GR 6307
Public Economics and Development

3. The Personnel Economics of the Developing State: Delivering Services to the Poor

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Outline

Theory

Financial Incentives

Non-financial Incentives

Recruitment & Selection

Open Questions

Outline

Theory

- Aghion & Tirole (JPE 1997) *Formal and Real Authority in Organizations*
- Banerjee, Hanna & Mullainathan (2012) *Corruption*
- Benabou & Tirole (AER 2006) *Incentives and Prosocial Behavior*
- Besley & Ghatak (AER 2005) *Competition and Incentives with Prosocial Agents*

Aghion & Tirole (1997): Model Setup

- Principal-agent framework: Agent is choosing among $n \geq 3$ a priori identical projects.
- Project k has profit B_k for the principal and private benefit b_k for the agent.
- They can also do nothing: $B_0 = b_0 = 0$
- Congruence:
  - Choosing the principal's preferred project gives her B and the agent βb.
  - Choosing the agent's preferred project gives him b and the principal αB.
  - $0 < \alpha, \beta \leq 1$ are exogenous parameters

Aghion & Tirole (1997): Model Setup

- Principal is risk neutral. Utility is

$$B_k - w$$

w is wage paid to the agent

- Agent is risk averse and has limited liability: $w \geq 0$. Utility is

$$u(w) + b_k$$

Agent is so risk averse that w can't depend on outcomes

- Initially, nobody knows projects' payoffs. Gathering information is costly.
- If agent pays cost $g_A(e)$ he learns the payoffs of all projects with probability e. With probability $1-e$ he learns nothing.
- Principal can pay cost $g_P(E)$ to learn payoffs with probability E. With probability $1-E$ she learns nothing.

Aghion & Tirole (1997): Authority

1. *P-formal authority:* The principal has formal authority. She may overrule the agent's recommendation.
2. *A-formal authority:* The agent picks his preferred project and cannot be overruled by the principal.

- Contracts specify an allocation of formal authority to either the principal or the agent.
- *Real authority:* Who actually gets to make the decision? Either because agent has formal authority or because P is just "rubber-stamping" agent's recommendation
- Timing:
  1. Prinicpal proposes a contract
  2. Parties gather information
  3. The party without formal authority communicates a subset of the projects' payoffs (s)he has learned
  4. The controlling party picks a project

Aghion & Tirole (1997): Utilities

- Under *P*-formal authority, the utilities are:

$$u_P = \underbrace{EB}_{\text{P picks her preferred project}} + \underbrace{(1-E)\,e\alpha B}_{\text{A suggests his preferred project}} - g_P(E)$$

$$u_A = \underbrace{E\beta b}_{\text{P picks her preferred project}} + \underbrace{(1-E)\,eb}_{\text{A suggests his preferred project}} - g_A(e)$$

- Under *A*-formal authority, the utilities are:

$$u_P^d = \underbrace{e\alpha B}_{\text{A picks his preferred project}} + \underbrace{(1-e)\,EB}_{\text{P suggests her preferred project}} - g_P(E)$$

$$u_A^d = \underbrace{eb}_{\text{A picks his preferred project}} + \underbrace{(1-e)\,E\beta b}_{\text{P suggests her preferred project}} - g_A(e)$$

Aghion & Tirole (1997): Basic Tradeoff

- In this model there is a basic tradeoff between loss of control and initiative.
- The reason is that efforts are *strategic substitutes:* The more effort the principal makes, the less the agent wants to (&vv).
- To see this, the FOCs for effort when the principal has formal authority are

$$(1-\alpha e)\,B = g_P'(E)$$
$$(1-E)\,b = g_A'(e)$$

- Both of these reaction curves slope *down*.
- Imagine the principal's effort became more costly: $g_P' \uparrow$
  - Probability of learning the best project goes down. The principal loses real authority (control)
  - The reduction in E will encourage initiative by the agent:, $e \uparrow$. The principal gains

