu_A + 1 \\ e_2^{**} &= (\mu_A + 1)\, x + (\mu_B + 1)\, (1 - x). \end{aligned}$$

- Suppose offer linear incentive scheme with $\beta\tilde{y} + w$

- Ignore w : it is set by the participation constraint of the worker

- Worker chooses effort anticipating that there will be some noise in the measurement

- He gets to see what d is before choosing effort.

- Principal has to form expectations, however.

- Now the ICs (from the principal's point of view) are*:

$$
\begin{aligned}
e_1 &= \mu_A + (1+d)\beta \\
e_2 &= x\mu_A + (1-x)\mu_B + (1-d)\beta
\end{aligned}
$$

- Observe that effort is increasing in intrinsic motivation and incentive pay

- So subject to these two ICs the principal maximizes

$$E(e_1 + e_2 - \frac{1}{2}e_1^2 - \frac{1}{2}e_2^2)$$

- His instrument is β.

*There is a mistake in the paper here.

- From now, on $\mu_A = \frac{M}{2} + \varepsilon$ and $\mu_B = \frac{M}{2} - \varepsilon$

- Therefore, the ICs are

$$
\begin{aligned}
e_1 &= \frac{M}{2} + \varepsilon + (1+d)\beta \\
e_2 &= \frac{M}{2} + (2x-1)\varepsilon + (1-d)\beta.
\end{aligned}
$$

- Substituting and given the fact that $E(d) = 0$:

$$
\begin{aligned}
\pi &= M + 2x\varepsilon + 2\beta \\
&\quad -\frac{1}{2}E\left(\frac{M}{2} + \varepsilon + (1+d)\beta\right)^2 \\
&\quad -\frac{1}{2}E\left(\frac{M}{2} + (2x-1)\varepsilon + (1+d)\beta\right)^2 \\
&= M + 2x\varepsilon + 2\beta \\
&\quad -\frac{1}{2}\left(\frac{M}{2} + \varepsilon\right)^2 - \left(\frac{M}{2} + \varepsilon\right)\beta - \frac{1}{2}\left(\frac{M}{2} + (2x-1)\right.
\end{aligned}
$$

- (Using the fact that $E(1+d)^2 = (1+\delta)^2$)

- Differentiate with respect to β to get the first order condition:

$$\beta^* = \frac{1 - \frac{M}{2} - x\varepsilon}{1 + \delta^2}.$$

- Under this contract the optimal expected effort levels are

$$\begin{aligned} E(e_1) &= \frac{M}{2} + \varepsilon + \frac{1 - \frac{M}{2} - x\varepsilon}{1 + \delta^2}. \\ E(e_2) &= \frac{M}{2} + (2x - 1)\varepsilon + \frac{1 - \frac{M}{2} - x\varepsilon}{1 + \delta^2}. \end{aligned}$$

- Observations:

  – As δ^2 rises β falls for standard reasons

– As M rises β falls as in Besley-Ghatak (2005)

– As x rises, β falls since x being different from 1 is what causes bias

– As ε rises β falls as less need to give incentives to a biased agent

– The choise of ε will be positive for a range of x.

– Suppose $x = 1$. Then agent's action only affects activity A and so choose a high μ_A person

- Consider $x = \frac{1}{2}$. Then you still want a biased agent.

- If $x = 0$ then the problem being symmetric, prinicpal and agent preferences are aligned, and definitely choose an unbiased agent.

C. Status Incentives (Besley-Ghatak 2008)

- A principal employs a continuum of agents of size one, each of whom works independently on a project whose success depends on effort and is uncorrelated across the agents.

- The project yields an output π_0 in all states of the world.

- In addition, it generates $\pi > 0$ for the principal if is successful.

- The agent's effort e determines the probability of success.

- We assume $e \in [0, 1]$ and the cost of effort is $\frac{c}{2}e^2$.

- The agent has an outside option of u which we set at zero.

