GR 6307
Public Economics and Development

1. Taxation:
Raising Revenues with Tax Evasion and Informality

Michael Best

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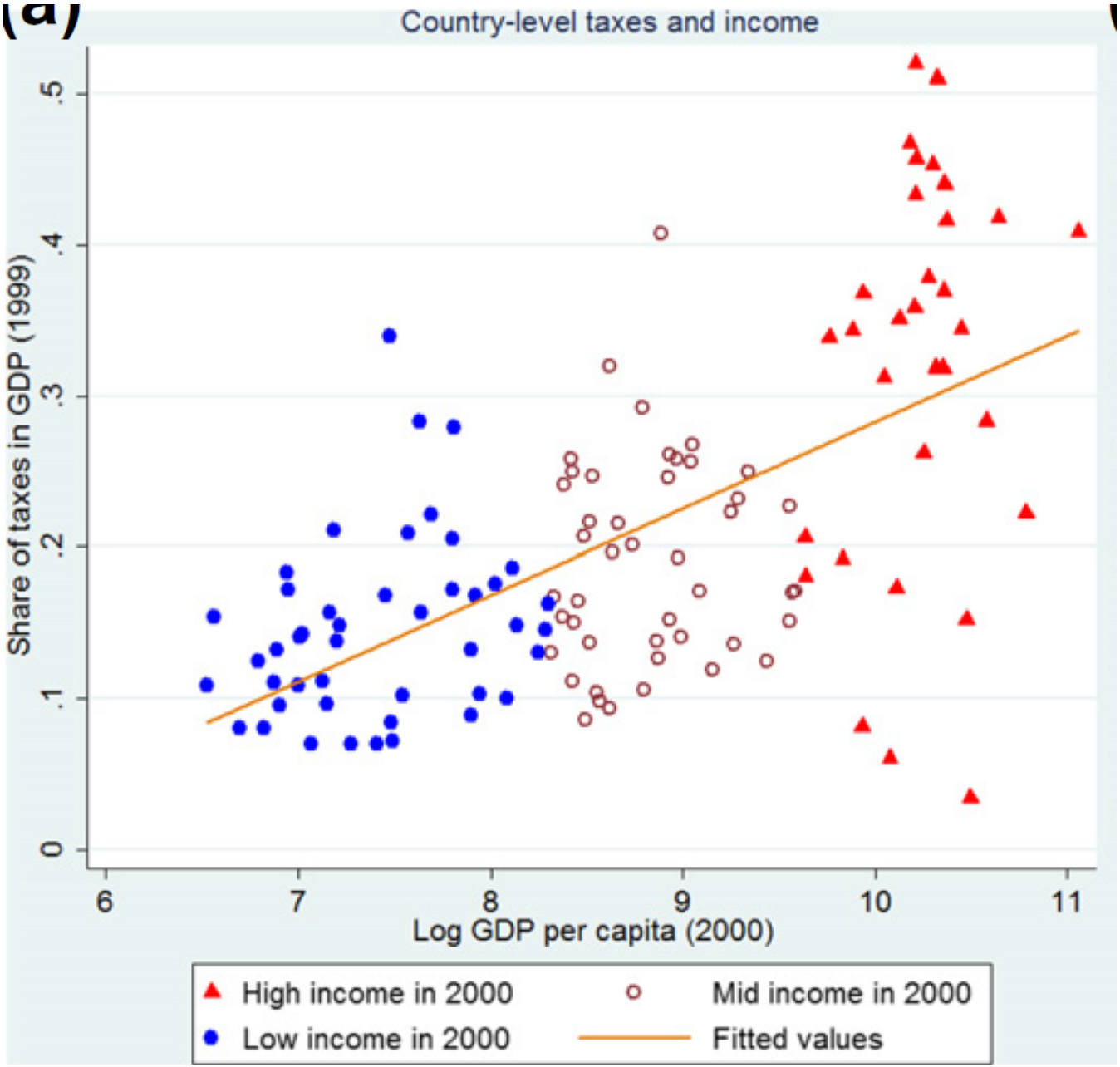
Outline

Taxation is key to achieving Development

It is shortage of resources, and not inadequate incentives, which limits the pace of economic development. Indeed the importance of public revenue from the point of view of accelerated economic development could hardly be exaggerated.

