Outline

- Do we care?
  - Magnitude and efficiency costs
- The corrupt official’s decision problem
  - Balancing risks, rents, and incentives
- Embedding corruption into larger structures
  - The IO of corruption: embedding the decision problem into a market structure
  - Corruption and politics
  - Corruption’s general equilibrium effects on the economy
Punishments, efficiency wages, etc

Becker and Stigler (1974): "Law Enforcement, Malfeasance, and Compensation of Enforcers"

- Setting: model of corruptible enforcers (police, auditors, etc)
- Wage $w$, outside wage $v$
- If bribed:
  - If detected, gets outside wage $v$ (probability $p$)
  - If undetected, gets $b + w$ (probability $1 - p$)
- Equilibrium wage set so the agent is indifferent

\[ w = pv + (1 - p) (b + w) \]

i.e.

\[ w - v = \frac{1 - p}{p} b \]
One issue: this creates rents for bureaucrats

Becker and Stigler suggest selling the job for \( \frac{1-p}{p} b \) so that agent only receives market wage in equilibrium

Suppose social cost of an audit is \( A \). Then social cost is \( pA \)

Then by setting \( p \to 0 \), can discourage corruption at no social cost!

In practice, high entry fees would encourage state to fire workers without cause, so optimal \( p \) is not 0
Multiple equilibria

Instead of endogenous wage, fix wage $w$, but suppose probability of detection $p$ is endogenous and depends on how many other people are also corrupt.

Denote by $c$ fraction of population that’s corrupt.

Suppose $p(c) = 1 - c$.

Recall agent will steal if

$$ w - v < \frac{1 - p}{p} b $$

Substituting terms:

$$ w - v < \frac{c}{1 - c} b $$
Multiple equilibria

Implication: temporary wage increase or corruption crackdown can have permanent effects
Multiple equilibria

Many potential reasons for multiple equilibria

- Probability of detection
- Enforcers (who will punish the punishers)
- Chance of being reported in binary interaction
- Selection into bureaucracy
- And others....
Key parameters of interest:

When you increase the probability of detection:
- How much does corruption decrease?
- Do corrupt officials substitute to other margins?
- Does this increase efficiency or is it just a transfer?

Testing Becker-Stigler:
- Do officials think about future rents when deciding how much to steal?
- Does increasing wages per se reduce corruption?

Can output-based incentives reduce corruption?
Are there multiple equilibria? If so, which theory governs them?
Randomized villages into one of three treatments:

- Audits: increased probability of central government audit from 0.04 to 1
- Invitations: increased grass-roots monitoring of corruption
- Comments: created mechanism for anonymous comments about corruption in project by villagers

Invitations & comment forms discussed in collective action section; we’ll focus here on the audits
Measuring Corruption

- **Goal**
  - Measure the difference between *reported expenditures* and *actual expenditures*

- Measuring reported expenditures
  - Obtain line-item reported expenditures from village books and financial reports

- Measuring actual expenditures
  - Take core samples to measure quantity of materials
  - Survey suppliers in nearby villages to obtain prices
  - Interview villagers to determine wages paid and tasks done by voluntary labor

- Measurement conducted in treatment and control villages
Measuring Corruption
Measuring Corruption

- Measure of theft:

\[ \text{THEFT}_i = \log(\text{Reported}_i) - \log(\text{Actual}_i) \]

- Can compute item-by-item, split into prices and quantities

- Assumptions
  - Loss Ratios - Material lost during construction or not all measured in survey
  - Worker Capacity - How many man-days to accomplish given quantity of work
  - Calibrated by building four small (60m) roads ourselves, measuring inputs, and then applying survey techniques

- All assumptions are constant – affect levels of theft but should not affect differences in theft across villages
Audits

- Audits
  - Conducted by Government Audit Agency (BPKP)
  - Auditors examine books and inspect construction site
  - Penalties: results of audits to be delivered directly to village meeting and followed up by project staff, with small probability of criminal action