- We assume there is limited liability.

- Outcome measure is noisy: signal $\sigma \in \{0, 1\}$

- Let $\gamma(1)$ denote the probability that the signal is $\sigma = 1$ when the project is successful and let $\gamma(0)$ denote the probability that the signal is $\sigma = 1$ when the project is a failure.

- We assume that the signal is (weakly) informative in the sense that $\gamma(1) \geq \gamma(0)$.

- If $\gamma(1) = 1$ and $\gamma(0) = 0$, then output is perfectly observed.

- The first-best effort level is:
$$e^* = \arg\max_e \left\{ e\pi - \frac{c}{2}e^2 \right\} = \frac{\pi}{c}.$$

- A contract is a pair $\{b(\sigma)\}_{\sigma \in \{0,1\}}$.

- Let $\Delta = \gamma(1) - \gamma(0)$.

- Recall that IC is

$$\hat{e} = \frac{\Delta \left[b(1) - b(0) \right]}{c}.$$

- Then we have: the optimal contract sets $b(0) = 0$ and

$$b(1) = \max\left\{0, \frac{\pi\Delta - \gamma(0)\,c}{2\Delta^2}\right\}.$$

- The corresponding effort level is

$$e = \max\left\{0, \frac{b(1)\Delta}{c}\right\}.$$

- This result is intuitive. It is optimal to reduce $b(0)$ down to the minimum possible level (given limited liability), i.e., 0, as extra effort can be elicited while reducing the principal's cost. The interesting issue is whether it is worthwhile to offer a bonus when the verifiable signal $\sigma = 1$ is observed.

- Here, Proposition 1 says that, if the output is sufficiently well-measured, then there is positive incentive pay to elicit effort.

- Specifically, this will be the case if

$$\frac{\pi}{c} \geq \frac{\gamma\,(0)}{\Delta}.$$

- This is more likely to be satisfied the higher is $\gamma(1)$ and the lower is $\gamma(0)$. In particular, it will always hold when $\gamma\,(0)$ is close enough to zero.

- If this condition does not hold, it is not worthwhile for the principal to use any incentive pay at all.

- We now allow the principal to introduce a purely nominal reward

- A pure positional good to the agent in the event that he produces high output for the principal.

- This could be a job title change (promotion from Associate to Full Professor), granting some agents interior offices rather than open-plan desks or calling some employees "employee of the week".

- We focus on the case where this good is completely free from the principal's point of view.

- We denote the award of a discrete positional good by $\eta \in \{0, 1\}$ and suppose that this good generates utility of $h(\hat{e})$ where $\hat{e}$ is the fraction of workers in the organization who are awarded the positional good.

- Assume that $h'(\hat{e}) < 0$ and $h(\hat{e}) = 0$ for $\hat{e} \geq \overline{e}$ where $\overline{e} \leq 1$.

- This says that there is a crowding effect – if everyone gets the positional good then its value goes to zero.

- We now consider how awarding positional goods to all agents who produce π affects the choice of monetary incentives.

- To get a simple closed form solution suppose that:

$$h(\hat{e}) = \begin{cases} \theta - \lambda\hat{e} & \text{if } \hat{e} \leq \theta/\lambda \\ 0 & \text{otherwise.} \end{cases}$$

- Thus, $\bar{e} = \theta/\lambda$ is the fraction of agents producing high effort above which the value of status goes to zero.

- In this case organizational effort (in a Nash equilibrium) will be:

$$\hat{e} = \frac{\theta + \Delta\,[b(1) - b(0)]}{c + \lambda}$$

which we assume is less than θ/λ.

- The optimal contract sets

$$b(0) = 0 \;\&\; b(1) = \max\left\{0, \frac{(\pi - \theta)\,\Delta - \gamma(0)(c + \lambda)}{2\Delta^2}\right\}.$$

- The corresponding effort level is

$$e = \frac{\theta + \Delta b(1)}{c + \lambda}.$$

- It is clear upon inspection that $b(1)$ is lower and e is higher compared to the previous case.

