Tax Administration versus Tax Rates

Evidence from Corporate Taxation in Indonesia

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- Many scholars have shown that pieces of tax administration can matter in developing countries (e.g. Pomeranz 2015; Khan et al 2016; Naritomi 2019; see Slemrod 2019 for a review), but how does large-scale administrative reform compare to raising rates?
- This paper investigates these questions by comparing a large-scale tax administration overhaul to changes in de jure tax schedule – allowing us to compare, on the margin, these two approaches to raising revenue

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  - Taxpayer administration reform in 2007
    - Corporate taxes tend to be very skewed, so few taxpayers pay most tax. So most countries have the largest taxpayers served by special tax offices with much higher staff-to-taxpayer ratios (Lemgruber et al 2015; Alumnia and Lopez-Rodriguez 2018).
    - What are the returns in a developing country setting?
    - Indonesia implemented this idea at the regional office, with creation of "Medium Tax Offices" (MTOs) to serve largest ~330 taxpayers in each region (~4 percent).
    - We study the impact on firms when MTOs are first created, using matched differences-in-differences to compare treated and non-treated firms.
    - Suggest one possible mechanism for why improved tax administration can be effective: a reduction in size-dependent enforcement

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  - Tax rate reforms in 2008-2009
    - Pre-2008 system: progressive CIT with marginal rate based on taxable income (*profits*). Top marginal rate 30%.
    - Post-2008 system: flat CIT, but with discounts based on gross revenue (*revenue*). Top marginal rate 28% in 2009 and 25% from 2010 on.
    - Estimate elasticity of taxable income by instrumenting for change in CIT using pre-period revenues and tax schedule change (a la Gruber and Saez 2002 and others).

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  - Taxpayer administration reform in 2007
  - Tax rate reforms in 2008-2009
- Benchmark improved administration effect to counterfactual tax rate increase using the ETI estimate.

Preview of results

- Improved tax administration had substantial effects on revenues.
  - Affected firms' tax payments 127% higher on average over the 6 years after moving to MTO.
  - Governments cost were miniscule – about 1.5 percent of additional revenue collected.
  - Similar effects for value-added tax, corporate income tax, and withholding taxes.
  - See dramatic increases in reported gross incomes and increases in formal employment and wage bill, not just taxable income or tax payments.
  - Effects on tax payments and gross incomes *increase* over time, no change in reported profit or collection margins.
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- One possible mechanism: reduction in size-based enforcement
  - In standard tax administration, overburdened staff focus enforcement efforts on large firms (as in Hsieh and Olken 2014; Bachas, Jaef, and Jensen 2018)
  - With more resources, staff can enforce more uniformly
  - So improved tax administration may raise effective tax rate on small firms, but reduces the additional 'enforcement tax' on firm growth.

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  - With more resources, staff can enforce more uniformly
  - So improved tax administration may raise effective tax rate on small firms, but reduces the additional 'enforcement tax' on firm growth.
  - This appears to happen in the data: MTO increases enforcement *levels* for small firms, but relationship flattens

Preview of results

- Tax Rates
  - Estimate elasticity of taxable income of 0.579.
    - A bit higher than US (0.2; Gruber and Rauh); similar to Germany (0.6; Dwenger and Steiner). Smaller than small firms in Costa Rica (3; Bachas forthcoming).
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- Comparison:
  - Increase in corporate income tax payments from MTO taxpayers alone is equivalent to raising tax rate on *all* firms by 8 pp (i.e. from 30 percent to 38 percent).
  - Suggests administrative improvements likely welfare improving unless private enforcement costs are very high

Setting: Corporate Taxation in Indonesia

- Corporations remit three main types of taxes
  - Corporate income taxes (CIT) (current top marginal tax rate is 25%; more detail below)
  - Value added taxes (VAT) (flat 10% rate)
  - Withholding taxes for employees
- Payments remitted monthly; annual CIT filing due by April of following year
- Administered by Directorate General of Taxation

Tax Administration Reform

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- Indonesia creates "Medium Taxpayer Offices" in each region for more intensive administration for large taxpayers.
  - Average of 330 taxpayers per office – about the top 4% of taxpayers in each region, assigned roughly based on pre-period gross income and taxable income (exact Excel sheets lost) Figure
  - Substantially higher staffing ratios than Primary Tax Offices – 3-4 times as many Account Representatives and 4-5 times as many Auditors per corporate taxpayer, and no individual taxpayers. Staff quality / experience broadly similar. Table

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- Focus on 13 (out of 19) regions where MTOs created in 2007.
  - Primary tax offices also reorganized to follow identical org chart in 2007. This experiment therefore captures intensity of supervision, holding org structure fixed.
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  - Results similar if we include pre-2007 MTOs as well. Robustness
- Identification: matched diffs-in-diffs, matching taxpayers based on pre-period (2005) gross and taxable income.

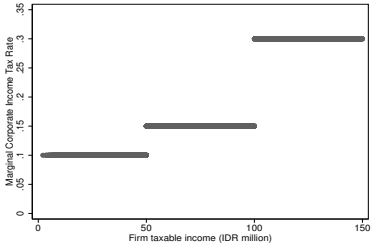
Tax Rate Reform

- Corporate income taxation prior to 2008:
  - Progressive taxation based on *taxable income*, with three bins (10%, 15%, 30%)
- Corporate tax reform in 2009:
  - Flat tax of 28% taxable income in 2009, lowered to 25% in 2010
  - Flat tax rate reduced (for all taxable income), as a function of *gross income,* using formula

$$\tau_{it} = \begin{cases} \frac{r_t^*}{2} & \text{if } g_{it} < \text{Rp. 4.8 bil.} \\ \frac{r_t^*}{2}\left(\frac{\text{4.8 billion}}{g_{it}}\right) + r_t^*\left[1 - \left(\frac{\text{4.8 billion}}{g_{it}}\right)\right] & \text{if Rp. 4.8 bil.} \leq g_{it} < \text{Rp. 50 bil.} \\ r_t^* & \text{if } g_{it} \geq \text{Rp. 50 bil.} \end{cases}$$

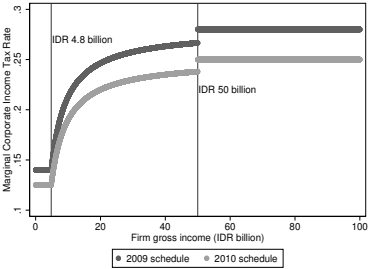
2009 Corporate Income Tax Rate Reform

Before 2009



- MTR based on **Taxable Income**
- Rates: 10%, 15%, 30%
- Thresholds: Rp 50mi and Rp 100 mi

After 2009



- MTR based on **Gross Income**
- Rates:
  - 14% to 28% (2009 on)
  - 12.5% to 25% (2010 on)
- Thresholds: Rp 4.8 bi and Rp 50 bi

Notch

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- Identification: instrument for tax change using pre-period π_{it} and g_{it} and changes to tax schedule

Data: Detailed Corporate Tax Filings and Payments

- Anonymized administrative data on tax payments and tax filings, 2003 - 2011
  - All corporate taxpayers except those covered by national Large Taxpayer Office and Special Tax Offices (foreign firms, public-ally traded, and firms in oil and gas industry). Total of over 100,000 corporate taxpayers.
  - Corporate income tax filings, including tax year and file date.
  - Taxes actually paid (Income tax and VAT), including both tax year and payment date.
- Other administrative tax data
  - Data on formal audits starting in 2009; VAT underpayment and collection letters, 2003-2011
  - Firm-level employment counts, all years except 2008

