14.75 : Corruption Lecture 3

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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

Industrial Organization of Corruption

Shleifer and Vishny (1993): "Corruption"

- Shleifer and Vishny (1993):
  - Key idea: think of bribe as a price, which is set endogenously to maximize profits
  - Analogy is to a monopolist
- Two types of corruption:
  1. Corruption without theft - bribes paid on top of official fees
     - Corruption decreases efficiency
  2. Corruption with theft - bribes paid instead of fees
     - Aligns the interests of briber and bribe payer and sustains corruption
     - Efficiency implications unclear

Corruption without theft

Images removed due to copyright restrictions. See: Shleifer, Andrei, and Robert W. Vishny. "Corruption." *The Quarterly Journal of Economics* 108 no. 3 (1993): 599-617.
Figure 1a Corruption Without Theft
Figure 1b Corruption with Theft

Centralized vs. decentralized corruption

- Idea: Corruption was more efficient in Communist Russia than in post-Communist Russia, or under Soeharto in Indonesia than in Indonesia today
- Suppose you need n permits to build a house
- Building a house has value v. Distribution of v determines demand $q(P)$, elasticity $\varepsilon(P) = \frac{\partial q}{\partial P}\frac{P}{q}$

Centralized vs. decentralized corruption

- Decentralized bribe-setting:
  - Each official announced a fixed price p_i. Define $P = \sum_j p^j$
  - Each official maximizes

$$p_i q\left(p_i + \sum_{j \neq i} p_j\right)$$

  - Taking derivatives with respect to p_i, we have the FOC

$$p_i q'\left(p_i + \sum_{j \neq i} p_j\right) + q\left(p_i + \sum_{j \neq i} p_j\right) = 0$$

  - Define $P = p_i + \sum_{j \neq i} p_j$. Assume symmetry so in equilbirum $p_i = p_j = p$.
  - Then we can rewrite the FOC as

$$\begin{aligned} \frac{P}{n} q'(P) + q(P) &= 0 \\ \frac{q'(P) P}{q(P)} &= -n \end{aligned}$$

Centralized vs. decentralized corruption

- Predictions:
  1. If $\varepsilon'(P) < 0$, then $\frac{\partial P}{\partial n} > 0$
     - Note that $\varepsilon'(P) < 0$ required to generate finite price in monopoly model with 0 marginal cost – standard assumption.
  2. If $q(P)$ not "too convex", then $\frac{\partial \frac{P}{n}}{\partial n} < 0$
     - Sufficient condition is that $\frac{q''(P)P}{q'(P)} > -1$, or $q'' \leq 0$
- Alternative models:
  - If pricing was centralized, then:
    - $\varepsilon(P) = -1$ in equilibrium
    - $\frac{\partial P}{\partial n} = 0$
  - If pricing was exogenous, then
    - $\frac{\partial \frac{P}{n}}{\partial n} = 0$

Competition

- Now suppose permits are perfect substitutes, i.e., you can get the permit either from agent 1 or agent 2.
  - If agents engage in Bertrand competition, then bribes are driven down to 0.
  - If agents engage in Cournot competition, then $\frac{\partial p}{\partial n} < 0$

Empirical Test: Trucking in Aceh

Olken and Barron (2009): "The Simple Economics of Extortion: Evidence from Trucking in Aceh"

- Setting: long-distance trucking in Aceh, Indonesia
- In addition to weigh stations (which we discussed before), trucks stop and pay bribes at checkpoints along the route
  - Set up by police, military ostensibly for security reasons, but mostly now for rent extraction
  - Drivers pay to avoid being harassed / ticketed by officers manning checkpoint
  - More like extortion than bribery: officer only mentioned a violation in 24 out of 5,387 transactions
  - Average payment: Rp. 5,000 - Rp. 10,000 (US $0.55 - US $1.10)
  - Average of 20 checkpoints per trip
- Idea: checkpoints are like a string of monopolists – you need to pay all of them to complete a trip

Map

Images removed due to copyright restrictions. See: Olken, Benjamin A., and Patrick Barron. "The Simple Economics of Extortion: Evidence from Trucking in Aceh." NBER Working Paper No. 13145 (2009).

