

14.750x: Corruption Lecture 2

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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.

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

Punishments, efficiency wages, etc

- 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 $p \rightarrow 0$, 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

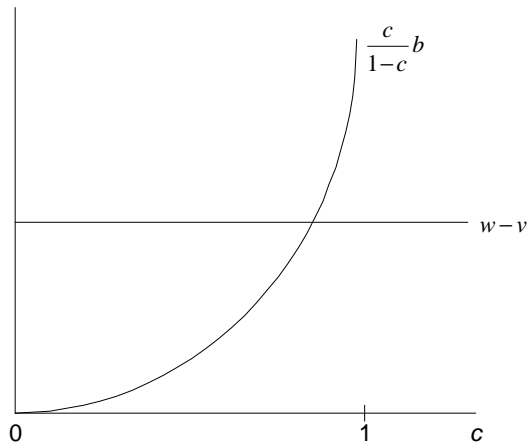
- Instead of endogenous wage, fix wage w , but suppose probability of detection p is endogenous and depends on how many other people are also corrupt
- Denote by c fraction of population that's corrupt
- Suppose $p(c) = 1 - c$
- Recall agent will steal if

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

- 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 (e.g. Hanna and Wang)
 - And others....

- Key parameters of interest:
 - When you increase the probability of detection:
 - How much does corruption decrease?
 - Do corrupt official 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?

Testing Becker-Stigler: Monitoring

Olken 2007: "Monitoring Corruption: Evidence from a Field Experiment in Indonesia"

- 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:

$$THEFT_i = \text{Log}(\text{Reported}_i) - \text{Log}(\text{Actual}_i)$$

- 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

- 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

Results

Impact of audits

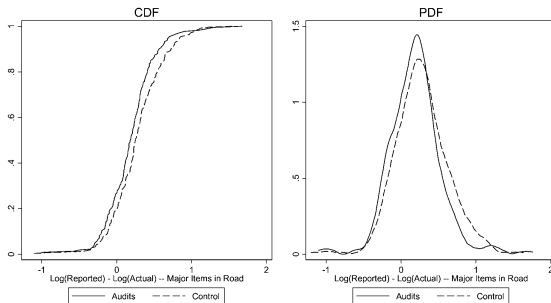


FIG. 1.—Empirical distribution of missing expenditures. The left-hand figure shows the empirical CDF of missing expenditures for the major items in a road project, separately for villages in the audit treatment group (solid line) and the control group (dashed line). The right-hand figure shows estimated PDFs of missing expenditures for both groups; PDFs are estimated using kernel density regressions using an Epanechnikov kernel.

Results

Impact of audits

TABLE 4
AUDITS: MAIN THEFT RESULTS

	CONTROL MEAN (1)	TREATMENT MEAN: AUDITS (2)	NO FIXED EFFECTS		ENGINEER FIXED EFFECTS	
			Audit Effect (3)	p-Value (4)	Audit Effect (5)	p-Value (6)
PERCENT MISSING ^a						
Major items in roads (<i>N</i> = 477)	.277 (.033)	.192 (.029)	-.085* (.044)	.058	-.076** (.036)	.039
Major items in roads and ancillary projects (<i>N</i> = 538)	.291 (.030)	.199 (.030)	-.091** (.043)	.034	-.086** (.037)	.022
Breakdown of roads:						
Materials	.240 (.038)	.162 (.036)	-.078 (.053)	.143	-.063 (.042)	.136
Unskilled labor	.312 (.080)	.231 (.072)	-.077 (.108)	.477	-.090 (.087)	.304

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?

Were auditors corrupt?

TABLE 6
RELATIONSHIP BETWEEN AUDITOR FINDINGS AND SURVEY TEAM FINDINGS

	Engineering Team Physical Score (1)	Engineering Team Administrative Score (2)	Percent Missing in Road Project (3)
Auditor physical score	.109** (.043)	-.067 (.071)	.024 (.033)
Auditor administrative score	.007 (.049)	.272** (.133)	-.055** (.027)
Subdistrict fixed effects	Yes	Yes	Yes
Observations	248	249	212
R^2	.83	.78	.46

What did auditors find?

