Maximizing Illicit Profits
Understanding How Corrupt Officials Chose How Much to Charge for Bribes

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Introduction

- Corruption though to be a serious impediment to development
  - Believed to be endemic in many countries
  - Potentially severe efficiency consequences
- Today I’ll talk about three issues in corruption
  1. Why we care: the efficiency costs of corruption
  2. The individual decision maker’s problem:
    - Do corrupt officials respond to incentives and punishments?
    - Why don’t they respond more?
  3. The role of market forces in influencing the amount people can charge for bribes
I’ll draw on examples from my work in Indonesia.

- I’ll draw from my work on:
  - Graft in road projects in Indonesia (Olken 2007)
  - Rice distribution for the poor in Indonesia (Olken 2006)
  - Bribes paid by truck drivers in Indonesia (Olken and Barron 2009)
  - Illegal logging in Indonesia (Burgess, Hansen, Olken, Potapov, and Sieber 2012)
  - Incentives for tax collectors in Pakistan (Khan, Khwaja, and Olken 2014)

- Will discuss 3 types of corruption:
  - Graft (theft of government funds)
  - Extortion (extracting money using threat of punishment)
  - Bribes (taking money to allow someone to ignore a government rule)

- Not meant to be an exhaustive list!
Why do we care about corruption?

► I’ll touch on three main costs:
  ▶ As a tax on certain types of government activity
  ▶ Distorting the efficacy of government activity
  ▶ Limits the government’s ability to correct externalities

► Other examples as well:
  ▶ E.g., tax on firm growth
Corruption acts like a tax on certain types of government activity.

- Example from Indonesia (Olken 2006)
  - Program distributes subsidized rice to rice to the poor
  - Estimated graft in the program by comparing receipt of rice in household survey to administrative data on how much rice distributed
  - Estimates are that at least 18% of rice may have been lost to corruption

- What are the costs of corruption?
  - Corruption itself is not a social cost; it’s just a transfer of funds to corrupt officials
  - Costs come from redistributive effects (marginal utility for officials is lower than for the poor) and marginal cost of funds for lost revenues
  - Net result: program may have made program not worth doing, so lose benefits from redistribution
Costs of corruption can make a program not cost effective.

Table 4
Comparing costs and benefits

<table>
<thead>
<tr>
<th>Allocations:</th>
<th>Utilitarian, CRRA utility $\rho = 1$ (% of welfare maximizing utility)</th>
<th>Utilitarian, CRRA utility $\rho = 2$ (% of welfare maximizing utility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual allocation</td>
<td>52.23</td>
<td>35.31</td>
</tr>
<tr>
<td>Actual allocation, no corruption</td>
<td>62.06</td>
<td>42.73</td>
</tr>
<tr>
<td>Official eligibility guidelines</td>
<td>60.90</td>
<td>42.10</td>
</tr>
<tr>
<td>No program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumption tax, MCF = 1.00</td>
<td>46.90</td>
<td>24.68</td>
</tr>
<tr>
<td>Consumption tax, MCF = 1.20</td>
<td>56.25</td>
<td>29.59</td>
</tr>
<tr>
<td>Consumption tax, MCF = 1.40</td>
<td>65.59</td>
<td>34.48</td>
</tr>
<tr>
<td>Consumption tax, MCF = 1.60</td>
<td>74.91</td>
<td>39.36</td>
</tr>
<tr>
<td>Baselines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure waste</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Welfare maximizing</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Notes: Calculations based on national SUSENAS data. Social welfare is normalized so that 0% represents the welfare if the costs were incurred but no benefits received and so that 100% represents the welfare if the costs were incurred and the benefits were distributed in such a way as to maximize the social welfare, subject to the constraint that all individuals who received rice in each district received the same size transfer. $b_Q$ represents the social welfare in the absence of the program, computed by multiplying the programs total cost by the marginal cost of funds shown, and allocating that cost across households proportionally to household consumption. Given these normalizations, the welfare level in the absence of the program increases as the programs welfare cost increases.