- Timing
  - Before construction began, village implementation team in treatment villages informed they would be audited during and/or after construction of road project
  - One village in each treatment subdistrict audited during construction
  - All villages audited after construction
  - Official letter from BPKP sent 2 months after initial announcement, and again after first round of audits
Fig. 1.—Empirical distribution of missing expenditures. The left-hand figure shows the empirical CDF of missing expenditures for the major items in a road project, separately for villages in the audit treatment group (solid line) and the control group (dashed line). The right-hand figure shows estimated PDFs of missing expenditures for both groups; PDFs are estimated using kernel density regressions using an Epanechnikov kernel.
## Results

Impact of audits

<table>
<thead>
<tr>
<th>PERCENT MISSING&lt;sup&gt;a&lt;/sup&gt;</th>
<th>CONTROL MEAN (1)</th>
<th>TREATMENT MEAN: AUDITS (2)</th>
<th>NO FIXED EFFECTS</th>
<th>ENGINEER FIXED EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major items in roads (N = 477)</td>
<td>.277 (.033)</td>
<td>.192 (.029)</td>
<td>-.085&lt;sup&gt;*&lt;/sup&gt; (.044)</td>
<td>-.076&lt;sup&gt;**&lt;/sup&gt; (.036)</td>
</tr>
<tr>
<td>Major items in roads and ancillary projects (N = 538)</td>
<td>.291 (.030)</td>
<td>.199 (.030)</td>
<td>-.091&lt;sup&gt;**&lt;/sup&gt; (.043)</td>
<td>-.086&lt;sup&gt;**&lt;/sup&gt; (.037)</td>
</tr>
<tr>
<td>Breakdown of roads: Materials</td>
<td>.240 (.038)</td>
<td>.162 (.036)</td>
<td>-.078 (.053)</td>
<td>-.063 (.042)</td>
</tr>
<tr>
<td>Unskilled labor</td>
<td>.312 (.080)</td>
<td>.231 (.072)</td>
<td>-.077 (.108)</td>
<td>-.090 (.087)</td>
</tr>
</tbody>
</table>

### Notes:
- <sup>a</sup> Percent missing: 2.9% for major items in roads, 3.5% for major items in roads and ancillary projects, 3.9% for breakdown of roads: materials, and 8.0% for unskilled labor.
- <sup>*</sup> Significant at the 0.05 level.
- <sup>**</sup> Significant at the 0.01 level.
Why wasn’t the effect bigger?

- Although audit probability went to 1, point estimates suggest 19% of funds were still missing
- Why didn’t it go to 0?
- Three possibilities
  - Maybe people didn’t believe the audits would take place?
  - Maybe auditors were corrupt after all?
  - Maybe audit probability of 1 doesn’t imply punishment probability of 1?
## TABLE 6
**RELATIONSHIP BETWEEN AUDITOR FINDINGS AND SURVEY TEAM FINDINGS**

<table>
<thead>
<tr>
<th></th>
<th>Engineering Team Physical Score (1)</th>
<th>Engineering Team Administrative Score (2)</th>
<th>Percent Missing in Road Project (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditor physical score</td>
<td>.109**</td>
<td>−.067</td>
<td>.024</td>
</tr>
<tr>
<td></td>
<td>(.043)</td>
<td>(.071)</td>
<td>(.033)</td>
</tr>
<tr>
<td>Auditor administrative</td>
<td>.007</td>
<td>.272**</td>
<td>−.055**</td>
</tr>
<tr>
<td>score</td>
<td>(.049)</td>
<td>(.133)</td>
<td>(.027)</td>
</tr>
<tr>
<td>Subdistrict fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>248</td>
<td>249</td>
<td>212</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.83</td>
<td>.78</td>
<td>.46</td>
</tr>
</tbody>
</table>

**Note:** $\star$ denotes significance at the 10% level, $\star\star$ at the 5% level.
What did auditors find?

| TABLE 7  
<table>
<thead>
<tr>
<th>Audit Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Villages with Finding</td>
</tr>
<tr>
<td>Any finding by BPKP auditors</td>
</tr>
<tr>
<td>Any finding involving physical construction</td>
</tr>
<tr>
<td>Any finding involving administration</td>
</tr>
<tr>
<td>Daily expenditure ledger not in accordance with procedures</td>
</tr>
<tr>
<td>Procurement/tendering procedures not followed properly</td>
</tr>
<tr>
<td>Insufficient documentation of receipt of materials</td>
</tr>
<tr>
<td>Insufficient receipts for expenditures</td>
</tr>
<tr>
<td>Receipts improperly archived</td>
</tr>
<tr>
<td>Insufficient documentation of labor payments</td>
</tr>
</tbody>
</table>