Aghion & Tirole (1997): Delegation

- If the principal cedes formal authority to the agent the effort FOCs become

$$(1-e)\,B = g'_P\,(E)$$
$$(1-\beta E)\,b = g'_A\,(e)$$

- These yield an equilibrium $\left(E^d, e^d\right)$ where
  - $e < e^d$: Greater initiative by the agent
  - $E > E^d$: Loss of formal *and* real authority to the agent.
  - Less effort required from principal
  - Agent is better off $\rightarrow$ slackens participation constraint so could lower wage

Aghion & Tirole (1997): Span of Control

- Consider a principal with multiple agents where the principal doesn't want to delegate.
- How many agents to hire? How to encourage effort among many agents?
- m identical agents. Each one solving the problem above.
- Principal's disutility is $g_P\left(\sum_i E_i\right)$, agents' tasks are independent. Fixed cost f per agent.

$$u_P = \sum_i \left[E_i B + (1 - E_i)\, e_i \alpha B - f\right] - g_P\left(\sum_i E_i\right)$$

Aghion & Tirole (1997): Span of Control

- Assume a symmetric equilibrium, each agent gets the same effort E from the principal. FOCs are

$$(1 - \alpha e) B = g_P' (mE)$$
$$(1 - E) b = g_A' (e)$$

  with solution $\{E(m), e(m)\}$.

- Principal's utility from m agents is

$$u_P(m) \equiv mR(E(m), e(m)) - g_P(mE(m))$$

  where $R(E(m), e(m)) \equiv E(m) B + [1 - E(m)] e(m) \alpha B - f$ is revenue per agent.

Aghion & Tirole (1997): Span of Control

- The optimal team size m then satisfies

$$\frac{du_P}{dm} = \underbrace{\underbrace{R\left(E\left(m\right), e\left(m\right)\right)}_{\text{extra revenue}} - \underbrace{E\left(m\right) g_P'\left(mE\left(m\right)\right)}_{\text{overload cost}}}_{\text{Marginal profit}<0}$$

$$+ \quad \underbrace{m\frac{\partial R}{\partial e}\frac{\partial e}{\partial m}}_{\text{initiative effect }>0} \quad = 0$$

- Principal commits to overhiring, being overloaded and underinvesting in E in order to encourage initiative e

Aghion & Tirole (1997): Wages and Effort

- Now reintroduce wage effects in the model where the principal has formal authority.
- How do changes in wages affect real authority?
- Suppose that two of the projects are relevant and give the principal profits of B and 0. This implies $\alpha = \beta =$probability they have the same preferred project.
- The agent gets a wage $w \geq 0$ when the principal's profit is B
- Principal's net gain is now $B - w$
- If the agent has information and real authority, his average net payoff is

$$\tilde{b} = \begin{cases} \underbrace{b}_{\text{choose preferred proj}} + \underbrace{\alpha u(w)}_{\text{w/pr } \alpha \text{, congruence}} & \text{if } u(w) < b \\ \underbrace{u(w)}_{\text{choose principal's preferred proj}} + \underbrace{\alpha b}_{\text{w/pr } \alpha \text{, congruence}} & \text{if } u(w) \geq b \end{cases}$$

Aghion & Tirole (1997): Wages and Effort

- Now the FOCs are

$$(1-\alpha e)\,\tilde{B} = g_P'(E)$$
$$(1-E)\,\tilde{b} = g_A'(e)$$

- Denote solution to this as $\{E(w), e(w)\}$. Then by backward induction solve for w

$$\frac{du_P}{dw} = \underbrace{(1-E)\,\alpha\,(B-w)\,\frac{de}{dw}}_{\text{additional effort}} - \underbrace{[E+(1-E)\,e\alpha]}_{\text{higher wage bill}}$$

- Higher wages increase real authority:
  1. Stronger incentives $\rightarrow$ agent more likely to make a recommendation
  2. Principal monitors less $\rightarrow$ less likely to overrule the agent

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Banerjee *et al.* 2012: Setup

- The government is allocating “slots” through a bureaucrat
- Continuum of slots of size 1 to be allocated to population of size $N > 1$
- 2 types of agents, H and L with masses N_H, N_L.
- Social value of a slot for type H if H, L for type L, $H > L$
- private benefits are l, and h, and ability to pay is $y_h \leq h$ and $y_l \leq l$ due to credit constraints.