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  - Keen and Slemrod (2017) extend this framework to the case of tax administration.
  - We adapt their framework to think about firms and incorporate non-uniform tax administration in the context of our model.
- Details in the paper

Welfare

- Define α as level of administration, z as taxable income, $\gamma(\alpha)$ as private compliance costs, l as business lines
- Social welfare in this context is given by:

$$W = \underbrace{\int_{l^*}^{L} (y_l^p - c(y_l^p)) - \tau z}_{\text{firm post-tax profits from taxed business lines}} + \underbrace{\int_{0}^{l^*} y_l^e(\alpha) - c(y_l^e(\alpha)) - \gamma(\alpha)}_{\text{firm post-tax profits from evaded business lines}} \quad (1)$$
$$+ \underbrace{v\left(\tau z - a(\alpha)\right)}_{\text{social value of public funds}}$$

  where $v \geq 1$ is the marginal value of government funds and $a(\alpha)$ are administration costs.
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- Approach: take derviatives w.r.t. α and τ and apply the envelope theorem

Welfare

- Change in tax administration:
  - Taking the derivative with respect to tax enforcement α and applying envelope theorem:

$$W_\alpha = -\frac{d\gamma}{d\alpha} + v\left(\tau\frac{dz}{d\alpha} - \frac{da}{d\alpha}\right)$$

  - Note that we do not observe the change in private compliance costs $-\frac{d\gamma}{d\alpha}$.
  - We can, however, estimate the $\tau\frac{dz}{d\alpha} - \frac{da}{d\alpha}$ - change in net government revenue.
  - Can use this to bound how large $-\frac{d\gamma}{d\alpha}$ would have to be.

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  - Can use this to bound how large $-\frac{d\gamma}{d\alpha}$ would have to be.
- Change in tax rates:
  - Taking derivative w.r.t. τ and applying the envelope theorem, impact of a change in tax rates on welfare is given by:

$$W_\tau = -z + v\left(z + \tau\frac{dz}{d\tau}\right) = -z + vz\left(1 - \frac{\tau}{1-\tau}\varepsilon_{1-\tau}\right)$$

  - Key parameter to estimate is $\varepsilon_{1-\tau}$

Comparing tax administration and tax rates

- Key calculation: the tax change such that government revenue is the same after a marginal change in tax administration (i.e. a change in α):

$$\frac{d\tau}{d\alpha}|_R = -\frac{\tau \frac{dz}{d\alpha} - \frac{da}{d\alpha}}{z\left(1 - \frac{\tau}{1-\tau}\varepsilon_{1-\tau}\right)}$$

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  - Change in administration: $\tau \frac{dz}{d\alpha} - \frac{da}{d\alpha}$
  - ETI: $\varepsilon_{1-\tau}$
- Welfare impacts of marginal shift from tax rates to tax administration

$$\begin{aligned} dW &= W_\tau \frac{d\tau}{d\alpha}|_R + W_\alpha \\ &= \left(\tau \frac{dz}{d\alpha} - \frac{da}{d\alpha}\right) \frac{1}{1 - \frac{\tau}{1-\tau}\varepsilon_{1-\tau}} - \frac{d\gamma}{d\alpha} \end{aligned}$$

  - Since all but $-\frac{d\gamma}{d\alpha}$ is observed, can use this to think about bounds

Tax Administration Research Design

- Key challenge: MTO firms are generally larger than PTO firms.
  - Assignment based on on gross income, tax payments, and possibly other variables.
  - Excel sheets used for assignment not retained, so cannot reproduce formula exactly or do RD.
  - We therefore match taxpayers based on gross income and tax payments in 2005 (last year unaffected by MTO) so that weighted sample is balanced.
- Then estimate reduced form effect of MTO assignment with weighted differences-in-differences:

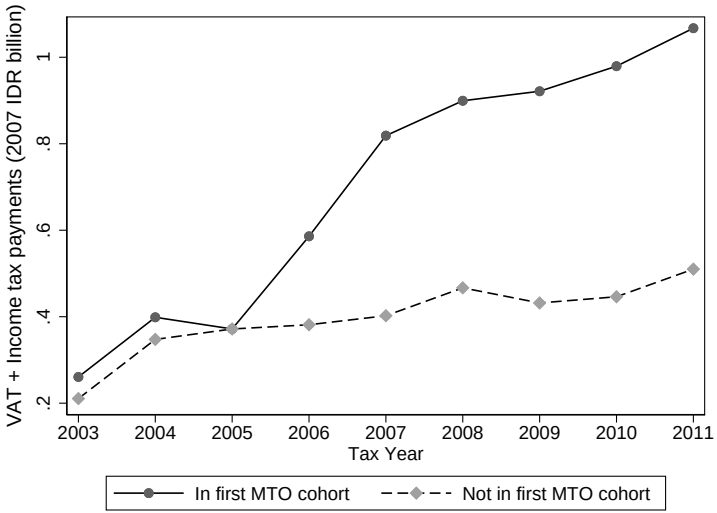
$$Y_{it} = \alpha + \beta^{RF} \left(M_{iFC} \times 1_{t>2005} \right) + \delta_t + \delta_i + \epsilon_{it}$$

  where M_{iFC} indicates firm i was in the first cohort of firms assigned to the MTO
- Compute event study version of above by estimating separate coefficients β_t for each year
- Some additional control firms move to MTO starting in 2009. Therefore estimate IV version of above, instrumenting for M_{it} with $M_{iFC} \times 1_{t>2005}$. First stage

Matching

- Restrict to common support (i.e. 97.5th / 2.5th percentiles; 99th / 1st percentile, etc).
  Figure Robustness
- Match on 2005 gross income and tax payments using 'entropy balancing' weights (Hainmuller 2012) Details
  - Show robustness to conventional inverse-probability weighted propensity score matching.
    Robustness
- Results balanced not just on levels (matched), but also on similar pre-trends (not matched) and similar on other non-matched variables.

Impacts on Tax Revenue



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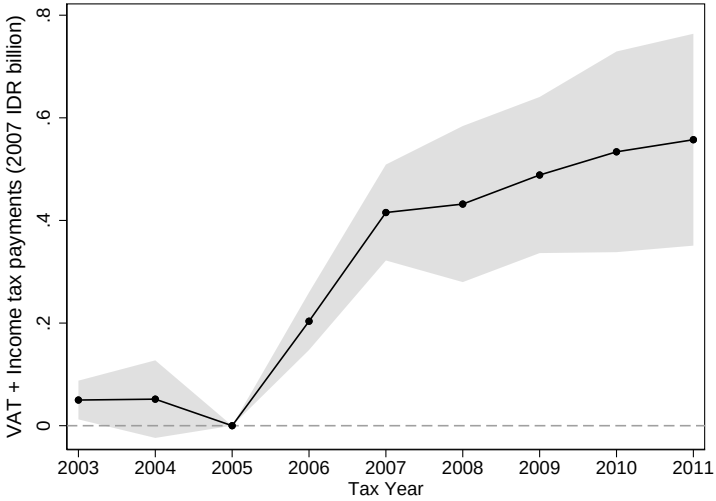

Magnitudes

Table 1: MTO Treatment Effect on Tax Payments, Reported Income, and Tax Collection Rate