11 The value of the subsidy is equal to the market price of rice, less the average price paid per kilogram of subsidized rice (Rp1050, or US$0.12) (LP3ES, 2000).
Corruption can distort the efficacy of government investment.

- Projects may be distorted to extract funds
- Examples from roads in Indonesia:
  - Steal by reducing bottom layer of materials because hardest to detect, so roads decay much more quickly
  - Can't complete a road because run out of funds, so road ends up being useless
A "road" in North Sumatra, Indonesia
Corruption can undermine the government’s ability to correct externalities.

- With externalities, idea of a fine/tax/etc is to equate private and social marginal cost
  - Examples: speeding tickets, etc.
- If there is corruption, the key question is how does corruption affect marginal cost
  - If you pay a bribe regardless of whether you are speeding, there can be a substantial efficiency loss, since marginal cost of speeding is now 0
  - If you pay a bribe (equal to the official fine) only if you are actually speeding, no efficiency loss
We test how corruption affects the marginal cost of driving an overweight truck.

- Example: weigh stations in Indonesia
  - Engineers say damage truck does to road rises to the 4th power of truck’s weight
  - Optimal fine should be highly convex so that truckers internalize this cost
  - Actual fine schedule is highly convex (major penalties if more than 5% overweight)

- Collected data by having assistants ride in trucks and record all bribes paid

- With corruption at weigh stations...
  - All truckers pay a bribe instead of actual fine
  - Efficiency question: how convex is bribe as a function of truck weight?
Corruption flattens the marginal cost curve.

Figure 2: Payments at weigh stations

Notes: Each graph shows the results of a non-parametric Fan (1992) locally weighted regression, where the dependent variable is the amount of bribe paid at the weigh station and the independent variable is the number of tons the truck is overweight. The bandwidth is equal to one-third of the range of the independent variable. Bootstrapped 95% confidence intervals are shown in dashes, where bootstrapping is clustered by trip. When the dashed lines are not shown, it indicates that the 95% confidence interval exceeds the y axis of the graph.
Potentially corrupt decision makers balance returns from honesty and corruption.

- Basic framework (e.g., Becker and Stigler 1974)
  - Decision considers gains from being corrupt and expected value of punishments
  - Decides to be corrupt if expected return exceeds value from honesty

- Suggests several natural ways of controlling corruption

- Increase expected punishment:
  - Probability of detection
  - Punishment conditional on detection

- Increase returns from being honest:
  - Wages
  - Output based incentive
Explore the problem with a randomized experiment that changed probability of detection.

- Setting: village infrastructure program where each village was building a 1-3km road
- Experimental intervention:
  - Audits by government auditors. Standard approach, but not clear the effect if auditors are also corrupt
  - Treatment: increase probability of audit from 4 percent baseline to 100 percent
  - Villages randomized, before road was built, to either 100 percent probability or control
- Also investigated improved grass-roots monitoring – not going to discuss today
We compared actual costs to reported costs to measure corruption in roads.

- Obtained final expenditure reports from village governments as to how much they spend on road construction.
- Separate survey to estimate road costs:
  - 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
- Build several corruption-free ‘test roads’ to account for normal losses during construction, measurement
- Answer – average of 25% of funds unaccounted for
Engineers used core samples to measure actual construction costs.
Experiment showed that audits reduce missing expenditures by about one-third.

- Moving audit probability from 0.04 to 1 reduces missing expenditures from about 27 percentage points to about 19 percentage points.