Banerjee *et al.* 2012: Setup

- Testing technology. Test for an amount of time t
- probability type L fails (outcome F) is $\phi_L(t)$, $\phi_L'(t) \geq 0$
- Type H never fails (always get outcome S) if she wants to pass.
- Both can opt to deliberately fail
- Cost of testing is νt to the bureaucrat and δt to the applicant

Banerjee *et al.* 2012: Possible Mechanisms

- Bureaucrats announce direct mechanisms that they commit to ex ante.
- A mechanism is a vector $R = (t_x, p_{xr}, \pi_{xr})$
  - t_x amount of testing of each announced type $x = H, L$
  - π_{xr} is the probability of getting a slot if announce type x and get result $r = F, S$
  - p_{xr} is the price paid by xr
- Restrict to winner-pay mechanisms
- 2 incentive compatibility constraints:
  1. High types prefer not to mimic low types:

$$\pi_{HS}\left(h - p_{HS}\right) - \delta t_H \geq \pi_{LS}\left(h - p_{LS}\right) - \delta t_L$$

  2. Low types don't mimic high types:

$$\begin{aligned} &\pi_{LS}\left(l - p_{LS}\right)\left[1 - \phi_L\left(t_L\right)\right] + \pi_{LF}\left(l - p_{LF}\right)\phi_L\left(t_L\right) - \delta t_L \\ \geq &\pi_{HS}\left(l - p_{HS}\right)\left[1 - \phi_L\left(t_H\right)\right] + \pi_{HF}\left(l - p_{HF}\right)\phi_L\left(t_H\right) - \delta t_H \end{aligned}$$

Banerjee *et al.* 2012: Possible Mechanisms

- Clients can also walk away $\rightarrow$ 2 participation constraints:
  1. High types don't walk away

$$\pi_{HS}\left(h-p_{HS}\right)-\delta t_{H}\geq 0$$

  2. Low types don't walk away

$$\pi_{LS}\left(l-p_{LS}\right)\left[1-\phi_{L}\left(t_{L}\right)\right]+\pi_{LF}\left(l-p_{LF}\right)\phi_{L}\left(t_{L}\right)-\delta t_{L}\geq 0$$

- There is only a mass 1 of slots so

$$N_{H}\pi_{HS}+N_{L}\pi_{LS}\left[1-\phi_{L}\left(t_{L}\right)\right]+N_{L}\pi_{LF}\phi_{L}\left(t_{L}\right)\leq 1$$

- Finally the clients can't borrow, so they can't pay more than they have

$$p_{Hr}\leq y_{H},\ r=F,S$$
$$p_{Lr}\leq y_{L},\ r=F,S$$

- Define $\mathbf{R}$ as the set of rules R that satisfy these constraints

Banerjee et al. 2012: Rules

- The government sets rules $\mathcal{R} = (T_x, P_{xr,}\Pi_{xr})$
  - T_x are permitted tests t_x
  - P_{xr} are permitted prices for each type
  - Π_{xr} are permitted assignment probabilities π_{xr}
- Assume that $\mathcal{R}$ is feasible: There's at least one $R \in \mathbf{R}$ satisfying the rules.
- If $\mathcal{R}$ is not a singleton, then the bureaucrat has *discretion*.
- Government also chooses p a price the bureaucrat has to pay the government for each slot he gives out.