	Weighted means				MTO treatment effect		
	Pre-treatment						
	Untreated (1)	Treated (2)	N (3)	Treated post-treatment counterfactual (4)	Reduced Form (5)	IV (6)	IV as % of post-treatment counterfactual (7)
Panel A: Tax Payments (2007 IDR billion)							
VAT	0.26	0.26	163,579	0.27	0.237	0.366	133%
					(0.050)	(0.078)	
Corporate Income Tax	0.05	0.06	163,579	0.06	0.048	0.074	118%
					(0.009)	(0.014)	
Other income taxes	0.06	0.06	163,579	0.07	0.052	0.080	114%
					(0.011)	(0.017)	
Total	0.37	0.37	163,579	0.41	0.337	0.520	127%
					(0.062)	(0.096)	

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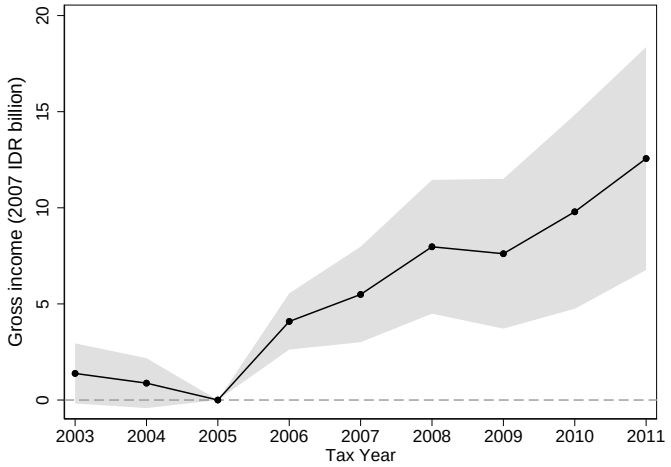
  - Extrapolating (in levels) to all MTO firms in Indonesia -> approx Rp. 40 trillion ($4.0 billion) over 6 years.
- Does not appear to be driven by changes in PTO group Details
- Key parameter is net revenues:
  - IV estimate of increased tax revenue effect: IDR 520 million / year
  - Difference in administrative costs per taxpayer: IDR 8 million / year. Two orders of magnitude smaller! Details
  - So net revenues gain is IDR 512 million / year

Reported incomes

- Effects appear on top-line (gross-incomes), not just bottom line



Reported incomes

- MTO leads to top-line increases in reported gross revenues – not just increased collections
  - Gross incomes (revenues) increase by 75%
    - Costs also increase as well by similar amounts (81%) Table
    - Profit margin remains unchanged Table
  - No change in collection rate (CIT paid / CIT due) Table
- Implications
  - Consistent with either new business being brought 'on the books' or firm growth
  - Not just increased collections or increased scrutiny of deductions

Reported employment

- Increases in permanent workers (21%), total wage bill (27%), and average yearly wage (18%)

Table 2: MTO Treatment Effect on Reported Employment

	Weighted means				MTO treatment effect		
	Pre-treatment						
	Untreated (1)	Treated (2)	N (3)	Treated post-treatment counterfactual (4)	Reduced Form (5)	IV (6)	IV as % of post-treatment counterfactual (7)
Total workers	92.16	167.52	116,611	161.46	6.900	12.498	--
					(11.742)	(21.271)	
Permanent workers	36.52	43.96	116,611	49.14	5.795	10.496	21%
					(3.226)	(5.840)	
Temporary workers	55.65	123.56	116,611	112.32	1.105	2.001	--
					(11.371)	(20.596)	
Total wage bill (2007 IDR billion)	1.10	1.34	116,611	1.35	0.203	0.367	27%
					(0.077)	(0.140)	
Permanent workers	0.70	0.81	116,611	0.92	0.111	0.201	22%
					(0.054)	(0.097)	
Temporary workers	0.41	0.52	116,611	0.44	0.092	0.166	38%
					(0.055)	(0.100)	
Average yearly wage (2007 IDR million)	16.27	15.94	116,611	14.55	1.458	2.641	18%
					(0.530)	(0.957)	

Graphs

Why might administration work so well?

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- To explore why we delve into the mechanisms of how MTO changed enforcement- both levels and whether it is size-dependent

Size-dependent enforcement

- Consider the enforcement function $\alpha m(z)(y)h(l)$
  - MTO presumably increases $\alpha m(z)(y)h(l)$ somewhere to make evasion more difficult
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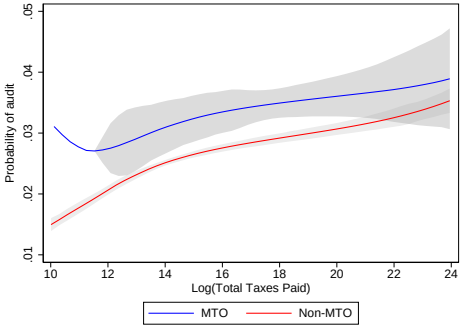
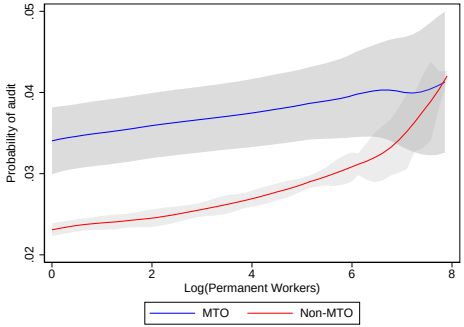
  - Continue to use balancing weights based on MTO assignment.
- Results in table form: Corrections Enforcement Slope - CS Enforcement Slope - D-inD

Results

Probability of audit



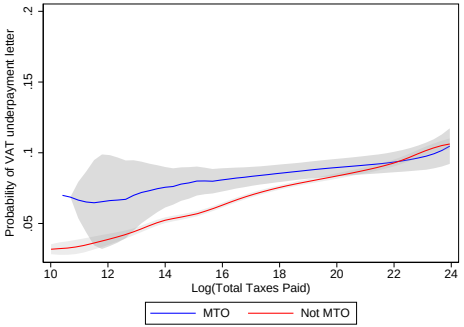
As a function of total taxes paid



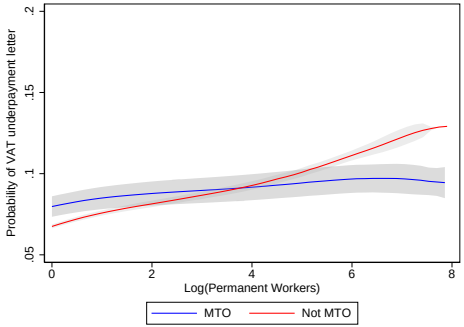
As a function of permanent workers

Results

Probability of VAT underpayment letter



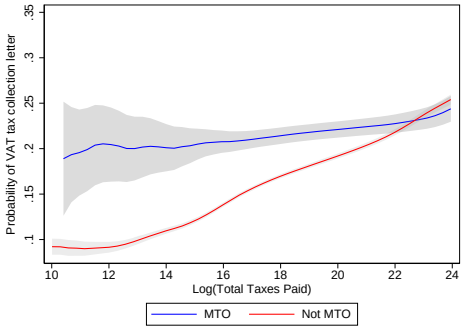
As a function of total taxes paid



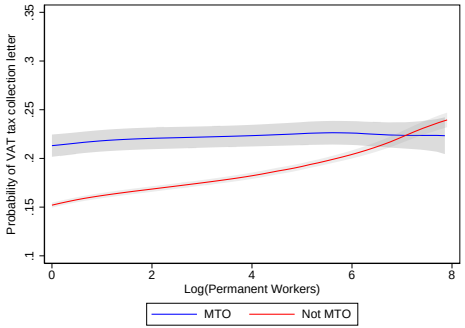
As a function of permanent workers

Results

Probability of VAT tax collection letter



As a function of total taxes paid



As a function of permanent workers

Summing up

- Improved tax administration...
  - Led to substantially higher revenues across all tax types
  - Driven by more top-line revenues being reported, rather than decreased deductions or improved collections
  - Did not slow the rate of firm growth
  - Appears to have reduced size-dependent enforcement
- Next... how does this compare to raising tax rates?