### TABLE 4
**Audits: Main Theft Results**

<table>
<thead>
<tr>
<th>Percent Missing³</th>
<th>Control Mean (1)</th>
<th>Treatment Mean: Audits (2)</th>
<th>No Fixed Effects</th>
<th></th>
<th>Engineer Fixed Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major items in roads (N = 477)</td>
<td>.277 (0.033)</td>
<td>.192 (0.029)</td>
<td>-.085* (0.044)</td>
<td>.058 (0.036)</td>
<td>-.076** (0.036)</td>
</tr>
<tr>
<td>Major items in roads and ancillary projects (N = 538)</td>
<td>.291 (0.030)</td>
<td>.199 (0.030)</td>
<td>-.091** (0.043)</td>
<td>.034 (0.037)</td>
<td>-.086** (0.037)</td>
</tr>
<tr>
<td>Breakdown of roads:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>.240 (0.038)</td>
<td>.162 (0.036)</td>
<td>-.078 (0.053)</td>
<td>.143 (0.042)</td>
<td>-.063 (0.042)</td>
</tr>
<tr>
<td>Unskilled labor</td>
<td>.312 (0.080)</td>
<td>.231 (0.072)</td>
<td>-.077 (0.108)</td>
<td>.477 (0.108)</td>
<td>-.090 (0.108)</td>
</tr>
</tbody>
</table>

Note.—Audit effect, standard errors, and p-values are computed by estimating eq. (1), a regression of the dependent variable on a dummy for audit treatment, invitations treatment, and invitations plus comment forms treatments. Robust standard errors are in parentheses, allowing for clustering by subdistrict (to account for clustering of treatment by subdistrict). Each audit effect, standard error, and accompanying p-value is taken from a separate regression. Each row shows a different dependent variable, shown at left. All dependent variables are the log of the value reported by the village less the log of the estimated actual value, which is approximately equal to the percent missing. Villages are included in each row only if there was positive reported expenditures for the dependent variable listed in that row.

* Significant at 10 percent. ** Significant at 5 percent. *** Significant at 1 percent.
Substantial correlation between auditors’ findings and independent assessment.

- Why don’t audits have a larger impact?
- It is not that auditors don’t detect corruption: there is a positive correlation between problems on auditors’ ‘administrative checklists’ and missing expenditures.

### 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 score</td>
<td>.007</td>
<td>.272**</td>
<td>-.055**</td>
</tr>
<tr>
<td></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.—Robust standard errors are in parentheses, adjusted for clustering at subdistrict level. Auditor scores refer to the results from the final BPKP audits; engineering team scores refer to the results from the engineering team that was sent to estimate missing expenditures. The results from the engineering team were not shared with the BPKP audit team. All specifications include subdistrict fixed effects, which therefore hold constant both the BPKP audit teams and the engineering teams. For both physical and administrative scores, scores are normalized to have mean zero and standard deviation one.

* Significant at 10 percent.
** Significant at 5 percent.
*** Significant at 1 percent.
Auditors’ findings insufficient to impose substantial punishments.

- Auditors rarely catch people ‘red-handed’
  - Most problems are procedural in nature
  - E.g., no receipts, tendering process not documented
- Suggests that audits may need to be complemented with higher punishments conditional on concrete evidence

<table>
<thead>
<tr>
<th>TABLE 7</th>
<th>Audit Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage of Villages with Finding</td>
</tr>
<tr>
<td>Any finding by BPKP auditors</td>
<td>90%</td>
</tr>
<tr>
<td>Any finding involving physical construction</td>
<td>58%</td>
</tr>
<tr>
<td>Any finding involving administration</td>
<td>80%</td>
</tr>
<tr>
<td>Daily expenditure ledger not in accordance with procedures</td>
<td>50%</td>
</tr>
<tr>
<td>Procurement/tendering procedures not followed properly</td>
<td>38%</td>
</tr>
<tr>
<td>Insufficient documentation of receipt of materials</td>
<td>28%</td>
</tr>
<tr>
<td>Insufficient receipts for expenditures</td>
<td>17%</td>
</tr>
<tr>
<td>Receipts improperly archived</td>
<td>17%</td>
</tr>
<tr>
<td>Insufficient documentation of labor payments</td>
<td>4%</td>
</tr>
</tbody>
</table>
How much to bribe depends on the return to being honest

- Randomized experiment on property tax in Pakistan
- Tax inspectors (teams of 3) randomized to receive high powered incentives or control
  - Incentives: An average of 30% of revenues above historical baseline will be paid to the team of 3 inspectors (so 10% each)
- How do we think about this?
Bargaining over bribes

- Suppose true tax liability is $1. Taxpayer and tax inspector can collude and claim true tax liability is $0 in return for a bribe. They split the surplus.
Bargaining over bribes

- Suppose true tax liability is $1. Taxpayer and tax inspector can collude and claim true tax liability is $0 in return for a bribe. They split the surplus.