To investigate this, Table 7 tabulates the “findings” reported in the final audit reports from the second phase of audits. While auditors reported at least one finding in 90 percent of the villages they visited, most of these findings were that procedures had not been properly followed (e.g., the tendering process for procurement was not properly followed in 38 percent of villages, receipts were incomplete in 17 percent of villages, etc.) rather than concrete evidence of malfeasance. For example, the finding that the tendering process for procurement was not followed might mean that “tenders were not submitted in writing, but instead were only submitted orally” or that “the auditors could not locate price survey or tender documents.” The finding that receipts were insufficient might mean that “purchase of 300 sacks of Portland cement could not be verified because no receipt was present” or that “reimbursement of operational expenses of Rp. 1,840,000 (US$200) to head of implementation team was not supported by receipts.” While a lack of receipts or lack of documentation from a tender process may be suspicious, it does not in itself constitute evidence of malfeasance.
Substitution to other forms of corruption

- Auditors investigate books and construction site, but not who worked on project
- Question: does hiring of family members change in response to audits?
- Investigate using household survey:
  - 4,000 households
  - Asked if anyone in household worked on project for pay
  - Asked if immediate / extended family of village government member or project official
- Specification:

\[
WORKED_{hijk} = \gamma_k + \gamma_2 \text{AUDIT}_{jk} + \gamma_3 \text{FAMILY}_{hijk} \\
+ \gamma_4 \text{AUDIT}_{jk} \times \text{FAMILY}_{hijk} + \gamma_5 X_{hijk} + \varepsilon_{hijk}
\]
## Results

### Nepotism

TABLE 8  
Nepotism

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audit</td>
<td>−.011</td>
<td>.004</td>
<td>−.017</td>
<td>−.038</td>
</tr>
<tr>
<td></td>
<td>(.023)</td>
<td>(.021)</td>
<td>(.32)</td>
<td>(.32)</td>
</tr>
<tr>
<td>Village government family member</td>
<td>−.020</td>
<td>.016</td>
<td>.016</td>
<td>−.014</td>
</tr>
<tr>
<td></td>
<td>(.024)</td>
<td>(.017)</td>
<td>(.017)</td>
<td>(.23)</td>
</tr>
<tr>
<td>Project head family member</td>
<td>.051</td>
<td>−.015</td>
<td>.051</td>
<td>−.004</td>
</tr>
<tr>
<td></td>
<td>(.032)</td>
<td>(.047)</td>
<td>(.032)</td>
<td>(.047)</td>
</tr>
<tr>
<td>Social activities</td>
<td>.017***</td>
<td>.017***</td>
<td>.013*</td>
<td>.014**</td>
</tr>
<tr>
<td></td>
<td>(.006)</td>
<td>(.006)</td>
<td>(.006)</td>
<td>(.006)</td>
</tr>
<tr>
<td>Audit × village government family member</td>
<td>.079**</td>
<td></td>
<td></td>
<td>.064*</td>
</tr>
<tr>
<td></td>
<td>(.034)</td>
<td></td>
<td></td>
<td>(.034)</td>
</tr>
<tr>
<td>Audit × project head family member</td>
<td></td>
<td>.138**</td>
<td></td>
<td>.115*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(.060)</td>
<td></td>
<td>(.061)</td>
</tr>
<tr>
<td>Audit × social activities</td>
<td></td>
<td></td>
<td>.010</td>
<td>.008</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(.008)</td>
<td>(.008)</td>
</tr>
<tr>
<td>Stratum fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>3,386</td>
<td>3,386</td>
<td>3,386</td>
<td>3,386</td>
</tr>
<tr>
<td>$R^2$</td>
<td>.26</td>
<td>.26</td>
<td>.26</td>
<td>.27</td>
</tr>
<tr>
<td>Mean dependent variable</td>
<td>.30</td>
<td>.30</td>
<td>.30</td>
<td>.30</td>
</tr>
</tbody>
</table>
Summary