Banerjee et al. 2012: Bureaucrats

- For each mechanism $R \in \mathbf{R} \cap \mathcal{R}$ that follow the rules, the bureaucrat's payoff is

$$\underbrace{N_H \pi_{HS} (p_{HS} - p)}_{\text{profits from } H \text{ types}} + \underbrace{N_L \pi_{LS} (p_{LS} - p) (1 - \phi_L (t_L))}_{\text{profits from } L \text{ types who pass}}$$
$$+ \underbrace{N_L \pi_{LF} (p_{LF} - p) \phi_L (t_L)}_{\text{profits from } L \text{ types who fail}} - \underbrace{\nu N_H t_H - \nu N_L t_L}_{\text{costs of testing}}$$

- If the bureaucrat uses a mechanism $R \in \mathbf{R} \cap \mathcal{R}^c$ that's against the rules, there's an extra cost γ of breaking the rules.
- Assume γ comes from a distribution $G(\gamma)$. As a result, $R(\mathcal{R}, \gamma)$ will be the mechanism chosen by a bureaucrat with corruption cost γ when the rule is $\mathcal{R}$

Banerjee et al. 2012: The Government

- Assume the government only cares about social value of slots (Could generalize. How?)
- Government's objective is to choose the rules $\mathcal{R}$ to maximize

$$\underbrace{\int N_H \pi_{HS}\left(R\left(\mathcal{R},\gamma\right)\right) H dG\left(\gamma\right)}_{\text{(expected) social value of slots to } H}$$

$$+\underbrace{\int N_L \pi_{LS}\left(R\left(\mathcal{R},\gamma\right)\right)\left[1-\phi_L\left(t_L\left(R\left(\mathcal{R},\gamma\right)\right)\right)\right] L dG\left(\gamma\right)}_{\text{social value of slots to } L \text{ who pass test}}$$

$$+\underbrace{\int N_L \pi_{LF}\left(R\left(\mathcal{R},\gamma\right)\right)\phi_L\left(t_L\left(R\left(\mathcal{R},\gamma\right)\right)\right) L dG\left(\gamma\right)}_{\text{social value of slots to } L \text{ who fail test}}$$

$$-\underbrace{\int \left(\nu+\delta\right) N_H t_H\left(R\left(\mathcal{R},\gamma\right)\right) dG\left(\gamma\right)}_{\text{social cost of testing } H}-\underbrace{\int \left(\nu+\delta\right) N_L t_L\left(R\left(\mathcal{R},\gamma\right)\right) dG\left(\gamma\right)}_{\text{social cost of testing } L}$$

Banerjee et al. 2012: 4 Cases

Valuation of Slot	Agent's Relative Ability to Pay	
	$y_H > y_L$	$y_H \leq y_L$
$h > l$	Case I: Alignment	Case III: Inability to Pay
$h \leq l$	Case II: Unwillingness to Pay	Case IV: Misalignment

- Case I: Social and private value rankings align
  1. Pure market case $H = h = y_H$, $L = l = y_L$
  2. Choosing an efficient contractor: H types are more efficient, make more money $h > l$. Also probably $y_H = h$ and $y_L = l$
  3. Allocating import licenses: H types make most profits. But credit constraints might bind: $y_H < h = H$ and $y_L < l = L$

Banerjee et al. 2012: 4 Cases

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	$y_H > y_L$	$y_H \leq y_L$
$h > l$	Case I: Alignment	Case III: Inability to Pay
$h \leq l$	Case II: Unwillingness to Pay	Case IV: Misalignment

- Case II: Seems pretty unlikely.
  1. A merit good? e.g. subsidized condoms. H are high risk types. But they like risk so $h < l$. Could also be richer so $y_H > y_L$.

Banerjee et al. 2012: 4 Cases

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	$y_H > y_L$	$y_H \leq y_L$
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- Case III: Social and pivate values are aligned, but the high value types can't afford it as much as the low value types
  1. Hospital beds. H needs bed urgently (e.g. cardiac vs cosmetic surgery). $H = h > L = l$. But no reason to assume H can afford more. e.g. $y_H = y_L = y$
  2. Targeting subsidized food to the poor. $H = h > L = l$ but $y_H < y_L$
  3. Allocating government jobs. Best candidates also value job the most (possibly because of private benefits!). But constrained in how much they can pay for the job up front.