Estimating the elasticity of taxable income

- Key parameter for understanding tax rate changes: elasticity of taxable income with respect to the tax rate
  - The ETI measures by how much taxpayers reduce reported taxable income when their marginal tax rate (MTR) changes.
  - Key parameter for computing deadweight loss of taxation
- We exploit variation in the MTR induced by the 2009 and 2010 tax rate schedule reforms to obtain estimates of Indonesia's ETI.
- Use this parameter to compute counterfactuals
  - How much would tax rates have had to be raised to generate same amount of revenue as tax administration increases?

Research Design

- Exploit switch from MTR based on taxable income to MTR based on gross income
  - This leads to very different tax rate changes as a function of the combination of taxable and gross income Variation in the Data
- Exploring our panel data structure, we estimate ε according to:

$$\ln\left(\frac{z_{it+1}}{z_{it}}\right) = \alpha + \varepsilon \cdot \ln\left(\frac{1-\tau_{it+1}}{1-\tau_{it}}\right) + \varphi_1 \ln z_{it} + \varphi_2 \ln g_{it} + \delta_t + \delta_i + \epsilon_{it}$$

where

  - z_{it} is taxpayer i 's reported taxable income at time t.
  - g_{it} is taxpayer i 's reported gross income at time t.
  - τ_{it} is taxpayer i's marginal tax rate at time t.
  - two tax changes, so can include firm fixed effects (δ_i) and time fixed effects (δ_t)
  - can alternatively include sector and MTO fixed effects
- Instrument with $\ln\left(\frac{1-\tau^C_{it+1}}{1-\tau^C_{it}}\right)$, where τ^C_{it} is taxpayer i's predicted MTR at year t using period 0 data

Estimates

Table 6: Estimated ETI with Respect to the Net of Tax Rate

	Instrument: Reform-induced change in marginal tax rate		
		Separate by MTO status	
	All taxpayers	MTO	Not MTO
	(1)	(2)	(3)
Panel A: First Stage			
Endogenous:	0.979	0.981	0.981
Δ Ln(Net of tax rate)	(0.010)	(0.018)	(0.010)
F-statistic	10173.650	3000.712	9075.552
N	12,816	726	12,090
Panel B: IV (ETI estimates)			
Outcome:	0.579	0.344	0.764
Δ Ln(Taxable Income)	(0.198)	(0.380)	(0.214)
P-value of difference		0.335	
Taxpayer FE	Yes	No	No
Year FE	Yes	Yes	Yes

Robustness

Some implications

- We estimate an ETI of 0.579
  - Somewhat more elastic than US (0.2; Gruber and Rauh (2007)) but similar to Germany (0.6; Dwenger and Steiner (2012)); less than very small firms in Costa Rica (3-5;Bachas and Soto 2018)
- Implications
  - Can calculate the marginal excess burden

$$-\frac{dB}{dR} = \frac{\varepsilon \tau a}{1 - \tau - \varepsilon \tau \rho} = 0.49$$

    I.e., each dollar of taxes raised raises a burden of 0.49 on taxpayers.
  - Can calculate optimal tax rate as a function of v, the marginal value of public funds:
    - $v \to \infty$ (Laffer rate): revenue-maximizing tax rate $\frac{1}{1+a\epsilon}$ is 57 percent. Substantially more room to raise revenues.
    - $v = 2$: optimal rate is 39 percent
    - current top rate of 30 percent consistent with $v = 1.5$
- Point estimates suggest ETI is lower with more enforcement, but different not statistically significant

Comparing tax rates to tax administration

- Recall counterfactual from theory:
  1. How much would τ have to be raised to generate same amount of revenue as generated by tax administration increase?
  2. Put another way, how much could government lower τ to keep total revenue unchanged?
- To compute these, given estimates of ε and dR_{MTO}, we can compute:

$$\frac{d\tau}{d\alpha}|_R = -\frac{\overbrace{\tau\frac{dz}{d\alpha} - \frac{da}{d\alpha}}^{\text{Total MTO effect}}}{\underbrace{N\left(z^m - \bar{z}\right)}_{\text{Total income subject to raise}}\left[1 - \underbrace{\left(\frac{\tau}{1-\tau}\right)\varepsilon}_{\text{Behavioral effect}}\right]\rho}$$

- Suppose we are in the 2006 3-tired Corporate MTR schedule.
- Calibrate with $\bar{z} =$ Rp 100 million. $N = \mathbb{1}\{z > \bar{z}\}$, z reported 2006 taxable income, $z^m = E[z|z > \bar{z}]$, $\rho = \left(\frac{z^m}{z^m - \bar{z}}\right)$ and $\tau = 30\%$

Results

Table 7: Counterfactual CIT Increases to Match MTO Effects

		MTR raise needed to generate MTO effect on total revenue	
	MTO IV treatment effect (IDR billion)	Taxing MTO taxpayers	Taxing all taxpayers
	(1)	(2)	(3)
Corporate Income Tax	0.086	Laffer	8 pp
Total Income Taxes	0.180	Laffer	16 pp

Extrapolating to 19 regions

Increase enforcement or increase rates?

- Recall framework suggests using this revenue-neutral counterfactual to think about welfare (Keen and Slemrod 2017) :
  - Consider the counterfactual where we improve administration and cut rates to keep government revenue (net of administration costs) constant.
  - Is welfare higher?

- Evaluate

$$dW = \left(\tau \frac{dz}{d\alpha} - \frac{da}{d\alpha}\right) \frac{1}{1 - \frac{\tau}{1-\tau}\rho\varepsilon_{1-\tau}} - \frac{d\gamma}{d\alpha}$$

  where
  - $\left(\tau \frac{dz}{d\alpha} - \frac{da}{d\alpha}\right)$ is the change in revenue due to MTO, net of administrative costs
  - $\varepsilon_{1-\tau}$ is the ETI
  - $\frac{d\gamma}{d\alpha}$ is the change in private compliance costs

Increase enforcement or increase rates?

$$dW = \left(\tau \frac{dz}{d\alpha} - \frac{da}{d\alpha}\right) \frac{1}{1 - \frac{\tau}{1-\tau}\rho\varepsilon_{1-\tau}} - \frac{d\gamma}{d\alpha}$$

- We do not observe change in private compliance costs $\frac{dc}{d\alpha}$
- But, holding $\frac{d\gamma}{d\alpha}$ fixed, improving tax administration is likely to be a good idea when
  - $\left(\tau \frac{dz}{d\alpha} - \frac{da}{d\alpha}\right)$ is large – i.e. net gains from improvement enforcement are large
  - and when ε is large – i.e. behavioral elasticity w.r.t. tax rates are non-trivial
- Both turn out to be true in our context
  - In particular $\frac{1}{1-\frac{\tau}{1-\tau}\varepsilon a} = 1.49$, so true even if revenue gains from enforcement only 68 of additional compliance costs induced by MTO.
    - Plus, MTO actually *reduced* compliance costs - survey from ACNeilsen found higher 'satisfaction' with MTO