- With no incentives:

  - Surplus is $1.
  - Half of that is $0.50.
  - So bribe is $0.50.
  - With incentives?

  - Surplus is $0.
  - Why? Because if pays honestly inspector gets $0.30.
  - Split the surplus: $0.35.
  - Bribe is the inspector’s outside option, $0.30, plus half the surplus, $0.35.
  - So bribe is $0.65.

  - So bribes go up!
Bargaining over bribes

- Suppose true tax liability is $1. Taxpayer and tax inspector can collude and claim true tax liability is $0 in return for a bribe. They split the surplus.

- With no incentives:
  - Surplus is $1

- With incentives?
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- With no incentives:
  - Surplus is $1
  - Half of that is $0.50.
  - So bribe is $0.50

- With incentives:
  - Surplus is $0.
  - Split the surplus: $0.70.
  - So bribe is $0.65
  - So bribes go up!
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  - So bribe is $.50

- With incentives?

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Bargaining over bribes

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  - So bribe is $.50

- With incentives?
  - Surplus is $0.70.
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- With no incentives:
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  - So bribe is $.50

- With incentives?
  - Surplus is $0.70. Why?
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  - So bribe is $.50

- With incentives?
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  - So bribe is $.50

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  - So bribe is $0.65
  - So bribes go up!
What happens in practice
Tax revenues go up

Table 1: Experimental Design

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Revenue</td>
<td>Revenue Plus</td>
</tr>
<tr>
<td>Revenue</td>
<td>53</td>
<td>72</td>
</tr>
<tr>
<td>Revenue Plus</td>
<td>54</td>
<td>74</td>
</tr>
<tr>
<td>Flexible Bonus</td>
<td>54</td>
<td>73</td>
</tr>
<tr>
<td>Information</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>Control</td>
<td>322</td>
<td>194</td>
</tr>
</tbody>
</table>

Notes: In cases where staff did not consent to treatment, circles were assigned treatment values of 1/3 for each treatment type. Values are rounded.

Table 2: Impacts on Revenue Collected

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>Current</td>
</tr>
<tr>
<td>Panel A: Main Treatment</td>
<td>Any treatment</td>
<td>0.090***</td>
</tr>
<tr>
<td></td>
<td>(0.028)</td>
<td>(0.027)</td>
</tr>
</tbody>
</table>

Notes: Circle-level 2SLS regressions of log total revenue collection on treatment. The different columns separate the margins of collection, i.e. on-time payments (Current) vs. late payments (Arrears). Outcomes are shown as of the end of the given fiscal year. Controls include stratum fixed effects and baseline values. Treatment is defined as the fraction of treated staff in a circle, instrumented by the original randomization result. 'Any treatment' in Panel A includes the 3 subtreatments in Panel B. The Information treatment is included in the controls. Robust standard errors in parentheses. Standard errors are clustered by robust partition, the partition of circles such that all circles that merged or split with each other are included within the same partition. * p < 0.10, ** p < 0.05, *** p < 0.01.
What happens in practice
But bribes go up, too

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self-reported Tax Payment</td>
<td>Bribe Payment</td>
<td>Frequency of Bribe Payment</td>
</tr>
<tr>
<td>Treatment</td>
<td>-126.9</td>
<td>594.1*</td>
<td>.2021**</td>
</tr>
<tr>
<td></td>
<td>(310.5)</td>
<td>(333)</td>
<td>(.0951)</td>
</tr>
<tr>
<td>N</td>
<td>9632</td>
<td>5993</td>
<td>4802</td>
</tr>
<tr>
<td>Mean of control group</td>
<td>4919.067</td>
<td>1874.542</td>
<td>0.683</td>
</tr>
</tbody>
</table>