Empirical strategy: military withdrawal from Aceh

- Thirty-year conflict between Indonesian government and Acehenese rebels (GAM)
  - Peace agreement signed in August 2005 to withdraw 30,000 police and military in 4 phases from September 2005 - January 2006
  - Data is from November 2005 - June 2006, and so encompasses the 3rd and 4th withdrawal phases, as well as post-period
  - Most checkpoints in Aceh had already disappeared from Banda Aceh route by the time data, so focus on Meulaboh route
- Trips passed through two provinces (Aceh and North Sumatra), but military withdrawals did not affect North Sumatra province
- Empirical strategy:
  - Withdrawal on troops from portion of Meulaboh-Medan route in Aceh province reduced number of checkpoints on the route (n)
  - Assumption: no direct effect of withdrawal on checkpoints in North Sumatra province
  - Therefore, can use changes in prices charged at checkpoints in North Sumatra to identify $\frac{\partial \frac{P}{n}}{\partial n}$ from the Shleifer-Vishny model

Data

- Direct observation of 304 trips across the two routes
  - Locally-recruited enumerators accompanied drivers on their regular routes, writing down all payments
  - Dressed as (and fulfilling role of) truck drivers' assistants
  - Total of over 6,000 illegal payments
- On average, extortion / bribes / protection payments are about 13% of cost of trip – more than drivers' salary
- Video

Impact of withdrawal of posts on bribes

- Estimation 1: Checkpoint level, with all checkpoints on Meulaboh - Medan road *in North Sumatra province*

$$LOGPRICE_{ci} = \alpha_c + X_i'\gamma + \beta LOGEXPECTEDPOSTS_i + \varepsilon_{ci}$$

  - Includes checkpoint fixed effects (α_c)
  - $LOGEXPECTEDPOSTS_i$ isolates variation from change in Aceh posts.
  - Can add Banda Aceh trips as a control group

- Predictions:
  - Note that $LOGPRICE_{ci} = LOG(P) - LOG(n)$
  - Centralized model: $\beta = -1$
  - Decentralized model: $-1 < \beta < 0$
  - "Exogenous" pricing model: $\beta = 0$

Impact of withdrawal of posts on bribes

- Estimation 2: Time series of total payments in North Sumatra.

$$LOGPAYMENT_i = \alpha + X_i'\gamma + \beta LOGEXPECTEDPOSTS_i + \varepsilon_i$$

  - $LOGPAYMENT_i$ is total payments in North Sumatra Province
  - Includes weigh stations, allows us to account for potentially endogenous changes in number of checkpoints
  - Can continue to use Banda Aceh road as control group
- Convincing?
- Main threat to identification is differential time trends between routes

Results

Images removed due to copyright restrictions. See: Olken, Benjamin A., and Patrick Barron. "The Simple Economics of Extortion: Evidence from Trucking in Aceh." NBER Working Paper No. 13145 (2009).

Does competition increase quantities and decrease bribes?

- With Cournot competition, as you increase the number of firms, quantities increase and prices decrease.
- Example from forestry:
  - Each district head can allow illegal logging in return for a bribe
  - As we increase the number of districts, total logging should increase and prices should fall
- Empirical setting:
  - In Indonesia, number of districts almost doubled between 2000 and 2008, with districts splits occurring asynchronously
  - We examine the impact of increasing number of districts in a market over time
- Tests:
  - Show impact on quantity using satellite data
  - Demonstrate impact on prices from official production data
- Can rule out various alternative explanations (impacts on legal production, changes in enforcement, differential time trends)

We track illegal logging using satellite imagery.

- MODIS satellite gives daily images of world at 250m resolution
- We use MODIS to construct annual change layers for forests for all Indonesia
  - Aggregate daily images to monthly level to get clearest cloud-free image for each pixel
  - Use 7 MODIS bands at monthly level + 8-day MODIS land surface temperature product -> over 130 images for each pixel
  - Use Landsat training data to predict deforestation
  - Once coded as deforested, coded as deforested forever
- Since we have pixel level data, we can overlay with GIS information on the four (fixed) forest zones – production, conversion, conservation, protection $\Rightarrow$ enables us to look directly at illegal logging

Magnitudes are consistent with benchmark Cournot model.