Taking stock

- This paper examined whether discrete changes in tax administration and tax rates can raise large amounts of revenue in developing countries – and the tradeoffs between these two approaches
- Exploiting major reforms in corporate tax policy in Indonesia, we:
  - Found that administration reform had very large effects on tax revenues
  - Raising same amount of revenue from increases in CIT from MTO taxpayers alone would have required raising MTR on *all* firms by 8 percentage points
- Administration reform may have been particularly effective through making enforcement $m(z)$ less size-dependent
- Suggests tax administration reforms can be as important, if not more, than reforms to tax rates

MTO Rollout

Table A.3: Indonesia's Medium Taxpayer Offices

MTO	Included in Analysis?	Creation Year	Overseen Provinces or Districts
KPP Madya Jakarta Pusat	No	2004	DKI Jakarta (Center)
KPP Madya Batam	No	2005	Riau
KPP Madya Pekanbaru	No	2006	Riau Islands
KPP Madya Denpasar	No	2006	Bali
KPP Madya Tangerang	No	2006	Banten
KPP Madya Bekasi	No	2006	West Java
KPP Madya Jakarta Barat	Yes	2007	DKI Jakarta (West)
KPP Madya Jakarta Selatan I	Yes	2007	DKI Jakarta (South)
KPP Madya Jakarta Timur	Yes	2007	DKI Jakarta (East)
KPP Madya Jakarta Utara	Yes	2007	DKI Jakarta (North)
KPP Madya Bandung	Yes	2007	West Java
KPP Madya Semarang	Yes	2007	Central Java
KPP Madya Surabaya	Yes	2007	East Java
KPP Madya Sidoarjo	Yes	2007	East Java
KPP Madya Malang	Yes	2007	East Java
KPP Madya Balikpapan	Yes	2007	East Kalimantan
KPP Madya Makassar	Yes	2007	South, Southeast, and West Sulawesi
KPP Madya Palembang	Yes	2007	South Sumatra and Bangka Belitung Islands
KPP Madya Medan	Yes	2007	North Sumatra

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Entropy Balancing Weights

- Loss function $h(w_i)$ distance metric.
- They use the Kullback (1959) entropy divergence criteria, defined by

$$h(w_i) = w_i log(\frac{w_i}{q_i}_i)$$

where q_i is the base weight, in this case uniform $q_i = \frac{1}{N}$

- Weights are the solution to Lagrangian

$$\min \sum_i w_i log(\frac{w_i}{q_i}_i) + \sum_r \lambda_r \left(\sum_i w_i X_i^r - m^r \right)$$

where r indexes which moment to match, and subject to condition that all weights are non-negative and weighs sum to 1.

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Common Support

Gross Income

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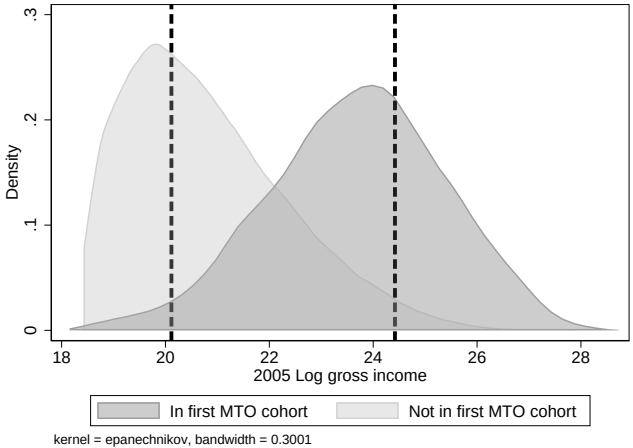

Common Support

Total taxes paid

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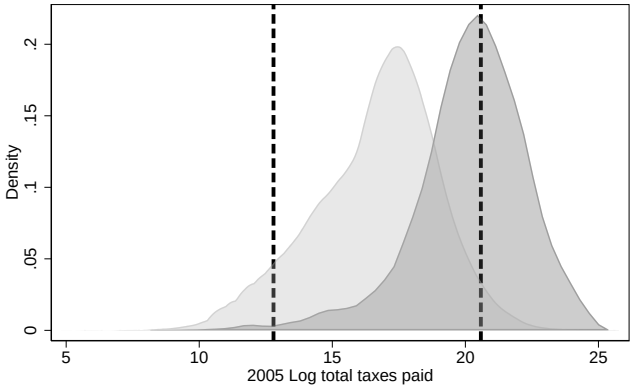

Common Support

Joint distribution

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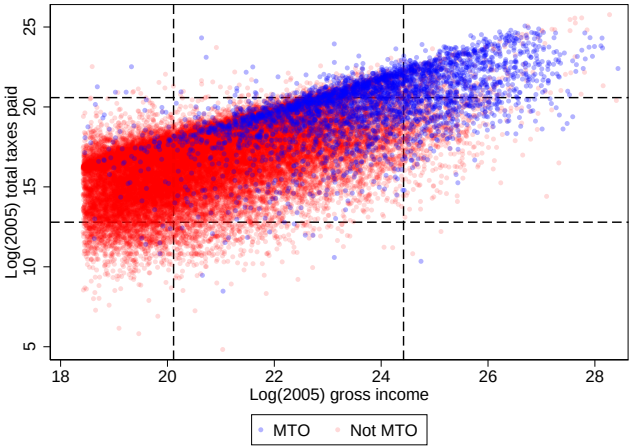
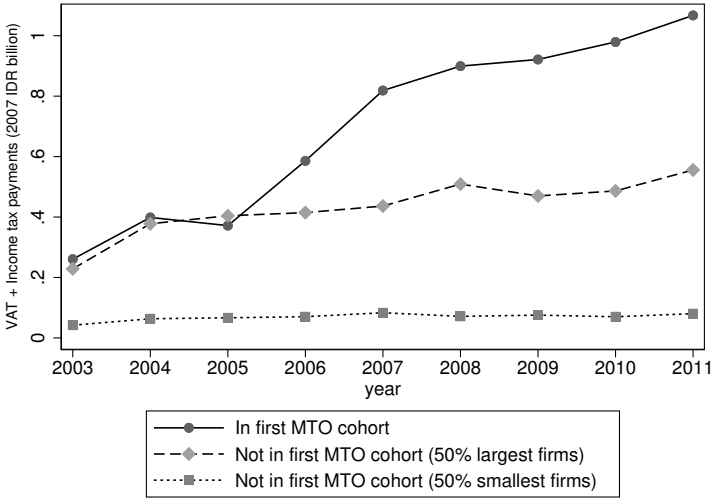


Larger vs. smaller PTO firms



MTO first stage

Table A.8: First stage of MTO regression

Instrument:	Treatment: Taxpayer in MTO in current year (1)
(Assigned to MTO in 2007) x (Year > 2005)	0.648 (0.008)
F-statistic	6,582.1

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MTO robustness

Robustness to weighting schemes

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Table A.5: Robustness to alternative weighting schemes

		Robustness to weighting method and matched years				
	Main specification	Unweighted	Logit IPW 2005	Entropy 2003-2005	Logit IPW 2003-2005	Random Forest IPW 2003-2005
	(1)	(2)	(3)	(4)	(5)	(6)
Observations	163,579	163,579	161,953	95,174	94,221	94,238
Treated observations	11,815	11,815	11,721	6,954	6,887	6,888
Panel A: Tax payments (2007 IDR billion)						
Total tax payments	0.520	0.508	1.104	0.536	0.681	0.539
	(0.096)	(0.075)	(0.444)	(0.140)	(0.135)	(0.111)
VAT	0.366	0.350	0.828	0.383	0.493	0.389
	(0.078)	(0.061)	(0.352)	(0.118)	(0.091)	(0.091)
Corporate Income Tax	0.074	0.072	0.093	0.075	0.055	0.072
	(0.014)	(0.011)	(0.033)	(0.020)	(0.011)	(0.015)
Other income taxes	0.080	0.086	0.182	0.077	0.133	0.078
	(0.017)	(0.012)	(0.065)	(0.019)	(0.048)	(0.014)

