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
Shleifer and Vishny (1993): "Corruption"

- 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


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 equilibrium
    $$p_i = p_j = p.$$
  - Then we can rewrite the FOC as
    $$\frac{P}{n} q' (P) + q (P) = 0$$
    $$\frac{q' (P) P}{q (P)} = -n$$
Centralized vs. decentralized corruption

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

- **Alternative models:**
  - If pricing was centralized, then:
    - $\epsilon (P) = -1$ in equilibrium
    - $\frac{\partial P}{\partial n} = 0$
  - If pricing was exogenous, then
    - $\frac{\partial P}{\partial n} = 0$
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 $\frac{dp}{dn} < 0$
Empirical Test: 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
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 $\frac{\partial P}{\partial n}$ 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

\[ \text{LOGPRICE}_{ci} = \alpha_c + X_i^\prime \gamma + \beta \text{LOGEXPECTEDPOSTS}_i + \epsilon_{ci} \]

- Includes checkpoint fixed effects \((\alpha_c)\)
- \(\text{LOGEXPECTEDPOSTS}_i\) isolates variation from change in Aceh posts.
- Can add Banda Aceh trips as a control group

- Predictions:
  - Note that \(\text{LOGPRICE}_{ci} = \log(P) - \log(n)\)
  - 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.

\[ \text{LOGPAYMENT}_i = \alpha + X'_i \gamma + \beta \text{LOGEXPECTEDPOSTS}_i + \varepsilon_i \]

- \( \text{LOGPAYMENT}_i \) 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
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 \( \rightarrow \) 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 \( \varepsilon \) 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 $\alpha$
- What happens at last checkpoint?
  - Officer receives $\alpha$, 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:

  \[ \text{LOGPRICE}_{ci} = \alpha_i + \alpha_c + \beta_1 \text{GUN}_{ci} + \beta_2 \text{NUMOFFICERS}_{ci} + \varepsilon_{ci} \]

- Includes trip fixed effects \((\alpha_i)\) and checkpoint \(\times\) month \(\times\) direction of travel fixed effects \((\alpha_c)\)
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:

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

- Includes trip fixed effects ($\alpha_i$) and checkpoint $\times$ month fixed effects ($\alpha_c$)
Do prices increase along the route?

Do prices increase along the route?

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 \( \beta \) 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:

\[ \text{LOGPRICE}_{ci} = \alpha_c + X_i' \beta + \epsilon_{ci} \]

- Includes checkpoint \( \times \) month \( \times \) direction of travel fixed effects \((\alpha_c)\)
- 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?

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

\[
Bribe_{it} = BIG_{it} + MED_{it} + BIG_{it} \times POST_{2001t} + BIG_{it} \times POST_{2004t} \\
+ MED_{it} \times POST_{2001t} + MED_{it} \times POST_{2004t} + \alpha_t + X + \varepsilon
\]
Endogenous contract values

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

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
Fall 2012

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