- This result gives a clear idea of how adding status incentives has an impact on the choice of monetary compensation.

- They relax monetary incentives in two distinct ways.

  - First, there is a direct effect due to the fact that status incentives create motivated agents

  - Second, there is an indirect effect due to crowding whereby increasing monetary rewards reduce the value of status and hence reduce the principal's use of monetary incentives.

- We will now see a bonus being offered if $\sigma = 1$ if and only if:

$$\frac{\pi - \theta}{c + \lambda} \geq \frac{\gamma\left(0\right)}{\Delta}.$$

- The condition for the use of incentive pay to be optimal for the principal is more stringent than in the absence of status incentives. Intuitively, incentive pay is costly while status is costless from the principal's point of view.

- What is the incentive of the firm to use status incentives?

- We show that firms that use status incentives will have higher payoffs, other things being equal.

- The expected payoff of the principal from a single agent, in the case of an interior solution, is:

$$\Pi = \pi_0 + e\pi - \Delta eb(1) - \gamma(0)b(1).$$

- As $b(1) = \frac{(c+\lambda)e-\theta}{\Delta}$ this can be viewed as a function of e.

- Since the principal can be viewed as "choosing" e via $b(1)$ by the envelope theorem, only the direct effect of θ needs to be considered.

- This turns out to be:
$$\frac{\partial \Pi}{\partial \theta} = e + \frac{\gamma(0)}{\Delta} > 0.$$

- That is, the principal always benefits from having a status-motivated agent and since creating status incentives is costless in our framework, will always do so.

- The intuition is simple: anything that raises effort for "free" will raise expected profits.

- Our model has implications for the balance of monetary and status incentives that we are likely to see an organization using.

- Even though an organization faces no variable cost in creating status incentives, suppose that it bears a fixed cost in setting up such a system of rewards.

- Differentiating the above condition we get:

$$\frac{\partial^2 \Pi}{\partial \theta \partial \pi} = \frac{1}{2(c+\lambda)} > 0.$$

- Hence firms with higher returns from high output will tend to benefit most from introducing status incentives.

- To see this, observe that how much expected profits go up when θ increases depends on e which is increasing in π.

- The model also predicts that the case for status incentives is higher, the more severe is the problem of measuring π.

- To see this most clearly, we normalize $\gamma(1)+\gamma(0)=1$ and let $q\equiv\gamma(0)=1-\gamma(1)$.

- The higher is q, the less informative is σ as a measure of high output.

- Now it is straightforward to show that

$$\frac{\partial^2 \Pi}{\partial \theta \partial q} = \frac{1}{2\left(1-2q\right)^2} > 0.$$

- To understand this, note that an increase in θ raises expected profits via two channels.

  – First, it raises effort for a given bonus level.

  – Second, it enables the firm to reduce the bonus.

- Bonuses are a costly and inefficient instrument to elicit effort when the signal of output is noisy.

- As a result, if q goes up, even though the first source of the gain is smaller, the second source of the gain is large and the net effect is to raise the marginal gain from having motivated workers.

- All firms gain from using status incentives but the gains are higher for firms where output is harder to verify and the return to higher output is greater.

- Status incentives work by creating social divisions.

- So far, we have assumed that they raise the utility of the winner while having no impact on the utility of those who are not awarded them.

- If this not the case incentives could be introduced even in situations where the welfare of agents goes down.

D. Identity and Incentives (Akerlof-Kranton, 2008)

- Workers can identify with the firm and fellow workers.

- This depends on how they are treated.

- If they are supervised, they feel like outsiders

- Otherwise they feel like insiders.

- Add the term $-t_c(\alpha e^* - \beta e)^2$ to their payoff

- e^* is the ideal effort level of other workers under identity c

- When $\alpha = 0$ this is similar to Besley-Ghatak (2005) sense of motivation under the correct mission

- Akerlof and Kranton set $\alpha = \beta = 1$.