TABLE 7
AUDIT FINDINGS

	Percentage of Villages with Finding
Any finding by BPKP auditors	90%
Any finding involving physical construction	58%
Any finding involving administration	80%
Daily expenditure ledger not in accordance with procedures	50%
Procurement/tendering procedures not followed properly	38%
Insufficient documentation of receipt of materials	28%
Insufficient receipts for expenditures	17%
Receipts improperly archived	17%
Insufficient documentation of labor payments	4%

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:

$$\begin{aligned} WORKED_{hijk} = & \gamma_k + \gamma_2 AUDIT_{jk} + \gamma_3 FAMILY_{hijk} \\ & + \gamma_4 AUDIT_{jk} \times FAMILY_{hijk} + \gamma_5 X_{hijk} + \varepsilon_{hijk} \end{aligned}$$

TABLE 8
NEPOTISM

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

- 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

Incentives

Khan, Khwaja, and Olken (2016): "Tax Farming Redux: Experimental Evidence on Performance Pay for Tax Collectors"

- What happens when you give incentives to potentially corrupt officials?
- Randomized experiment on incentives for property tax collectors in Pakistan
 - Tax officers in treatment group (team of three staff) receive 20-40% of all revenue collected above a historical benchmark (On average each person faces a 10% incentive on the margin)
 - Many staff get close to doubling their base wages
- What do you expect will happen?
- [▶ Video](#)

- Nash bargaining between Taxpayer (P) and Tax Collector (C) to collude and reduce official tax liability
- What is this?
- Imagine a and b are bargaining over dividing \$1. If they agree, agree a and b get \$1 to divide. If not, a gets a_0 and b gets b_0 . Assume $a_0 + b_0 < 1$.
- What should happen?
- Clearly they should agree on something, since $a_0 + b_0 < 1$. But how to split the surplus?
- Nash (1950) showed that under many conditions, in this case the solution is that each side gets his outside option, then some share γ of surplus, where γ is the bargaining weight.
- So if $\gamma = \frac{1}{2}$, solution is?
 - a gets $\frac{1}{2} (1 - a_0 - b_0) + a_0$
 - b gets $\frac{1}{2} (1 - a_0 - b_0) + b_0$

Bargaining over taxes

- Suppose that τ^* is true amount of tax, same for everyone. Can instead negotiate to pay bribe (b) and report less tax $\tau \leq \tau^*$.
- What is surplus from an agreement to pay τ instead of τ^* ?
- If no penalties from being caught, then surplus is $\tau^* - \tau$.
- What is the bribe?
- The bribe is the payment from the taxpayer to tax collector that allows them to split the surplus What is this?
 - Outside option of taxpayer? $-\tau^*$
 - Outside option of tax collector? 0
- So what is the bribe?
 - Tax collector needs to get share $(1 - \gamma)$ of surplus
 - So bribe is $(1 - \gamma) (\tau^* - \tau)$

Incentives for tax collectors

- Full model adds two things:
 - An incentive for tax collectors. Tax collector gets paid a share r of all taxes he collects. How does this change the model?
 - Some chance tax inspector is caught.

- Taxpayer's utility:

$$u_p(\tau, b) = -\tau - b$$

where $\alpha(\tau^* - \tau)$ is cost of under-paying: α is heterogeneous among taxpayers

- Tax collector's utility:

$$r\tau - \beta(\tau^* - \tau) + b$$

r : proportional incentive, $\beta(\tau^* - \tau)$ is cost of under-taxing (i.e. getting caught)

- Possibility of getting caught/penalty embedded in $\beta(\tau^* - \tau)$.

- Nash bargaining: Maximize (net of outside options) joint surplus from agreement

$$[-\tau - b + \tau^*] + [r\tau - \beta(\tau^* - \tau) + b - r\tau^*]$$

Rewrite as:

$$-\tau(1 - r - \beta) + (1 - r - \beta)\tau^*$$

- Solving yields (corner solutions; γ is bargaining weight of taxpayer):

$$(\tau, b) = \begin{cases} (0, r\tau^* + \beta\tau^* + \gamma(1 - r - \beta)\tau^*) & \text{if } r + \beta < 1 \\ (\tau^*, 0) & \text{o/w} \end{cases}$$