Nicholas Kaldor, *"Taxation for Economic Development,"* Journal of Modern African Studies, 1963, p. 7.

Motivating Facts: Besley & Persson (2013)



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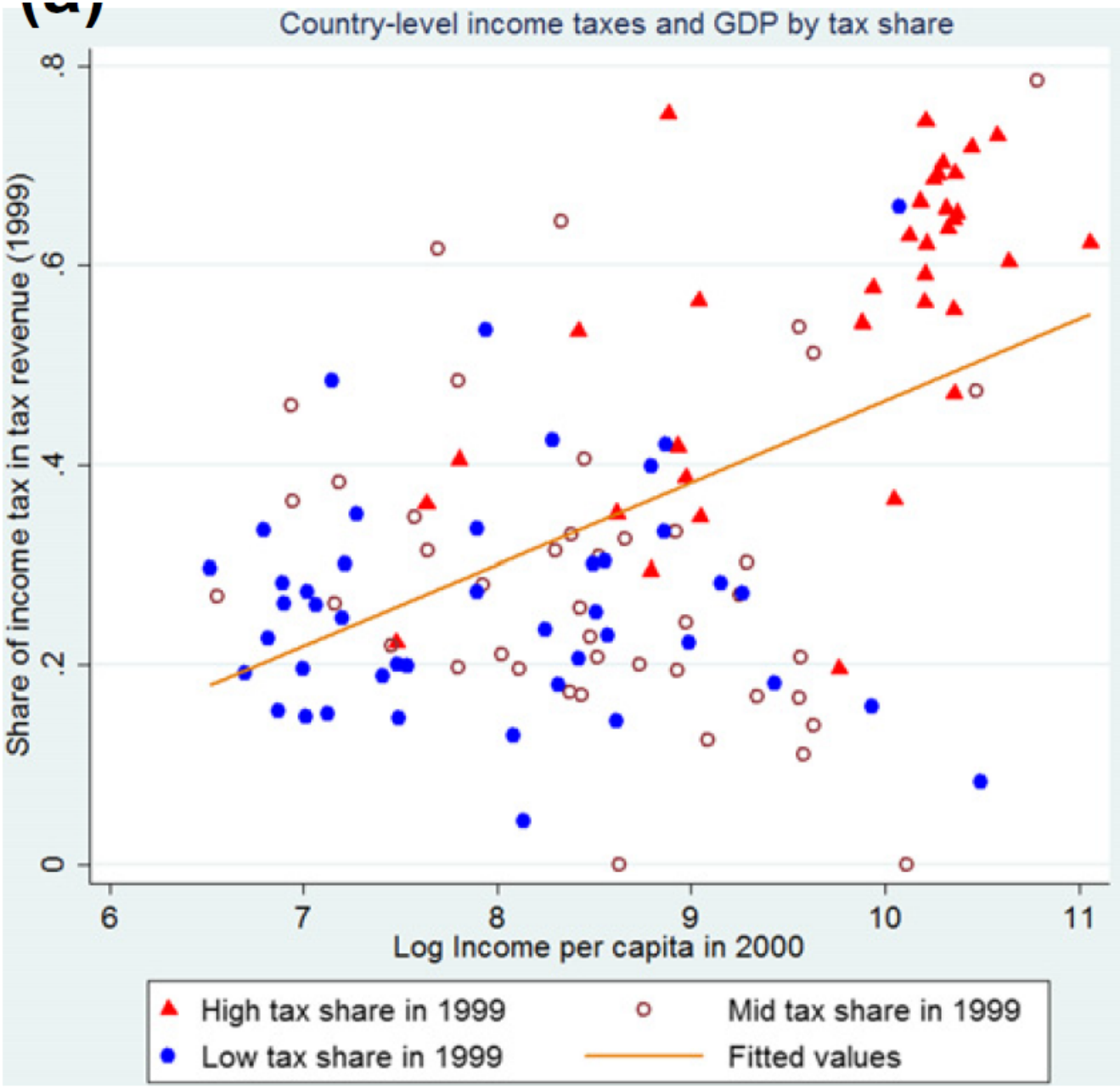