MTO robustness

Robustness to sample restrictions

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Table A.6: Robustness to alternative sample restrictions

		Robustness to sample restriction:					
	Main specification	No common support restriction	No gross income restriction	Restrict sample to 1st-99th common support		Adding 2005 and 2006 MTOs	Restrict to years 2003-2009
				Weighted	Unweighted		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Observations	163,579	455,888	192,569	293,741	293,741	209,258	130,875
Treated observations	11,815	33,064	10,210	16,425	16,425	14,246	9,492
Panel A: Tax payments (2007 IDR billion)							
Total tax payments	0.520	1.553	0.448	0.312	0.611	0.323	0.464
	(0.096)	(0.148)	(0.111)	(0.241)	(0.066)	(0.068)	(0.077)
VAT	0.366	0.713	0.330	0.187	0.378	0.228	0.339
	(0.078)	(0.096)	(0.090)	(0.184)	(0.047)	(0.056)	(0.063)
Corporate Income Tax	0.074	0.550	0.052	0.052	0.122	0.045	0.061
	(0.014)	(0.067)	(0.013)	(0.055)	(0.025)	(0.009)	(0.011)
Other income taxes	0.080	0.291	0.067	0.073	0.111	0.050	0.064
	(0.017)	(0.031)	(0.018)	(0.038)	(0.012)	(0.010)	(0.014)

Tax Returns - Item by Item Effects

Table A.10: Detailed effects of MTO on corporate income tax returns

	Weighted means				MTO effect (IV)	
	Pre-treatment			Treated post-treatment counterfactual		
Tax Filing item (2007 IDR billion)	Untreated (1)	Treated (2)	N (3)	(4)	Point estimate (5)	Standard error (6)
Gross income	13.04	13.04	136,445	12.07	9.106	(2.160)
- Cost of sales	10.34	10.21	135,861	9.37	7.617	(2.010)
- Other expenses	2.20	2.39	136,395	2.11	1.054	(0.234)
Net income from business	0.68	0.49	136,987	0.54	0.490	(0.163)
+ Net income from side business	0.04	0.01	136,972	-0.04	-0.015	(0.080)
Total domestic commercial net income	0.72	0.50	136,910	0.50	0.474	(0.148)
+ Total foreign commercial net income	0.00	0.00	136,914	0.00	0.004	(0.009)
Total commercial net income	0.72	0.50	137,044	0.52	0.461	(0.152)
- Non-taxable inc. and inc. subject to final tax	0.86	0.52	137,451	0.23	0.963	(0.451)
+ Total positive fiscal adjustment	0.54	0.41	137,448	0.18	0.784	(0.424)
- Total negative fiscal adjustment	0.03	0.03	137,446	0.21	-0.120	(0.115)
Fiscal net income	0.31	0.37	137,446	0.34	0.313	(0.091)
- Compensation for fiscal loss carried forward	0.02	0.03	137,441	0.03	-0.010	(0.019)
Taxable Income	0.39	0.45	137,442	0.47	0.245	(0.071)
Total corporate income tax due	0.09	0.12	137,443	0.12	0.067	(0.020)

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Impacts on Collections

Table 1: MTO Treatment Effect on Tax Payments, Reported Income, and Tax Collection Rate

	Weighted means				MTO treatment effect		
	Pre-treatment			Treated post-treatment counterfactual	Reduced Form	IV	IV as % of post-treatment counterfactual
	Untreated (1)	Treated (2)	N (3)	(4)	(5)	(6)	(7)
Panel B: Reported Income (2007 IDR billion)							
Gross income	13.04	13.04	136,445	12.07	5.752	9.106	75%
					(1.365)	(2.160)	
Taxable income	0.39	0.45	137,442	0.47	0.155	0.245	52%
					(0.045)	(0.071)	
Corporate Income Tax due	0.09	0.12	137,443	0.12	0.042	0.067	56%
					(0.012)	(0.020)	
Profit margin (net income/ gross income)	0.06	0.07	109,729	0.07	0.001	0.001	--
					(0.002)	(0.003)	
Panel C: Tax Collection Rate							
CIT paid/ CIT due	0.97	0.72	112,787	0.80	0.059	0.096	--
					(0.130)	(0.210)	

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Tax Office Staffing Over Time

Table A.1: Tax Office Staffing

	MTO tax offices				Non-MTO tax offices			
	2008	2009	2010	2011	2008	2009	2010	2011
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Taxpayers-to-staff ratios								
Taxpayers per Auditor	18	24	23	21	107	107	115	125
Taxpayers per AR	17	26	25	20	56	105	93	80
Taxpayers per staff	4	6	6	6	10	16	17	17
Auditors								
Total auditors	329	370	366	361	1,110	1,668	1,643	1,591
Has college degree	0.79	0.79	0.84	0.90	0.74	0.64	0.70	0.75
Female	0.07	0.07	0.07	0.06	0.09	0.09	0.09	0.09
Years in DGT	8.6	9.1	10.1	11.1	7.8	7.7	8.7	9.7
Monthly salary (2007 IDR thousands)	6,227	5,920	5,616	5,880	6,070	5,473	5,167	5,295
Account Representatives								
Total ARs	349	341	341	369	2,101	1,862	2,057	2,494
Has college degree	0.83	0.86	0.85	0.81	0.70	0.70	0.68	0.70
Female	0.16	0.17	0.23	0.23	0.27	0.32	0.31	0.32
Years in DGT	8.3	9.2	9.9	10.4	7.9	9.0	9.6	9.8
Monthly salary (2007 IDR thousands)	4,502	4,426	4,237	4,279	4,490	4,417	4,114	4,073

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Variation in Tax Changes

2008-2009 Schedule Change

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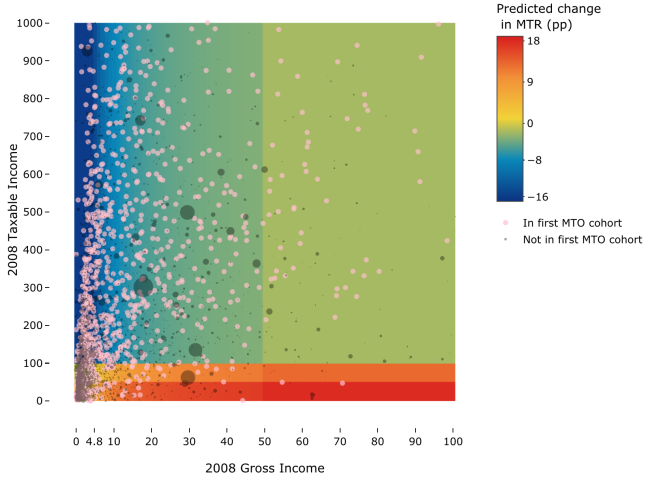