- Comparative statics: As r increases (performance pay introduced) - two effects:
 - Equilibrium Selection: LESS likely to get collusive equilibrium
 - Recall Need: $r + \beta < 1$ for collusion
 - Intuition: “Outside” option (fully collect taxes) of collector has gone up
 - Equilibrium Bribe Amount:
 - Recall (conditional on collusion) $\text{bribe} = r\tau^* + \beta\tau^* + \gamma(1 - r - \beta)\tau^*$
 - Intuition: Increased outside option of collector means he requires larger bribe
- Overall:
 - total amount of tax collected increases.
 - but, bribe prices go up for those who still pay bribes!
 - total amount of money paid by the taxpayers (tax + bribe) increases.

TAX FARMING REDUX

TABLE III
IMPACTS ON REVENUE COLLECTED

	(1)	(2)	(3)	(4)	(5)	(6)
	Year 1			Year 2		
	Total	Current	Arrears	Total	Current	Arrears
Panel A: Main treatment						
Any treatment	0.091*** (0.028)	0.073*** (0.027)	0.152** (0.069)	0.094*** (0.031)	0.091*** (0.032)	0.113 (0.083)
Panel B: Subtreatments						
Revenue	0.118*** (0.035)	0.109*** (0.034)	0.134 (0.099)	0.129*** (0.043)	0.152*** (0.044)	0.005 (0.133)
Revenue plus	0.080 (0.053)	0.086* (0.052)	0.072 (0.110)	0.093** (0.045)	0.081* (0.049)	0.175 (0.114)
Flexible bonus	0.071* (0.038)	0.024 (0.035)	0.243** (0.098)	0.056 (0.041)	0.035 (0.042)	0.148 (0.108)
<i>N</i>	481	481	481	482	482	479
Mean of control group	15.671	15.379	14.030	15.745	15.518	13.915
Rev. vs. multitasking <i>p</i>	0.323	0.193	0.830	0.233	0.049	0.262
Objective vs. subjective <i>p</i>	0.530	0.090	0.212	0.220	0.084	0.634
Equality of schemes <i>p</i>	0.562	0.143	0.433	0.359	0.086	0.527
Joint significance <i>p</i>	0.004	0.010	0.073	0.012	0.005	0.305

TABLE VI
IMPACTS ON TAX PAYMENTS AND CORRUPTION, BY REASSESSED STATUS

	(1)	(2)	(3)	(4)
	Self-reported tax payment	Bribe payment	Frequency of bribe payment	Perception of corruption
Panel A: General population sample only				
Treatment	-62.81 (264.7)	594.1* (341.7)	0.2021** (0.0951)	0.0113 (0.0254)
N	11,586	5,993	4,802	6,050
Mean of control group	4,069.425	1,874.542	0.683	0.644
Panel B: Reassessed and general population sample				
Reassessed * treatment	1,884* (1,083)	-557.4 (380.1)	-0.1592* (0.0942)	-0.0031 (0.0221)
Reassessed	2,763*** (572.9)	-66.38 (177.5)	0.0137 (0.0403)	-0.0191* (0.0107)
N	16,353	8,207	6,993	8,268
Sample	Full	Phase 1	Phase 1	Phase 1
Mean of control group in gen. pop. sample	3928.252	1874.542	0.683	0.644

TABLE VII
IMPACTS ON SATISFACTION AND ACCURACY, BY REASSESSED STATUS

	(1) Quality	(2) Satisfaction	(3) Inaccuracy	(4) Tax gap
Reassessed * treatment	0.009 (0.024)	0.005 (0.024)	0.001 (0.017)	-0.005 (0.028)
Reassessed	0.049*** (0.013)	0.044*** (0.013)	-0.061*** (0.009)	0.122*** (0.015)
<i>N</i>	8,268	8,268	14,173	14,173
Sample	Phase 1	Phase 1	Full	Full
Mean of control group in gen. pop. sample	0.538	0.555	0.339	-0.103

Summary

- Corrupt officials respond to incentives
- But...
 - They may substitute to other margins, and one needs to be sure that those margins have lower social cost
 - Incentives can work, but be careful with incentives in the misaligned case – may just lead to higher transfers