Public Finance I: Taxation

14.740x: Foundations of Development Policy

Professor Ben Olken

The role of government

- What should governments do?
- What should the private sector do?
- General principle in economics:
  - Governments should only do those things that the private sector can't do on its own
  - Why might this be?
- What are taxes?
  - Why might taxes be bad?

The role of government

- Broadly speaking the government does 4 things:

1. Provide public goods
   - Definition: a public good is *non-rival* and *non-excludable*. Examples?
   - Note: government may also want to private rival, non-excludable goods. Examples?

2. Correct externalities.
   - Definition: an externality is the cost or benefit that affects a party who did not choose to incur that cost or benefit.
   - Examples?

3. Regulate monopolies. Examples?

4. Redistribution and social safety nets.
   - This is what I'm going to focus on in these lectures.
   - But before we can talk about this, we need to talk about taxes.

Plan for discussion

- Taxation (today)
    1. An overview of why taxation is different in developing countries
    2. How value added taxes help improve enforcement
    3. The role of tax collectors

- Targeting and government welfare programs (2nd lecture)

- Transparency (3rd lecture)

Plan for discussion

- Taxation (today)
  1. An overview of why taxation is different in developing countries
  2. How value added taxes help improve enforcement
  3. The role of tax collectors

- Targeting and government welfare programs (2nd lecture)
- Transparency (3rd lecture)

Tax

- There is a vast literature in PF on taxation. E.g., incidence, optimal income tax theory, capital taxation, consumption taxes, dynamic considerations, etc, etc.

- By comparison we know very little about tax – either theory or empirics – in developing countries.

- What we do know suggests that there is a fundamental difference between developing and developed countries:

  - *Information.* There is much less information available. How do you levy an income tax on people who are subsistence farmers? Or laborers in an all-cash economy?
  - *Enforcement.* Given the information problems there is substantial opportunity for corruption.

- Naturally, these two problems are related

Tax

- What do we tax in the United States?

  - Personal income
  - Sales tax (consumption)
  - Corporate income (relatively small)
  - Real property (relatively small)

- What might be harder in a developed country? Why?

- Turns out developing countries raise less taxes – and what they do raise looks very different because you need to tax things governments can observe (Gordon and Li 2005)

Developed and developing countries tax structure
Gordon and Li 2009

Table 1
Sources of government revenue (1996–2001).

GDP per capita	Tax revenue (% of GDP)	Income taxes (% of revenue)	Corporate income tax (% of income taxes)	Consumption and production taxes (% of revenue)	Border taxes (% of revenue)	Inflation rate	Seignorage income (% of revenue)	Informal economy (% of GDP)
<$745	14.1	35.9	53.7	43.5	16.4	10.6	21.8	26.4
$746–2975	16.7	31.5	49.1	51.8	9.3	15.7	24.9	29.5
$2976–9205	20.2	29.4	30.3	53.1	5.4	7.4	6.0	32.5
All developing	17.6	31.2	42.3	51.2	8.6	11.8	16.3	30.1
>$9,206	25.0	54.3	17.8	32.9	0.7	2.2	1.7	14.0

Tax

- Key problem is information
  - In developed countries, government observes income through double-reporting, bank records, etc. In developing countries, much less information!

- How to deal with this problem? We'll explore two approaches
  - Value added tax – encourages double-reporting (evidence from Chile)
  - Individual tax inspectors to find out information – but what are their incentives? (evidence from Pakistan)

VAT

- What is the Value Added Tax (VAT)?
  - Firms taxed on output, but receive tax credit for taxes already paid on inputs
  - Imports taxed, exports not
- Why VAT?
  - If everyone participates, this is equivalent to a sales tax
  - But it has much better enforcement properties:
    - Firms higher up on the chain want the credit that comes from their input-firms having paid VAT
    - Thus firms have an incentive to get other firms to pay taxes
  - This it is particularly useful in low-compliance places like developing countries, and has rapidly diffused across the world

Empirical evidence on chains
Pomeranz forthcoming: "No Taxation without Information: Deterrance and Self-Enforcement in the Value Added Tax"

- Setting: VAT in Chile
- Two types of tax evasion:
  - *Omissions*. Omit certain transactions entirely.
  - *Discrepancies*. Mis-report value of transactions (overstate inputs, understate sales).
- Suppose that there are three firms:
  1. Supplier of raw materials (sells to 2)
  2. Intermediate producer (buys from 1, sells to 3)
  3. Final retailer (buys from 2, sells to general public)
- Where is there double reporting?
- Suppose you increase attention to firm #2. What do you expect to happen?