Variation in Tax Changes

2009-2010 Schedule Change

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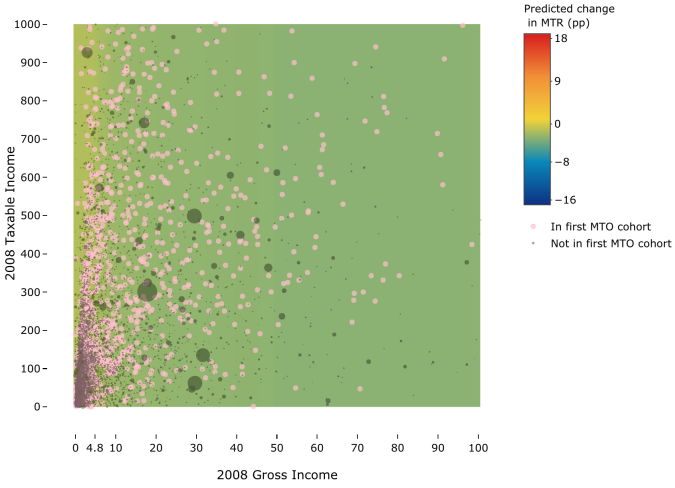

Corporate ETI robustness

Table A.14: Robustness of ETI estimates

										By 2008-2009 predicted tax change	
	Main specification (1)	Unweighted regressions (2)	Re-estimated weights (3)	Restricting estimation to 2007-2010 balanced sample (4)	Using lagged data for instrument and baseline controls (5)	No taxpayer fixed effect (6)	No baseline controls (7)	Use 2008-2009 change only (8)	Use 2008-2010 change only (9)	Predicted tax cut (10)	Predicted tax raise (11)
Panel A: First Stage											
Endogenous:	0.979	0.984	0.986	0.977	0.954	0.960	0.969	0.953	0.957	0.982	0.989
Δ Ln(Net of tax rate)	(0.010)	(0.003)	(0.017)	(0.010)	(0.013)	(0.008)	(0.012)	(0.009)	(0.010)	(0.013)	(0.053)
F-statistic	10173.650	146048.300	3441.327	9621.134	5089.842	14709.310	6669.979	11244.390	8,914.13	5635.501	344.596
N	12,816	26,298	6,916	10,784	10,904	14,768	13,146	8,284	7,681	9,444	3,372
Panel B: IV (ETI estimate)											
Outcome:	0.579	0.676	0.535	0.402	0.471	1.063	0.471	1.008	1.120	0.606	1.248
Δ Ln(Taxable Income)	(0.198)	(0.073)	(0.329)	(0.201)	(0.373)	(0.255)	(0.354)	(0.305)	(0.350)	(0.232)	(1.325)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes
Taxpayer FE	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes
Sector FE	No	No	No	No	No	Yes	No	Yes	Yes	No	No
MTO dummy	No	No	No	No	No	Yes	No	Yes	Yes	No	No
Panel C: MTR raise needed to generate MTO effect on Corporate Income Tax revenues											
Taxing MTO taxpayers only	Laffer	Laffer	Laffer	28 pp	29 pp	Laffer	29 pp	Laffer	Laffer	Laffer	Laffer
Taxing all taxpayers	8 pp	9 pp	8 pp	7 pp	7 pp	Laffer	7 pp	12 pp	15 pp	8 pp	Laffer
Panel D: Revenue-maximizing corporate income tax rate											
Revenue-max CIT MTR	57%	53%	58%	65%	62%	41%	62%	43%	40%	55%	38%

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Corporate ETI robustness: counterfactual MTR increases and revenue-maximizing rate

Table A.14: Robustness of ETI estimates

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Panel D: Revenue-maximizing corporate income tax rate											
Revenue-max CIT MTR	57%	53%	58%	65%	62%	41%	62%	43%	40%	55%	38%

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Counterfactual CIT rate increase extrapolating to 19 regions

Table A.16: CIT income tax increases to match MTO effects: extrapolated counterfactual

		MTR raise needed to generate MTO effect on total revenue	
	MTO IV treatment effect (IDR billion)	Taxing MTO taxpayers	Taxing all taxpayers
	(1)	(2)	(3)
Panel A: Main counterfactual: tax change among analysis sample taxpayers			
Corporate Income Tax	0.086	Laffer	8 pp
Total Income Taxes	0.180	Laffer	16 pp
Panel B: Counterfactual tax change extrapolated to taxpayers in 19 regions			
Corporate Income Tax	0.086	7 pp	6 pp
Total Income Taxes	0.180	15 pp	12 pp

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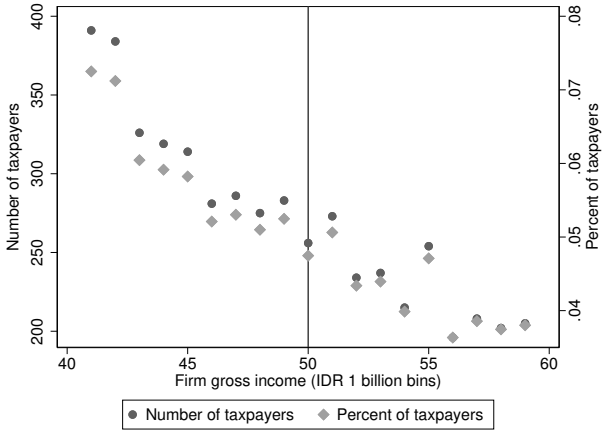
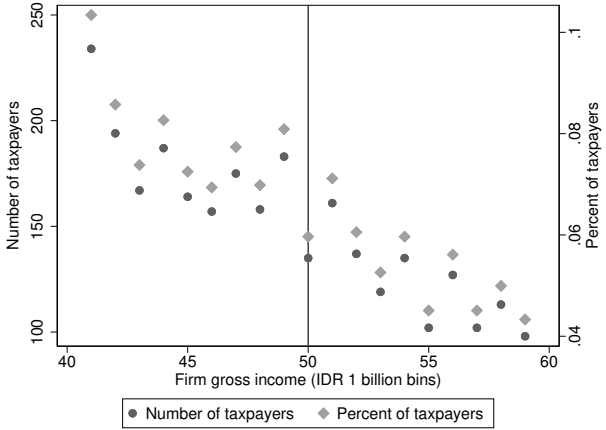
Bunching at the notch?

Before notch introduced



Bunching at the notch?

After notch introduced



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Administrative Costs

Table A.9: Administrative Costs

	MTO (1)	Not MTO (2)
Total budget (2007 IDR billion)		
Staff	85.8	908.3
Goods + Capital	55.1	1187.8
Total	140.9	2096.0
Number of corporate taxpayers	18,051	1,115,850
Cost per corporate taxpayer	0.00789	0.00095

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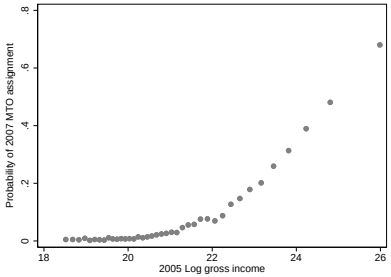
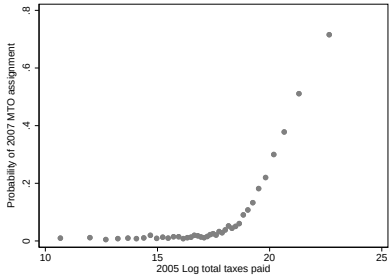
Probability of MTO assignment

2005 Gross Income



2005 Taxes Paid



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Changes in Enforcement

Cross-sectional estimates

Table 3: Impacts of MTO on CIT Corrections and VAT Underpayment Letters

	Weighted means				MTO treatment effect		
	Pre-treatment						
	Untreated	Treated	N	Treated post-treatment counterfactual	Reduced Form	IV	IV as % of post-treatment counterfactual
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Corporate Income Tax Corrections							
Filed any corrections	0.13	0.06	163,579	0.07	0.074	0.114	161%
					(0.008)	(0.012)	
Corrected this tax year's figures	0.21	0.36	163,579	0.25	-0.054	-0.084	-34%
					(0.012)	(0.018)	
Panel B: VAT tax assessment letters							
Tax collection letter	0.21	0.25	163,579	0.23	-0.007	-0.010	--
					(0.012)	(0.018)	
Underpayment letter	0.12	0.12	163,579	0.08	0.001	0.002	--
					(0.009)	(0.014)	

Enforcement

- Can estimate these in regression form as well
- Cross-section

$$Y_{it} = \alpha + \beta_1 M_{iFC} + \beta_2 l_{it} + \beta_3 M_{iFC} \times l_{it} + \delta_y + \epsilon_{it}$$

  where l is firm size; same matching weights as before.