Banerjee et al. 2012: 4 Cases

Valuation of Slot	Agent's Relative Ability to Pay	
	$y_H > y_L$	$y_H \leq y_L$
$h > l$	Case I: Alignment	Case III: Inability to Pay
$h \leq l$	Case II: Unwillingness to Pay	Case IV: Misalignment

- Case IV: The government wants to give the slots to those who value it the least
    1. Law enforcement: Slot is avoiding jail $H > 0 > L$, $y_H = y_L = y$, $h = l > 0$
    2. Driving licenses. Bad drivers more likely to get in trouble, so $H > 0 > L$, $y_H = y_L = y$. $h < l$
    3. Procurement: Imagine there are high and low quality firms. The slot is the contract. Want to buy from high quality firms $(H > L)$ even though costs higher $(l > h)$. Without credit constriants, $y_H = h$ and $y_L = l$

Banerjee et al. 2012: Alignment

- Assume $N_H < 1$ but $L > 0$ so optimal to give leftover slots to L
- We will analyze 4 possible mechanisms:

1. The socially optimal mechanism
2. All slots to the highest bidder: The *auction* mechanism
3. Pay to avoid missing out on a slot: The *monopoly* mechanism
4. Using testing to deter mimicry: The *testing* mechanism

- We will characterize each mechanism and show when the bureaucrat will pick each one

Banerjee et al. 2012: Alignment

- Candidate solution:

$$p_H = y_L + \epsilon,\ p_L = y_L$$
$$\pi_H = 1,\ \pi_L = \frac{1 - N_H}{N_L}$$
$$t_H = t_L = 0$$

- Low types can't mimic (can't afford p_H). High types won't mimic as long as

$$\underbrace{h - (y_L + \varepsilon)}_{\text{slot for sure at } p_H} \geq \underbrace{\frac{1 - N_H}{N_L}(h - y_L)}_{\text{slot w/pr } (1-N_H)/N_L \text{ at price } p_L}$$

Banerjee et al. 2012: Alignment

- This can always be guaranteed for small enough ϵ
- Affordable to H since $y_H > y_L$
- Feasible since π_L chosen to satisfy slot constraint
- Let E be set of ϵs such that this mechanism is in $\mathcal{R}$
- Will the bureaucrat choose $\epsilon \in E$? Given the fixed cost of breaking the rules, if he breaks them, he'll maximize his profits.

Banerjee et al. 2012: Alignment

- How can the bureaucrat extract more rents? Given π_L the highest price he can charge Hs is

$$p_H = p_H^* = \min\left\{ y_H, y_L + (h - y_L)\frac{N-1}{N_L} \right\}$$

- $\Rightarrow$ Auction mechanism

$$p_H = p_H^*,\ p_L = y_L$$
$$\pi_H = 1,\ \pi_L = \frac{1-N_H}{N_L}$$
$$t_H = t_L = 0$$

Banerjee et al. 2012: Alignment

- The auction mechanism still leave Hs positive surplus: $p_H^* < y_H$. Can the bureaucrat extract more?
- He needs to satisfy the mimicry constraint. So he can play with π_L to do this and maybe get more money.
- $\Rightarrow$ the Monopoly mechanism.

$$p_H = \tilde{p}_H \leq y_H,\ p_L = y_L$$
$$\pi_H = 1,\ \pi_L = \min\left\{\frac{h - \tilde{p}_H}{h - y_L}, \frac{1 - N_H}{1 - N_L}\right\}$$
$$t_H = t_L = 0$$

- Note, this mechanism is inefficient whenever $\pi_L < (1 - N_H) / (1 - N_L)$. Slots are wasted

Banerjee et al. 2012: Alignment

- Will the bureaucrat prefer the auction or monopoly mechanism?
- The profits to the bureaucrat from the monopoly mechanism are
$$N_H\left(\tilde{p}_H - p\right) + N_L \frac{h - \tilde{p}_H}{h - y_L}\left(y_L - p\right)$$
- Note that at $\tilde{p} = y_L + \left(h - y_L\right)\left(N - 1\right)/N_L$ he gets the auction mechanism profit
- Profits are increasing in $\tilde{p}_H$ iff
$$N_H > N_L \frac{y_L - p}{h - y_L}$$
- If this condition holds, the monopoly mechanism with $\tilde{p}_H = y_H$ dominates.