Intuition for detecting VAT spillovers

Pomeranz forthcoming: Table 1

Table 1: Two Forms of VAT Evasion on Inter-Firm Transactions

Position in supply chain	Omission		Discrepancies	
Supplier	Sales ↑	VAT ↑	Sales ↑	VAT ↑
Treated firm	Inputs ↑ Sales ↑	VAT (↑)	Inputs ↓ Sales ↑	VAT ↑
Client	Inputs ↑	VAT ↓	Inputs ↓	VAT ↑

Empirical evidence on VAT chains

- Key ideas for testing VAT chains:
    - Suppose you audit firm 2. What should be the impact on firms 1 and 3?
    - Suppose you audit some of firm type 1, some of type 2, and some of type 3 (in different chains). Where should reponse be highest?
- Two experiments:
    1. *Spillovers*. Consider subsample of 5,600 firms suspected of tax evasion. Half of them were given pre-announcement of an audit. Examine what to their trading partners at time of audit.
    2. *Deterrance*. Letter sent to around 102,000 randomly chosen firms to make them think they were more likely to be audited.

Heterogeneity and interactions

- Key prediction is heterogeneous impacts of treatment
    - In particular, we hypothesize that the treatment has different impacts depending on whether you are a supplier or client
- To do this in a regression format, we consider *interactions*. Define a variable $SUPPLIER_i$ to whether a firm is a client firm to capture whether a firm is a supplier firm. Then we can regress

$$y_i = \alpha + \beta TREAT_i + \gamma TREAT_i \times SUPPLIER_i + \omega SUPPLIER_i + \varepsilon_i$$

- The interpretation of γ is that it is like a second derivative. Differentiating the equation above:

$$\frac{\partial^2 y}{\partial TREEAT \partial SUPPLIER} = \omega$$

- So γ tells us how $\frac{\partial y}{\partial TREAT}$ changes with a given change in $SUPPLIER$
- Note: in general, in a regression like this you also want to include all first order terms:

Heterogeneity and interactions

$$y_i = \alpha + \beta TREAT_i + \gamma TREAT_i \times SUPPLIER_i + \omega SUPPLIER_i + \varepsilon_i$$

- Suppose we are interested in the net effect of the treatment for suppliers. How do we compute this?
- What is β?

Firm fixed effects

- In this case we are interested in comparing changes within firms. Why might we want to do this?
- So regression is actually

$$
\begin{aligned}
y_i \;=\; & \alpha_i + \beta TREAT_i \times POST_t + \\
& + \gamma TREAT_i \times SUPPLIER_i \times POST_t \\
& + \omega SUPPLIER_i \times POST_t + \varepsilon_i
\end{aligned}
$$

Table 7: Spillover Effects on Trading Partners' VAT Payments

	(1) Percent VAT > Previous Year	(2) Percent VAT > Predicted	(3) Percent VAT > Previous Year	(4) Percent VAT > Predicted	(5) Percent VAT > Previous Year	(6) Percent VAT > Predicted
Audit announcement X	2.41**	2.03*				
post	(1.14)	(1.11)				
Audit announcement X			4.28***	3.92***	4.14***	3.83***
supplier X post			(1.54)	(1.50)	(1.52)	(1.52)
Audit announcement X			-0.26	-0.28	-0.14	-0.28
client X post			(1.64)	(1.51)	(1.67)	(1.55)
Supplier X post			-0.64	0.34	-1.11	0.60
			(1.62)	(1.59)	(1.67)	(1.64)
Constant	52.07***	49.06***	52.07***	49.06***	52.75***	50.11***
	(0.95)	(0.94)	(0.95)	(0.94)	(0.96)	(0.96)
Controls X post	No	No	No	No	Yes	Yes
Controls X						
audit announcement X post	No	No	No	No	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	45,264	45,264	45,264	45,264	44,288	44,288
Number of firms	2,829	2,829	2,829	2,829	2,768	2,768
Adjusted R^2	0.05	0.11	0.05	0.11	0.05	0.10

Deterrance results
Pomeranz Table 6

Table 6: Interaction of Firm Size and Share of Sales to Final Consumers

Panel A:	Percent VAT > Previous Year				
	(1)	(2)	(3)	(4)	(5)
Deterrence letter X final sales share	1.61***			1.48***	1.43***
	(0.26)			(0.27)	(0.26)
Deterrence letter X size category		-0.17***		-0.10***	
		(0.04)		(0.04)	
Deterrence letter X log employees			-0.45***		-0.29**
			(0.11)		(0.12)
Deterrence letter	0.68***	2.63***	1.66***	1.49***	0.92***
	(0.16)	(0.29)	(0.13)	(0.35)	(0.19)
Constant	47.53***	48.87***	47.50***	48.89***	47.53***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Final sales share X post	Yes	No	No	Yes	Yes
Size measure X post	No	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Month dummies	Yes	Yes	Yes	Yes	Yes
Observations	7,308,631	7,116,590	7,340,994	7,084,823	7,308,631
Number of firms	406,834	396,135	408,636	394,367	406,834
Adjusted R^2	0.14	0.14	0.14	0.14	0.14
Panel B:	Percent VAT > Predicted				
	(1)	(2)	(3)	(4)	(5)
Deterrence Letter X final sales share	1.51***			1.51***	1.44***
	(0.23)			(0.25)	(0.24)
Deterrence Letter X size category		-0.10***		-0.03	
		(0.03)		(0.04)	
Deterrence Letter X log employees			-0.28***		-0.11
			(0.10)		(0.11)
Deterrence Letter	0.74***	2.15***	1.57***	1.00***	0.83***
	(0.14)	(0.26)	(0.12)	(0.32)	(0.16)
Constant	48.48***	49.79***	48.26***	50.01***	48.48***
	(0.08)	(0.08)	(0.08)	(0.08)	(0.08)
Final sales share X post	Yes	No	No	Yes	Yes
Size measure X post	No	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	7,308,631	7,116,590	7,340,994	7,084,823	7,308,631
Number of firms	406,834	396,135	408,636	394,367	406,834
Adjusted R^2	0.28	0.26	0.29	0.26	0.28