- Audits:
  - Reduced corruption by about 8 percentage points
  - Increased actual quantities of materials, rather than decreased price markups – so an increase in efficiency, not just a transfer
  - Led to more nepotism
  - May have been limited by the degree to which auditors can prove ‘punishable’ offences
Setting: hospitals in Argentina

Empirical idea:
- Corruption crackdown in 1996
- Examine differential effects depending on procurement officer’s wage

Measure corruption by examining prices pay for identical inputs

Regression

\[ \text{LOGPRICE}_{iht} = \lambda \text{LOGSIZE}_{iht} + \alpha_t \theta_t + \delta_t \left( w_h - w^0_h \right) + \Sigma_h + \varepsilon_{iht} \]

where \( w_h \) is log procurement officer’s wage and \( w^0_h \) is log of "predicted wage" based on characteristics
First stage and efficiency wages


Table 1: The Effect of the Corruption Crackdown on Prices
Table 2: The Role of Wages During the Corruption Crackdown
Another approach: incentives

- Setting: para-teachers in India
- Experiment:
  - Teacher’s daily attendance was verified through photographs with time and date stamps.
  - Salary was made a non-linear function of his attendance
- Paper:
  - Estimates average effects of incentive scheme from a randomized experiment
  - Uses non-linearity in incentives to show that they respond to incentives
  - Estimate a structural model from treatment group, which allows them to simulate counterfactuals
Incentive scheme

Incentive scheme:

- Teacher in Intervention school were provided with a camera with non-temperable time and date stamp
- Instructed to take a picture of themselves and the children every day (morning and afternoon). A valid pairs of picture has:
  - Two pictures taken the same day, separated by at least 5 hours each.
  - At least 8 children per picture
- Payment is calculated each month and is a non-linear function of attendance:
  - Up to 10 days: Rs 500.
  - Each day above 10 days: Rs 50.
- In non-intervention schools, teachers receive Rs 1000, and are reminded by attending at least 20 days is compulsory.

Table 2
Table 9
Figure 3
Table 3
Monitoring vs. incentives?

- **Question:** Are teachers sensitive to increased monitoring or to incentives?

- **Empirical idea:** When teachers switch from the last day of the month to the first day of the month:
  - A teacher who has attended 9 days or less in the rest of the month faces no incentive at the end of month $t$ and faces incentives again at the end of month $t + 1$.
  - A teacher who has attended more than 10 days in the rest of the month faces a Rs 50 incentives at the end of month $t$ and slightly smaller at the beginning of the next month

- **Regression:**

  $$ W_{itm} = \alpha + \beta 1_m(d > 10) + \gamma F + \lambda 1_m(d > 10) \times F + \nu_i + \epsilon_{itm} $$

- **What would this tell us?**
But a cautionary note...

- Setting: Nurses in Indian public health care centers, with high absenteeism
- Experiment:
  - NGO used automated time clocks to monitor nurse attendance
  - Government used time clock information combined with fines and punishments
- So, sounds very similar to cameras
Results

- What happened?
- Initially worked well
  - First 6 months had dramatic improvement in attendance – as much as 24 percentage points more likely to be present
- But subsequently, health administration undermined incentive system
  - System allows "excused" absences for government-mandated meetings, surveys, or other health work, or if machine malfunctions
  - So nurses started reporting many more excused absences, with no response from district administration
  - By 16 months after intervention started, treatment and comparison was essentially the same

- Why? Conclusions?
Corrupt officials respond to incentives

- Static incentives (punishments, output based incentives)
- And, potentially, dynamic incentives (wages, future corruption)

But...

- They may substitute to other margins, and one needs to be sure that those margins have lower social cost
- Enforcing the incentives may be difficult if the enforcers are, themselves, corrupt
- Suggests multiple equilibria in corruption – on which there is no evidence
- Would be nice to see output-based incentives applied to other types of corruption (esp. the ‘misaligned’ case). Why might this be different?
14.75 Political Economy and Economic Development
Fall 2012

For information about citing these materials or our Terms of Use, visit: http://ocw.mit.edu/terms.