Banerjee et al. 2012: Alignment

- Finally, consider the testing mechanism:

$$p_H = \min\left\{y_H, h - (h-l)\,\frac{1-N_H}{N_L}\right\},\ p_{LS} = p_{LF} = y_L$$

$$\pi_H = 1,\ \pi_{LS} = \pi_{LF} = \frac{1-N_H}{N_L}$$

$$t_H = 0,\ t_L = \max\left\{0, \frac{1}{\delta}\min\left\{(h-y_L)\,\frac{1-N_H}{N_L} - (h-y_H)\,, \right.\right.$$
$$\left.\left. (l-y_L)\,\frac{1-N_H}{N_L}\right\}\right\}$$

- Aim: Use testing to relax the IC constraint that Hs don't mimic Ls

Banerjee et al. 2012: Alignment

- Note testing here is completely wasteful: Nothing depends on the outcome.
  - H types more likely to pass, so don't want to reward passing (trying to discourage pretending to be L)
  - H types can fail on purpose, so don't want to reward failing
- Testing relaxes the IC constraint though:

$$h - p_H \geq (h - y_L)\frac{1 - N_H}{N_L} - \delta t_L$$

  - RHS decreasing in t_L so can increase p_H
- Can't go past y_H so

$$\delta t_L \leq h - y_H - (h - y_L)\frac{1 - N_H}{N_L}$$

- Also can't scare away all the Ls

$$\delta t_L \leq (l - y_L)\frac{1 - N_H}{N_L}$$

Banerjee et al. 2012: Alignment

- This doesn't exhaust all possible mechanisms, but they're useful archetypes. So which one will the bureaucrat choose?
- Scenario 1: Suppose that $(h - y_L)\frac{N-1}{N_L} + y_L \geq y_H$. Now the auction mechanism extracts the most rents. The government gives the bureaucrat full discretion and sets p to dicide the surplus between them.
- Scenario 2: $(h - y_L)\frac{N-1}{N_L} + y_L < y_H$ but testing is a) easy: $\nu = 0$, and b) effective, $y_H \leq h - (h - l)\frac{1-N_H}{N_L}$.
  - Government can set a rule that price must be below $(h - y_L)\frac{N-1}{N_L} + y_L$ and there cannot be any testing. Bureaucrats with high γ will follow this rule and choose the auction mechanism. Those with low γ will break it and choose either the testing or monopoly mechanism. In equilibrium there are both bribes and inefficiency.
  - Note that therefore the optimal rules depend on the degree of corruptibility of the bureaucrats.

Banerjee et al. 2012: Alignment

- Scenario 3: $(h - y_L)\,\frac{N-1}{N_L} + y_L < y_H$ but testing is hard: $\nu \gg 0$ so bureaucrats don't use red tape.
- Without rules the bureaucrats choose either auction or monopoly mechanism.
- They choose the monopoly mechanism (which the govt dislikes) if

$$N_H > N_L \frac{y_L - p}{h - y_L}$$

  - Government can set low p to avoid monopoly mechanism
- Government may prefer to cap the price again. There will be bribery, and also inefficiency amongst those choosing the monopoly mechanism.

Banerjee et al. 2012: Inability to Pay

- Focus on Banerjee (1997) special case: $L > 0$, $N_H < 1$, $h > l$, $y_H = y_L = y < l$, $\phi_L(t) = 0$
- Three mechanisms:

1. Auction mechanism:

$$p_H = y,\ p_L = l - \frac{N_L}{1 - N_H}(l - y)$$
$$\pi_H = 1,\ \pi_L = \frac{1 - N_H}{N_L}$$
$$t_H = t_L = 0$$

- H types prefer paying the higher price and getting the slot for sure.

Banerjee et al. 2012: Inability to Pay

2. Testing mechanism:

$$p_H = y,\ p_L = y$$
$$\pi_H = 1,\ \pi_L = \frac{1 - N_H}{N_L}$$
$$t_H = \frac{N_H + N_L - 1}{N_L}\left(l - y\right),\ t_L = 0$$

- Satisfy the IC constraint by making H types do the test, even though they're guaranteed to pass.