Tax inspectors

- A second approach is to have the government try to ferret out information with tax inspectors
- What do they do?
- What might the problem be?

Tax inspectors
Khan, Khwaja, and Olken (2014): "Tax Farming Redux: Experimental Evidence on
Performance Pay for Tax Collectors"

- Idea of this project is to provide incentives to property tax staff
- 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

Model

- 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, agreem 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 $\tau \le \tau^*$.
- 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 surplusWhat 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 $\beta(\tau^* - \tau)$.

Model

- 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):

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

Model

- 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) 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.

Table 3: Impacts on Revenue Collected

	Year 1			Year 2		
	(1) Total	(2) Current	(3) Arrears	(4) Total	(5) Current	(6) Arrears
Panel A: Main Treatment						
Any treatment	0.090***	0.073***	0.152**	0.093***	0.091***	0.113
	(0.028)	(0.027)	(0.069)	(0.031)	(0.032)	(0.083)
Panel B: Subtreatments						
Revenue	0.117***	0.109***	0.134	0.128***	0.152***	0.005
	(0.035)	(0.034)	(0.099)	(0.044)	(0.044)	(0.133)
Revenue Plus	0.080	0.086*	0.072	0.092**	0.081*	0.175
	(0.053)	(0.052)	(0.110)	(0.045)	(0.049)	(0.114)
Flexible Bonus	0.070*	0.024	0.243**	0.056	0.035	0.148
	(0.038)	(0.035)	(0.098)	(0.041)	(0.042)	(0.108)
N	481	481	481	482	482	479
Mean of control group	15.672	15.379	14.030	15.745	15.518	13.915
Rev. vs. Multitasking p.	0.322	0.193	0.830	0.237	0.049	0.262
Objective vs. Subjective p.	0.530	0.090	0.212	0.222	0.084	0.634
Equality of Schemes	0.561	0.143	0.433	0.363	0.086	0.527
Joint significance	0.004	0.010	0.073	0.014	0.005	0.305

Table 7: Impacts on Tax Payments and Corruption, by Reassessed Status

	(1) Self-reported Tax Payment	(2) Bribe Payment	(3) Frequency of Bribe Payment	(4) Perception of Corruption
Panel A: General Population Sample				
Treatment	-126.9	594.1*	.2021**	.0113
	(310.5)	(333)	(.0951)	(.0254)
N	9632	5993	4802	6050
Mean of control group	4919.067	1874.542	0.683	0.644
Panel B: Re-assessed				
Re-assessed * Treatment	2248*	-557.4	-.1592*	-.0031
	(1311)	(367.1)	(.0934)	(.0221)
Re-assessed	3430***	-66.38	.0137	-.0191*
	(688.5)	(177.3)	(.0403)	(.0107)
N	13693	8207	6993	8268
Sample	Full	Phase 1	Phase 1	Phase 1
Mean of control group in gen. pop. sample	4713.484	1874.542	0.683	0.644

Table 8: Impacts on Satisfaction and Accuracy, by Reassessed Status

	(1) Quality	(2) Satisfaction	(3) Inaccuracy	(4) Tax Gap
Re-assessed * Treatment	0.009	0.005	0.001	-0.005
	(0.024)	(0.024)	(0.017)	(0.028)
Re-assessed	0.049***	0.044***	-0.061***	0.122***
	(0.013)	(0.013)	(0.009)	(0.015)
N	8268	8268	14182	14182
Sample	Phase 1	Phase 1	Full	Full
Mean of control group in gen. pop. sample	0.538	0.555	0.339	-0.103

Summary

- Taxes are fundamental to government's ability to solve problems
- But taxes are more challenging in developing counties because of information problems
- This can be solved to some degree by good tax policy and by working with tax inspectors
- But challenges remain

References

- Gordon and Li (2009): "Tax structures in developing countries: Many puzzles and a possible explanation
- Pomeranz (2014): "No Taxation wthout Information: Deterrence and Self-Enforcement in the Value Added Tax"
- Khan, Khwaja, and Olken (2014): "Tax Farming Redux: Experimental Evidence on Performance Pay for Tax Collectors"