*Panel A: Random Sample*

Table 6: Impacts on Tax Payments and Corruption, by Reassessed Status

Notes: Property-level 2SLS regressions. Bribe Payment is the respondent's response to how much bribe they think others would pay for a similar property. Frequency of Bribe Payment and Perception of Corruption are graded on a 5 point rubric and scaled to the interval [0,1]. Panel A compares properties in treatment vs. control circles in the random sample. Columns (1) and (5) control for self-reported baseline (FY 2011) tax payment. Specification includes strata fixed effects. Panel B compares re-assessed properties in treatment vs. control circles. Re-assessed is a dummy variable = 1 if the property belongs to the re-assessed sample. Re-assessed * Treatment is the interaction term. Specification includes circle fixed effects. In both Panels A and B, specification includes a control for whether the response came from the short version of the survey. For Columns (2-4), sample is restricted to Phase 1 circles. For regressions including the full sample, specification also includes a control for survey phase. The Information treatment is included in the controls. Robust standard errors in parentheses. Standard errors are clustered by robust partition, the partition of circles such that all circles that merged or split with each other are included within the same partition. * p < 0.10, ** p < 0.05, *** p < 0.01.
Opportunities for corruption may also be determined by market forces.

- When we examined the individual corrupt decision maker, opportunities for corruption were treated as exogenous.
- But, they may be determined by market forces (e.g. Shleifer & Vishny 1993)
- Examples:
  - If you need to get multiple permits, double marginalization may mean you pay higher total bribes than if corruption was centralized, since each bribe taker doesn’t fully internalize effect of their bribes on total demand
  - Conversely, if you can choose where to get a permit, competition among officials may increase quantities and drive bribes down
- Does this happen?
First example: Trucking in Aceh.

► Setting: the two main roads in Aceh, one to Meulaboh and one to Banda Aceh
Two main trucking routes in Aceh.
We test for double-marginalization in bribes at checkpoints.

- To test for endogenous bribes:
  - Look what happened when 30,000 police and military were withdrawn in 4 phases from Aceh province, from September 2005 to January 2006
  - Our data is from November 2005 - June 2006
  - (includes 3rd and 4th phases of withdrawals, plus post period)

- Empirical strategy:
  - During out period, withdrawals only affected Meulaboh road
  - Withdrawals did not affect portion of road in North Sumatra
  - Therefore, can use changes in prices charged at checkpoints in North Sumatra to identify how prices respond, using Banda Aceh road as a control
Decentralized price setting predicts elasticity between 0 and 1.

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

  \[ \logprice_{ci} = \alpha_c + X_i' \gamma + \beta \logexpectedposts_i + \varepsilon_{ci} \]

- **Predictions**
  - If pricing is exogenous, *cost per checkpoint* does not change \((\beta = 0)\)
  - If pricing is centralized, *total cost* of passing through the road does not change \((\beta = -1)\)
  - If pricing is decentralized, change is somewhere in between \((-1 < \beta < 0)\)
Evidence shows endogenous price response.
Evidence shows endogenous price response.

### TABLE 2
**Impact of Number of Checkpoints in Aceh on Bribes in North Sumatra**

<table>
<thead>
<tr>
<th></th>
<th>Meulaboh OLS (1)</th>
<th>Meulaboh OLS (2)</th>
<th>Meulaboh (Pre-Press Conference) OLS (3)</th>
<th>Meulaboh (4) IV IV</th>
<th>Both Routes OLS (5)</th>
<th>Both Routes OLS (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Log Payment at Checkpoint</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log expected</td>
<td>−.545***</td>
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<td>−.787***</td>
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<td>Yes</td>
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<td>None</td>
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</table>
Does competition between jurisdictions increase quantities?