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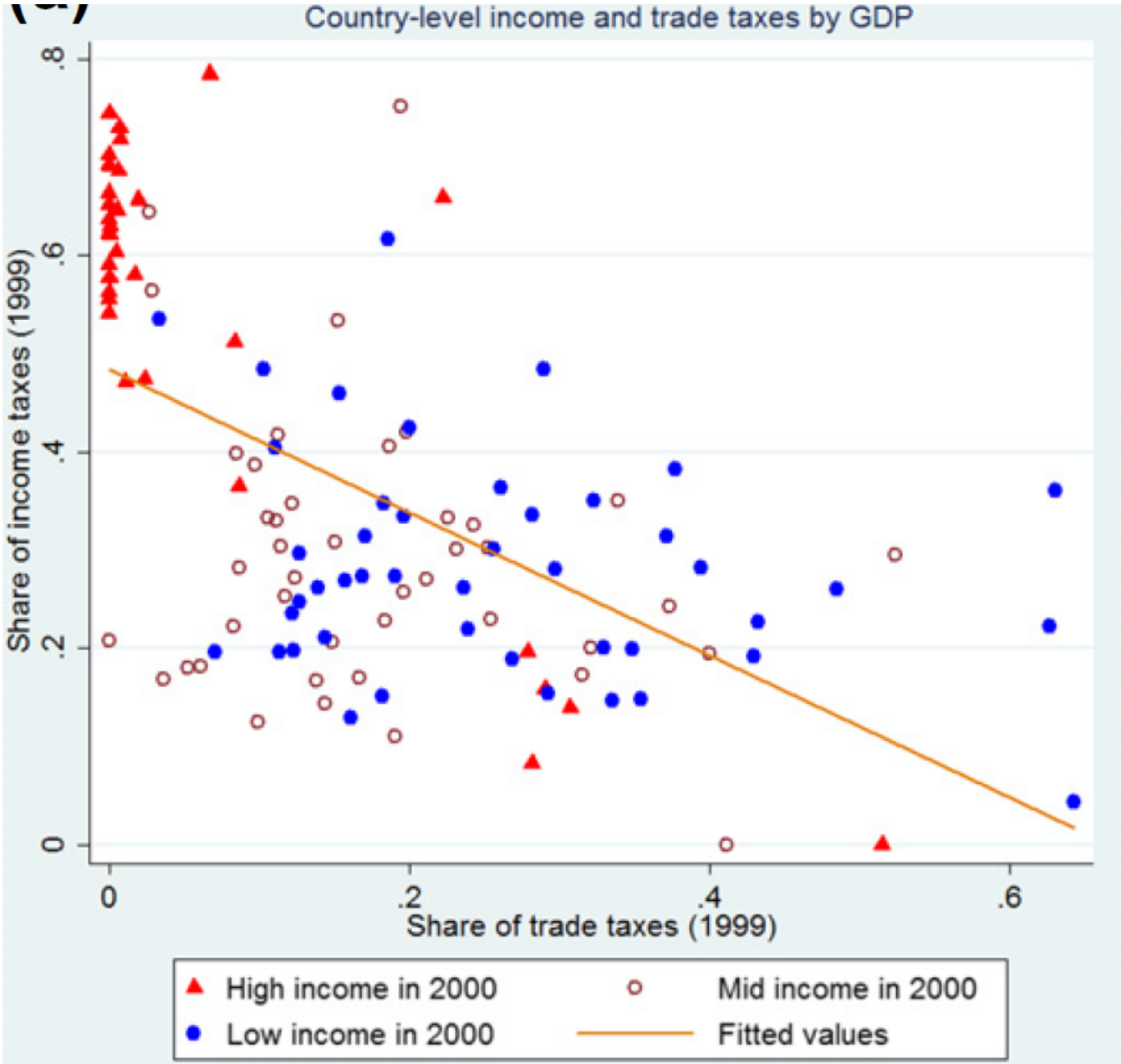