- Benchmark Cournot model:

$$\max_{q_i} q_i p\left(\sum q\right) - cq_i$$

- Taking derivatives and rewriting yields:

$$\frac{(p-c)}{p} = \frac{1}{n\varepsilon}$$

  where n is number of jurisdictions and ε is elasticity of demand

- If we assume $p = \frac{a}{Q^{\lambda}}$, so we have constant elasticity of demand $\varepsilon = \frac{1}{\lambda}$, we can derive a formula for semi-elasticity of extraction with respect to n (which is what we estimate), i.e.

$$\frac{1}{Q}\frac{dQ}{dn} = \frac{1}{n^2 - n\lambda}$$

Magnitudes are results consistent with benchmark Cournot model.

- Does this match the data?
- With $n = 5.5$ and $\varepsilon = 2.1$, formula implies $\frac{1}{Q}\frac{dQ}{dn} = \frac{1}{n^2 - n\lambda}$, which is about 0.035
- We estimate $\frac{1}{Q}\frac{dQ}{dn}$ to be between 0.036 in short run and 0.079 in long run – so in the right order of magnitude

Transaction level IO issues

- Analysis above was about "market-level" IO issues
- There are also several important "transaction-level" IO issues
  - Bargaining and hold-up
  - Price discrimination
  - Auction design

Bargaining and hold-up

- Model above had fixed prices, announced in advance
- Suppose instead there was ex-post bargaining between the officer guarding the checkpoint and the truck driver
- Assume officer's bargaining weight α
- What happens at last checkpoint?
  - Officer receives α, driver keeps $(1-\alpha)$
- What happens at previous checkpoint?
  - Officer receives $\alpha(1-\alpha)$, driver keeps $1-\alpha(1-\alpha)$.
  - Why?
  - Intuition is that there is less surplus from agreement at "upstream" checkpoints, since some part of that surplus will be extracted at "downstream" checkpoints
  - Analogy is to ex-post bargaining in chain of Leontief production technologies (e.g. Blanchard and Kremer 1997)

Testing bargaining and hold-up

- First question: is there any ex-post bargaining?
- Certain factors likely to increase bargaining power of officer manning the post
  - Is officer carrying a gun?
  - How many officers are visible manning post?
- We can test whether these factors:
  - Increase amount paid at checkpoint
  - Increase probability of negotiation over amount paid
- Estimation:

$$LOGPRICE_{ci} = \alpha_i + \alpha_c + \beta_1 GUN_{ci} + \beta_2 NUMOFFICERS_{ci} + \varepsilon_{ci}$$

  - Includes trip fixed effects (α_i) and checkpoint $\times$ month $\times$ direction of travel fixed effects (α_c)

Do prices increase along the route?

- Prediction from model: if $\alpha > 0$, so there is some ex-post bargaining, prices increase as you near the end of the trip
- To estimate this, take advantage of the fact that we have trips in both directions
- For each checkpoint $\times$ direction of travel:
  - Define $MEANPERCENTILE_{ci}$ as the percentile in the trip where the checkpoint is on average encountered each month
  - Each checkpoint will have two values of $MEANPERCENTILE_{ci}$ each month, one going to Aceh and one coming from Aceh
- Estimation:

$$LOGPRICE_{ci} = \alpha_i + \alpha_c + \beta MEANPERCENTILE_{ci} + \varepsilon_{ci}$$

  - Includes trip fixed effects (α_i) and checkpoint $\times$ month fixed effects (α_c)

Do prices increase along the route?

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Do prices increase along the route?

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Do prices increase along the route?

- Why Meulaboh but not Banda Aceh?
- Model predicts

$$\log b_n = -n \log (1 - \alpha) + k$$

- Since we estimate the coefficient on $\frac{n}{N}$, $\beta = -N \log (1 - \alpha)$
- Estimates from Meulaboh imply $\alpha = 0.005$
- Since there are fewer checkpoints on Banda Aceh route, the estimated slope β will be smaller
- Also, the presence of intermediate cities on the Banda Aceh route substantially weakens the prediction

Third degree price discrimination

- Theory: if corrupt officials can observe characteristics that are correlated with willingness to pay, they will adjust prices accordingly
- Estimation from trucking paper:

$$LOGPRICE_{ci} = \alpha_c + X_i'\beta + \varepsilon_{ci}$$

  - Includes checkpoint $\times$ month $\times$ direction of travel fixed effects (α_c)
- Results indicate price discrimination on:
  - Truck age
  - Cargo value
  - Cargo types (higher for food, agricultural produce, steel)
- Svensson (2003) finds similar results in Uganda looking at firms' bribe payments

Third degree price discrimination

- Do trucks with observable characteristics correlated with higher willingness to pay in fact pay more?