3. Lottery mechanism:

$$p_H = y,\ p_L = y$$
$$\pi_H = \pi_L = \frac{1}{N_H + H_L}$$
$$t_H = 0,\ t_L = 0$$

Banerjee et al. 2012: Inability to Pay

- Scenario: $\nu = 0$.
- With no rules, the bureaucrat prefers the lottery $\Rightarrow$ inefficient allocation of slots
- Suppose rule is set to require $\pi_H = 1$, $\pi_L = (1 - N_H)/N_L$.
- Now bureaucrat uses the testing mechanism. Yields same payoff as lottery.
- To stop this the government can set rule that the auction mechanism must be followed.
  - Bureaucrats with high γ will follow the rule. Bureaucrats with low γ will use the testing mechanism.
  - Bribery and red tape.
- Alternatively the government could have the rule be the lottery.
  - No corruption and no red tape. But misallocation

Banerjee et al. 2012: Misalignment

- Focus on the following case:
  - $N_H > 1$: Slots are scarce.
  - $y_L = l > h = y_H$: social and private values are misaligned
  - $L < 0$: Low types should not have a slot.
- Consider three types of mechanisms the bureaucrat might use

Banerjee et al. 2012: Misalignment

1. "testing + auction"

$$p_{HS} = p_H^*,\, p_{HF} = p_L = l$$
$$\pi_{HS} = 1/N_H,\, \pi_{HF} = \pi_L = 0$$
$$t_H = t_H^*,\, t_L = 0$$

where t_H^* and p_H^* solve

$$h - \delta t_H^* - p_H^* = 0$$
$$\left(1 - \phi_L\left(t_H\right)\right)\left(l - p_H^*\right) - \delta t_H^* = 0$$

- Note the IC constraint for the L types:

$$\left(1 - \phi_L\left(t_H\right)\right)\left(l - p_H^*\right) - \delta t_H^* \leq 0$$

they have to prefer not getting the slot to pretending to be H and getting it with some probability

Banerjee et al. 2012: Misalignment

2. “auction”

$$p_H = p_L = l$$
$$\pi_H = 0,\ \pi_L = 1/N_L$$
$$t_H = 0,\ t_L = 0$$

Noone is tested, but the allocation is terrible: Only Ls get slots

3. “lottery”

$$p_H = p_L = h$$
$$\pi_H = \pi_L = 1/\left(N_L + N_H\right)$$
$$t_H = 0,\ t_L = 0$$

Banerjee et al. 2012: Misalignment

- What should the government do?
- With no rules the bureaucrats choose the auction mechanism. Terrible!
- Government could set rules to be the testing + auction mechanism.
  - Bureaucrats with low γ break rules and use the auction mechanism.
- Government could set rules to be the lottery
  - Bureaucrats make more money $\rightarrow$ smaller incentive to deviate$\rightarrow$ fewer bureaucrats give all slots to Ls
  - But some slots go to L types even when rules are followed.

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Benabou & Tirole 2006:

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- Aghion & Tirole (JPE 1997) *Formal and Real Authority in Organizations*
- Banerjee, Hanna & Mullainathan (2012) *Corruption*
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Outline

Theory

Financial Incentives

Non-financial Incentives

Recruitment & Selection

Open Questions

Papers

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Karthik and Sandip's 2011
Khan Khwaja Olken
auditors reputation paper

Outline

Theory

Financial Incentives

Non-financial Incentives

Recruitment & Selection

Open Questions

Papers

Khan Khwaja Olken
Ashraf no mission
Callen personalities
discretion paper

Outline

Theory

Financial Incentives

Non-financial Incentives

Recruitment & Selection

Open Questions

Papers

Do gooders
Dal Bo
Erika
Weaver or Iyer

Outline

Recruitment & Selection

- Ashraf et al.

Outline

Theory

Financial Incentives

Non-financial Incentives

Recruitment & Selection

Open Questions

Open Questions

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