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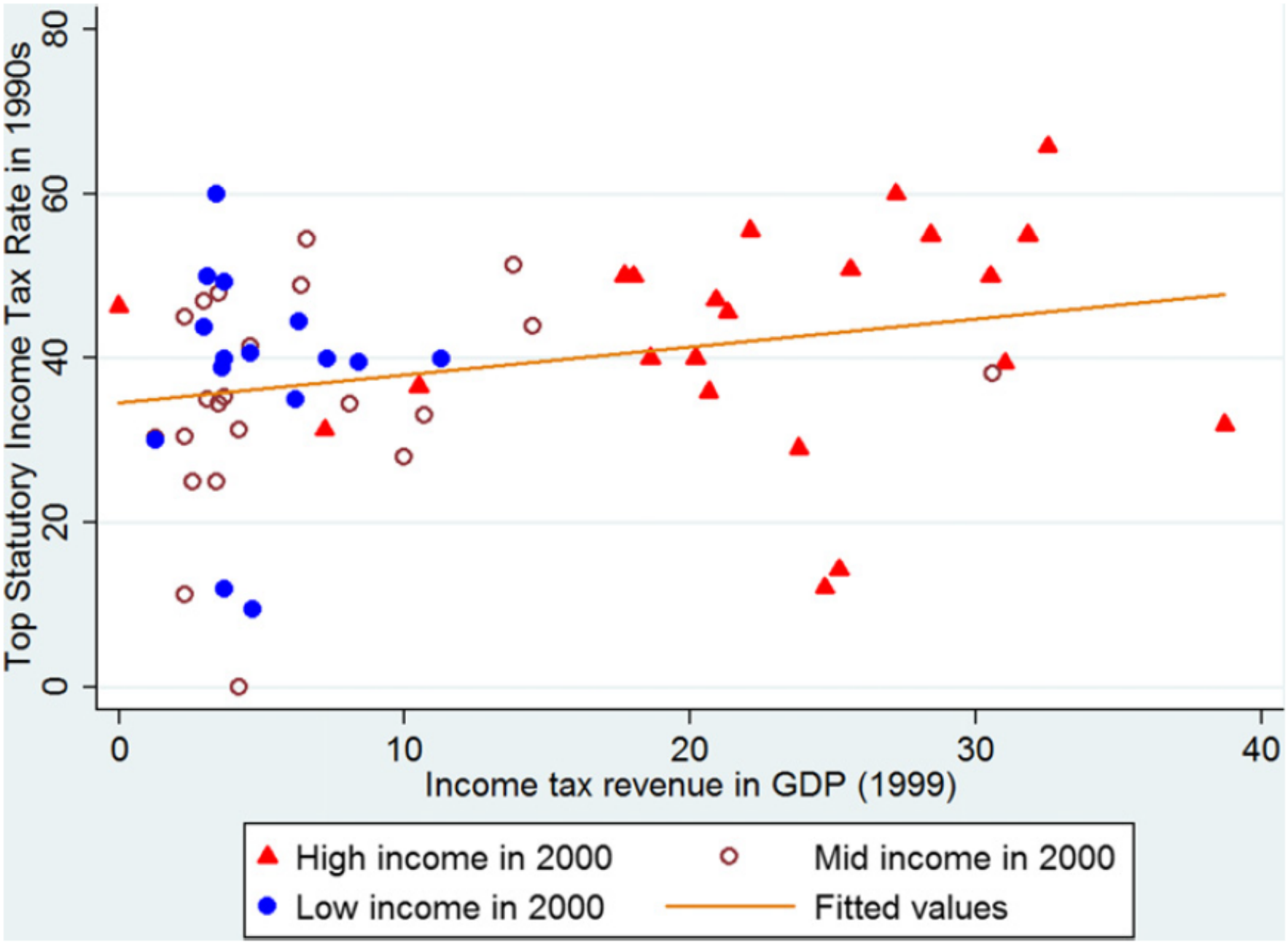