Images removed due to copyright restrictions. See: Olken, Benjamin A., and Patrick Barron. "The Simple Economics of Extortion: Evidence from Trucking in Aceh." NBER Working Paper No. 13145 (2009).

Second degree price discrimination

- Another type of price-discrimination is screening – e.g., create different contracts and let people self-select
- Does this happen with corruption?
- Evidence
  - We saw evidence of this in the trucking paper at weigh stations
  - What else? Does drivers' license paper speak to this?

Procurement auctions

- Much corruption takes place in government procurement of goods and services
- To mitigate corruption (and other problems), governments typically procure through procurement auctions, which restrict the discretion that procurement officials have
- Procurement is more complicated than auctions to sell a product, since the procurer cares about quality in addition to price
- There are therefore two main types of procurement regimes:
  - Best-price auction: conditional on meeting a minimum quality threshold, lowest price wins
  - Best-value auctions: every bidder receives a quality score, and winner determined by a formula that combines quality and price
- Do these auctions prevent corruption? Under what circumstances? What auction rules work best for mitigating corruption?

Empirical tests

Tran 2008: Can Procurement Auctions Reduce Corruption? Evidence from the Internal Records of a Bribe Paying Firm

- Setting: Government procurement of electrical equipment in an Asian country
- Data: Tran obtained a firm's secret records of every bribe they had paid in a procurement auction over the past 10 years, 562 total transactions
  - Bribes average about 15% of cost of the equipment
  - This data allows him to observe not just hot auctions change total prices, but also how they change the share of rents that accrue to the corrupt official

Empirical strategy

- Empirical strategy: diffs-in-diffs with changes in procurement rules
- First difference:
  - Prior to 2000, no auctions required whatsoever
  - 2001 - 2004, best-value auctions required
  - 2004 - present, best-price auctions required
- Second difference:
  - High-value contracts (above $14,540) require open auctions under both regimes (anyone can bid)
  - Medium-value contracts ($7,270 - $14,540) require restricted auctions under both regimes (officer solicits bids)
  - Low-value contracts do not require auctions
- Estimate

$$Bribe_{it} = BIG_{it} + MED_{it} + BIG_{it} \times POST2001_t + BIG_{it} \times POST2004_t + MED_{it} \times POST2001_t + MED_{it} \times POST2004_t + \alpha_t + X + \varepsilon$$

Endogenous contract values

- Officials manipulate contract values to get around thresholds (e.g., including or excluding maintenance contracts, specifying cheaper brands, etc)

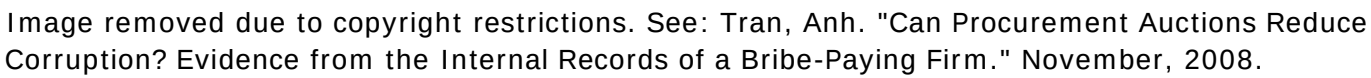
Image removed due to copyright restrictions. See: Tran, Anh. "Can Procurement Auctions Reduce Corruption? Evidence from the Internal Records of a Bribe-Paying Firm." November, 2008.

- Solution: instrument using the power capacity of the equipment being purchased, which does not change

Results

- Relative to control:
  - Best-value auctions
    - Have no impact on big contracts (open auctions)
    - Increase bribes (and firm profits) on medium contracts (restricted auctions)
  - Best-price auctions
    - Reduce bribes (and firm profits) on big contracts (open auctions)
    - No impact (and firm profits) on medium contracts (restricted auctions)
- Explanations?
  - Tran's explanation: best-value auctions decrease scrutiny while not actually constraining the procurement officer at all

Summary

- Applying IO models to corruption: corrupt officials behave like firms in many ways
- Theory:
  - Market structure models (double marginalization, competition), with efficiency implications that depend on the context
  - Price discrimination as in standard IO contexts
- Empirics:
  - Evidence for double marginalization – but no compelling evidence to date on competition
  - Evidence of price discrimination – both third degree and (to a lesser degree) second degree
  - Evidence that auction design is important for corruption – but this is an area for future work as well

14.75 Political Economy and Economic Development

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