- 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
Example

Figure 1: Forest cover change in the province of Riau, 2001-2008
Example

Figure 1: Forest cover change in the province of Riau, 2001-2008

INDONESIA

Maximizing Illicit Profits
Example

![Forest Cover Change in the Province of Riau, 2001-2008](image)

- **2001**
- **2002**
- **2003**
- **2004**
- **2005**
- **2006**
- **2007**
- **2008**

**Forest Loss**

**Non-Forest**

**Forest**

*Indonesia*

*Olken Optimizing Illicit Profits*
Example
Example

Figure 1: Forest cover change in the province of Riau, 2001-2008
Example

![Forest cover change in the province of Riau, 2001-2008](image-url)
Example

Figure 1: Forest cover change in the province of Riau, 2001-2008.
Example
Logging increases as number of jurisdictions increase.

Estimate fixed-effects Poisson Quasi-Maximum Likelihood count model:

\[
E(\text{deforest}_{pit}) = \mu_{pi} \exp(\beta \text{NumDistrictsInProv}_{pit} + \eta_{it})
\]

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
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<td>Panel A: Lags</td>
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<td>NumDistricts in province</td>
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<td>0.0833***</td>
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<td>-0.129**</td>
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<td>336</td>
<td>128</td>
<td>168</td>
<td>144</td>
<td>168</td>
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</tbody>
</table>

Joint p: 4.75e-06, 6.95e-08, 0.0235, 0.0428, 0.00923, 0.0486, 0.0665
Sum of lags: 0.0789***, 0.0783***, 0.0900**, 0.0712, 0.0793***, 0.125**, 0.0484

Notes: The forest dataset has been constructed from MODIS satellite images, as described in Section 2.2.1. It counts the total number of forest cells by year and forest zone. Note that 1000HA = 10 square kilometres. Number of districts in province variable counts the number of districts within each province. The regression also includes province and island-by-year fixed effects. The robust standard errors are clustered at the 1990 province boundaries and reported in parentheses. *** 0.01, ** 0.05, * 0.1.

Olken
Maximizing Illicit Profits
Prices for wood fall as number of jurisdictions increase.

Estimate:

$$\log(y_{wipt}) = \beta \text{NumDistricts}_\text{InProv} + \mu_{wpi} + \eta_{wit} + \varepsilon_{wipt},$$

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<td>Log Price</td>
<td>Log Quantity</td>
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<td>0.089**</td>
<td>-0.019*</td>
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<td>-0.023**</td>
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<td>(0.041)</td>
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<td>0.098</td>
<td>-0.027**</td>
<td>0.126</td>
<td>-0.029***</td>
<td>0.071***</td>
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<td>(0.010)</td>
<td>(0.074)</td>
<td>(0.012)</td>
<td>(0.078)</td>
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<td>(0.004)</td>
<td>(0.036)</td>
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<tr>
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<td>(0.0116)</td>
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<td>(0.0131)</td>
<td>(0.0363)</td>
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Notes: The log price and log quantity data has been compiled from the 'Statistics of Forest and Concession Estate'. The number of districts in province variable counts the number of kabupaten and kota within each province. The regression also includes wood-type-by-province and wood-type-by-island-by-year fixed effects and are weighted by the first volume reported by wood type and province. The robust standard errors are clustered at the 1990 province boundaries and reported in parentheses. *** 0.01, ** 0.05, * 0.1.
Concluding thoughts

- Efficiency costs can be severe, particularly if they undo government’s ability to correct externalities or distort investment decisions
- Corrupt officials do respond to monitoring and punishments, but there may be limits:
  - What if the auditors are corrupt? Then it depends on whether the amount you have to bribe the auditors depends on how corrupt you are
  - Evidence of substitution to other margins: in road example, nepotism increased in response to audits
  - Bargaining can imply perverse impacts of incentives
- Market forces can affect bribe levels in equilibrium
  - Whether competition is good or bad depends on whether increasing quantities is socially good or bad
  - In forestry, it led to more illegal logging
  - In other cases (getting an ID card) it could lead to lower bribes
  - Not clear how this interacts with case when government also a\textsuperscript{p}pears in negotiations (e.g., driver’s license in China)