- If workers are supervised then their participation constraint tightens

- Also the incentive constraints of workers are affected: doing the right thing is cheaper under the right identity

Appendix (Supplementary Material - Not required Reading)

Competition and Incentives in Private Sector

- Not much known about role of competition on incentives in general, even in the context of the private sector

- Useful to know this, so that we have a benchmark vis a vis competition and incentives in public organizations

- Klaus Schmidt: "Managerial Incentives and Product Market Competition", Review of Economic Studies, 1997.

- Principal: firm owner

- Agent: manager

- Agent undertakes unobservable effort to reduce cost

- If successful, profits are π_H otherwise π_L

- Let $\pi \equiv \pi_H - \pi_L$

- There is a cost of liquidating the firm to the manager L which could happen with some probability l if cost is high

- Let $\lambda \equiv lL$

- Otherwise same as our benchmark model.

- Therefore, $e = b + \lambda$

- Given this (we focus on case where the PC does not bind), owner chooses $b = \frac{\pi - \lambda}{2}$

- Assume $\pi > L$ so b always positive

- Equilibrium effort $e = \frac{\pi + \lambda}{2}$

- Therefore, effort is increasing in liquidation cost.

- Principal better off, agent may or may not be as λ goes up (Exercise: prove it.)

- Effect of competition.

  - Could affect liquidation costs.

  - Also, likely to reduce revenue, and hence π_H and π_L

- The question is, does it affect π?

- Therefore, two effects of competition

  - To the extent it increases liquidation costs, incentive pay goes down and effort goes up

- To the extent it increases π, same thing.

- But possible to reduce π too.

Start with Monopoly

- Let $\pi_L = 0$ and so $\pi_H = \pi$

- Suppose the cost reductions are "drastic": even monopoly price with low cost is lower than competitive price with high cost

- Even if cost reduction does not take place, monopoly is not liquidated so $l = 1$

- Therefore, initially

$$b = \frac{\pi - L}{2} \text{ and } e = \frac{\pi + L}{2}$$

Now consider duopoly

- Let e' be the probability of success of rival firm

- Positive profits only if you succeed and the other firm fails (probability $e(1 - e')$)

- If both succeeds or both fails then both earn zero profits

- If you fail and the other firm succeeds, your firm is liquidated (Probability $(1 - e)e'$)

- As before, focus on case where PC does not bind.

- Agent's choice of e :

$$\max_e \left\{ e(1-e')b - (1-e)e'L - \frac{1}{2}e^2 \right\}$$

which yields

$$e = (1-e')b + e'L.$$

- Principal maximizes

$$\max_b e(1-e')(\pi - b)$$

subject to the ICC

- This yields

$$b = \frac{\pi}{2} - \frac{1}{1-e'}\frac{e'L}{2}.$$

- Substituting back in ICC effort choice is given by equation

$$2e = (1 - e')\pi + e'L$$

- In a symmetric Nash equilibrium

$$e = e' = \frac{\pi}{2 + \pi - L} .$$

- Clearly, bonuses have gone down: this is the rent reduction effect.

- Has effort gone up?

- Depends on the condition

$$\frac{\pi}{2 + \pi - L} > \frac{\pi + L}{2}$$

- This simplifies to

$$2 > \frac{\pi + L}{\pi} (2 + \pi - L) .$$

- As we assume $\pi - L > 0$ this cannot hold.

Exercise: More General Case: $n > 2$ Firms

- Suppose there are $n \geq 2$ firms

- Assume that profits are always zero for a firm unless it happens to be the one and only one firm that has low cost that results in π_H

- The probability of this, conditional on having low cost, is $(1 - e')^{n-1}$

- Assume also that the probability of liquidation of a firm when it has low cost is zero, and conditional on having high cost it is $1 - (1 - e')^{n-1}$

- What is the effect of increasing n on b and e?