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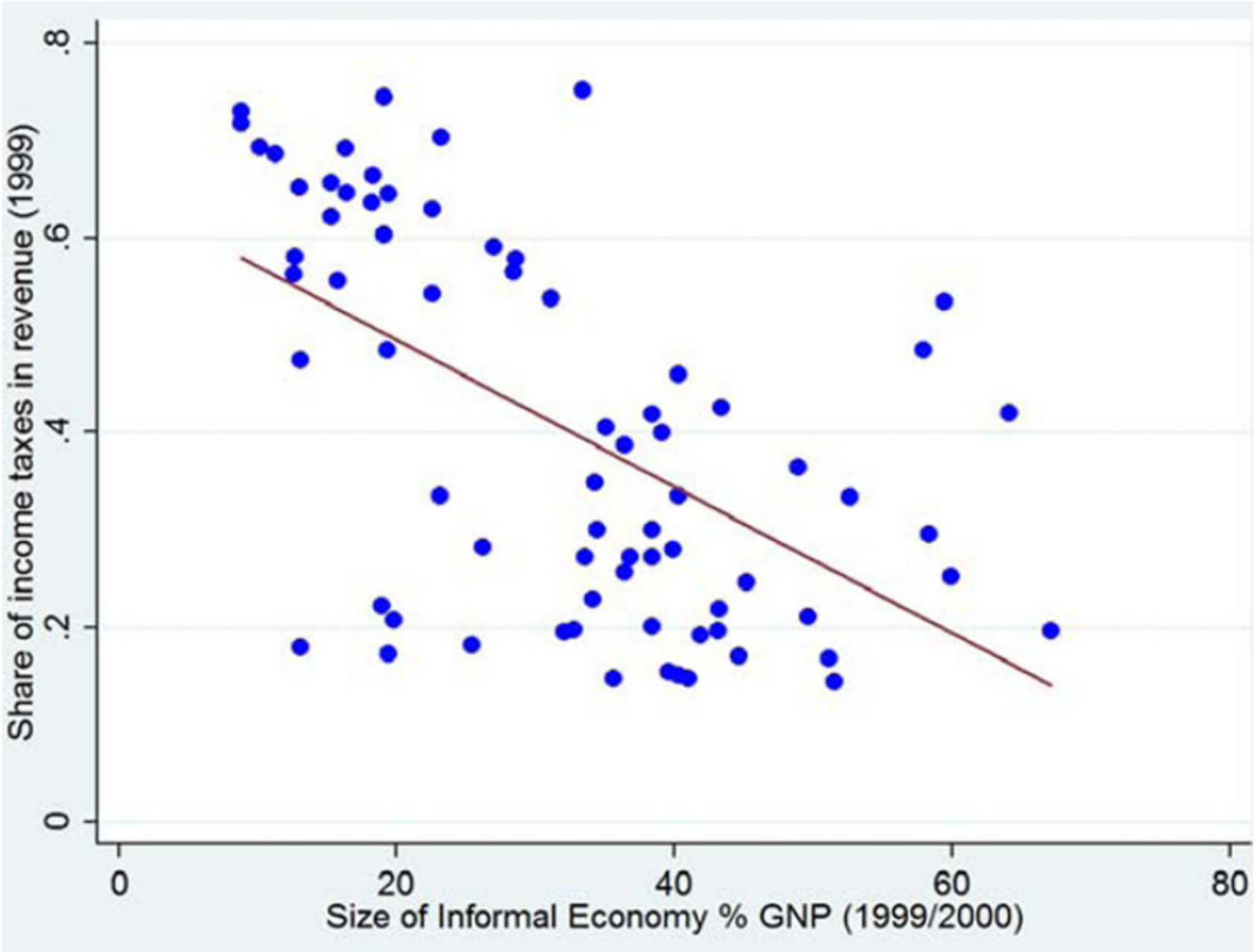

Gordon & Li (2009): Motivating Facts

- Traditional optimal tax theory makes some stark predictions for the tax mix
  - Diamond-Mirrlees (1971): Preserve production efficiency
  - Atkinson-Stiglitz (1976): Uniform commodity taxation
  - $\Rightarrow$ no tariffs, no taxes on intermediate goods, no differentiated sales taxes, no seignorage

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

Notes: Authors' calculations based on available data between 1996 and 2001 from Government Finance Statistics (IMF, 2004a), International Finance Statistics (IMF, 2004b), and World Development Indicators (World Bank, 2003). The ranges for GDP per capita follow the World Bank 2003 classification of low income, lower middle income, middle income and