- For VAT enforcement letters, observe pre-MTO data as well, so can run weighted diffs-in-diffs

$$Y_{it} = \alpha + \gamma_1 l_{it} + \gamma_2 M_{iFC} \times l_{it} + \gamma_3 M_{iFC} \times 1_{t>2005} + \gamma_4 M_{iFC} \times l_{it} \times 1_{t>2005} + \delta_y + \delta_i + \epsilon_{it}$$

- Results suggest that MTO led to higher, but flatter, $\alpha(l)$ function. Table - CS | Table - D-inD

Changes in Enforcement: Cross-sectional evidence

Table 4: Enforcement, Firm Size, and the MTO: Cross-Sectional Evidence

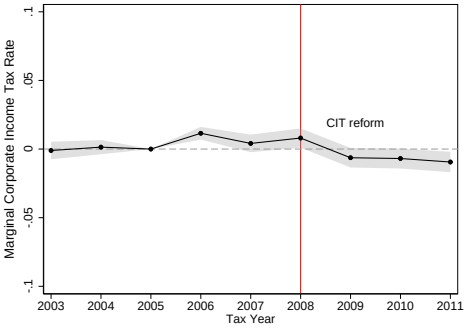
	Outcome		
	Audited	Received VAT Collection Letter	Received VAT Underpayment Letter
	(1)	(2)	(3)
Panel A: Measuring firm size as total taxes paid			
Assigned to MTO in 2007	-0.003	0.002	-0.002
	(0.009)	(0.009)	(0.007)
Ln(Total Taxes Paid)	0.011	0.027	0.011
	(0.002)	(0.002)	(0.002)
Ln(Total Taxes Paid) x Assigned to MTO in 2007	-0.008	-0.016	-0.003
	(0.003)	(0.003)	(0.002)
N	52,772	111,982	111,982

Changes in Enforcement: Diff-in-Diffs

Table 5: Enforcement, Firm Size, and the MTO: Difference-in-Difference Estimates

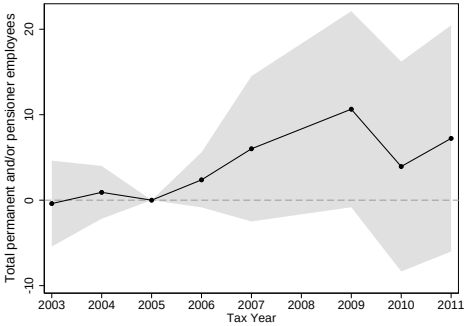
	Outcome	
	Received VAT Collection Letter	Received VAT Underpayment Letter
	(1)	(2)
Panel A: Measuring firm size as total taxes paid		
Assigned to MTO in 2007 x (Year>2005)	-0.043	-0.022
	(0.016)	(0.013)
Ln(Total Taxes Paid)	0.016	0.003
	(0.003)	(0.002)
Ln(Total Taxes Paid) x Assigned to MTO in 2007	0.009	0.010
	(0.005)	(0.003)
Ln(Total Taxes Paid) x Assigned to MTO in 2007 x (Year>2005)	-0.018	-0.011
	(0.005)	(0.004)
N	168,583	168,583

MTO effect on CIT rate

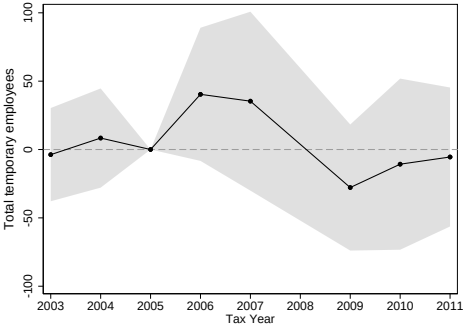


Effects on employement

Permanent workers



Temporary workers



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- For a line where firm pays taxes, firm solves
$$\max_{y_l}(1-\tau)y_l - (1-\tau\mu)c(y_l)$$
which yields the optimum conditions:
$$c'(y^p) = 1 - \tau\frac{1-\mu}{1-\tau\mu} = 1 - \tau_E$$
where y^p is optimal production if it pays taxes on this line.

Evasion

- *Evasion*: Cost of evading line l given by $\alpha b(y_l)h(l)$.
  - Lines are ordered by $h(l)$ in terms of difficulty of evasion. Assume $h(0) = 0$ and h increasing and continuous.
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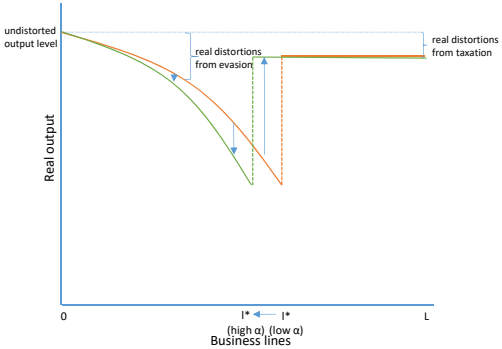
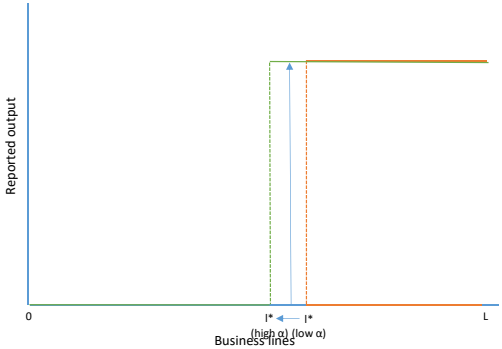
- Firms evade to the point where

$$y_{l^*}^e(\alpha) - c(y_{l^*}^e(\alpha)) - \alpha b(y_{l^*}^e(\alpha))h(l^*) = (1-\tau)y^p - (1-\tau\mu)c(y^p)$$

- Total taxes collected are therefore given by $\tau \int_{l^*}^{L} y_l^p - \mu c(y_l^p)$, where $z \equiv \int_{l^*}^{L} y_l^p - \mu c(y_l^p)$.

Example of increase in α





Comparative statics

- Changes in enforcement (increasing α):
  - Leads to more lines being reported
  - Leads to large, immediate jump in reported revenues, costs, and taxes paid from those new lines
  - Ambiguous effects on real activity. For lines that switch, they no longer pay enforcement tax $\alpha b(y_l^e(\alpha))h(l^*)$. But, they now face effective tax rate $\tau\frac{1-\mu}{1-\tau\mu}$.
  - For real activity to increase, need both $\alpha b'(y)h(l^*) > \tau\frac{1-\mu}{1-\tau\mu}$ and that this increase offsets the decline from higher enforcement on all inframarginal evaded lines

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- Potential complementarity between α and τ

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$$- \underbrace{m'(z)\int_0^{l^*} \alpha b(y^e_l(\alpha))h(l)}_{\text{loss from having higher evasion costs on evaded lines}}$$

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- Will explore this in the empirics below