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Taxation in Developing Countries: Big Picture

- Gordon & Li (JPubE 2009) *Tax Structures in Developing Countries: Many Puzzles and a Possible Explanation*
- Besley & Persson (2013 Handbook of Public) *Taxation and Development*

Gordon & Li (2009): Model

- J industries with CRS $f_j(K_j, L_j)$
- If don't use financial sector, informal firm and no tax:
  $\Pi = p_j^* f_j - rK_j - wL_j$
- If use finance, generate paper trail, but more efficient
  $\Pi = \frac{1+a_j}{1+s_j} p_j^* f_j - rK_j - wL_j$
- Let $\beta = I\{\text{use finance}\}$ then

$$\Pi = \max_{\beta_j, L_j, K_j} \left((1-\beta_j) p_j^* f_j + \beta_j p_j^* \frac{1+a_j}{1+s_j} p_j^* f_j - rK_j - w_{L_j} \right)$$

- Formalize if $s_j < a_j$

Gordon & Li (2009): Model

- Simple GE model with 3 goods to replicate stylized facts

0 Non-tradable good

1 Exported Tradable good

2 Imported Tradable good

- Tax instruments:
  - excise taxes s_j
  - corporate profit tax τ_j (base is $rK_j/(1-\tau_j)$ by CRS)
  - tariff m_2
  - seignorage iM (interest rate i, money stock M)

Gordon & Li (2009): Model

- Households: OLG.

$$V_t\left(\frac{wh}{g\left(p_t, \frac{p_{t+1}}{1+r}, \frac{i}{1+r}\right)}\right)$$

- $g(\cdot)$ is a price index, assume equal expenditure shares across hhs, welfare depends on g and wh

- Budget Constraint

$$whL_t = p_t C_t + \frac{p_{t+1}C_{t+1} + iM^h_{t+1}}{1+r}$$

Gordon & Li (2009): Model

- Assumption 1:
  1. Inelastic labor supply
  2. non-tradables weakly larger budget share for the old
- a_j varies across countries and industries: $a_c = \phi_j \theta_c$
- Assumption 2:
  1. $\phi_0 < \phi_1 < \phi_2$
  2. $\frac{K_0}{L_0} < \frac{K_1}{L_1} < \frac{K_2}{L_2}$ for all factor prices

Gordon & Li (2009): Formality Decision

- Formal firms: 0-profit condition gives

$$p_j \frac{1+a_j}{1+s_j} = c_j\left(w, r\left(1+\tau_j\right)\right)$$

- Informal firms: cash transactions $\rightarrow$ subject to inflation.
  - Costs $d\left(\mu\right)$ to hold a share μ of turnover in cash.
  - Profit rate: $\left(1-i\mu-d\left(\mu\right)\right)p_j - c_j\left(w,r\right)$
- Indifference:

$$p_j \frac{1+a_j}{1+s_j} - c_j\left(w, r\left(1+\tau_j\right)\right) = \left(1-i\mu^*-d\left(\mu^*\right)\right)p_j - c_j\left(w,r\right)$$

Gordon & Li (2009): Results

- Informality decision implies constraints on tax instruments.
- Government gets more revenues from formal firms, so won't raise taxes so much as to tip firms into informality
- Proposition 1: Rich countries: θ_c high so no constraints bind and then
  - uniform s_j
  - $\tau_j = 0$
  - $m_2 = 0$, low i
- Proposition 2: If constraint binds in sector 0
  - $1 + m_2 = \frac{1+s_2}{1+s_1}$
  - $s_2 > s_1$ if $e_0 > 1$ (PED of good 0)
  - $\tau > 0$
  - bigger i

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Besley & Persson (2013): Motivation

- Looking through history of how rich countries built tax systems, the political motivations of governments feature heavily.
  - Tilly (1985) argues war fueled need for revenue
- Suggests tax compliance is something governments deliberately build. Treat it as a form of capital they invest in for political motives.
- Creates feedback loop: More capacity for taxation $\rightarrow$ government has more incentive to create growth $\rightarrow$ more taxes

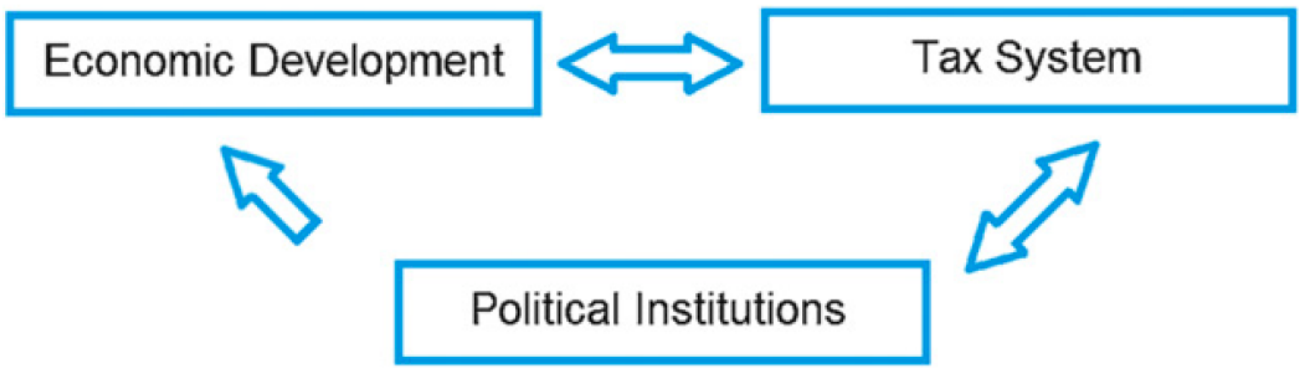

Figure 3 Extended approach.

Besley & Persson (2013): Setup

- Population consisting of $\mathcal{J}$ groups $J = 1, \ldots, \mathcal{J}$. Each group is a fraction ξ^J of the population.
- 2 time periods $s = 1, 2$
- $N + 1$ consumption goods $n = 0, 1, \ldots, N$. Consumption is $x^J_{n,s}$
- Non-rival and non-excludable public good g_s
- Labor supply L^J_s
- pre-tax prices $p_{n,s}$ and wage ω^J_s

Besley & Persson (2013): Setup

- Taxes:
  - each good's post-tax price is $p_{n,s}\left(1+t_{n,s}\right), \quad n=1,2,\ldots,N$
  - good 0 untaxed numeraire
  - net wage is $\omega_s^J\left(1-t_{L,s}\right)$
- Evasion.
  - tax raised from group J's consumption of good n are $t_{n,s}\left[p_{n,s}x_{n,s}^J-e_{n,s}\right]$
  - Evasion is subject to convex cost $c\left(e_{n,s},\tau_{n,s}\right)$
  - Labor taxes raise $t_{L,s}\left[\omega_s^J-e_{L,s}\right]$

Besley & Persson (2013): Fiscal Capacity

- Fiscal capacity $\boldsymbol{\tau}_s = \{\tau_{1,s}, \ldots, \tau_{N,s}, \tau_{L,s}\}$ makes evasion more difficult

$$\frac{\partial c\left(e_{k,s}, \tau_{k,s}\right)}{\partial \tau_{k,s}} > 0 \quad \frac{\partial^2 c\left(e_{k,s}, \tau_{k,s}\right)}{\partial e_{k,s} \partial \tau_{k,s}} \geq 0$$

- Investment in fiscal capacity.
  - period-1 fiscal capacity is given.
  - Cost of period-2 fiscal capacity is

$$\mathcal{F}^k\left(\tau_{k,2} - \tau_{k,1}\right) + f^k\left(\tau_{k,2}, \tau_{k,1}\right), \quad k = 1, \ldots, N, L$$

  - fixed cost is

$$f^k\left(\tau_{k,2}, \tau_{k,1}\right) = \begin{cases} f^k \geq 0 & \text{if } \tau_{k,1} = 0 \ \& \ \tau_{k,2} > 0 \\ 0 & \text{if } \tau_{k,1} > 0 \end{cases}$$

  - total cost is $\mathcal{F}\left(\boldsymbol{\tau}_2, \boldsymbol{\tau}_1\right) = \sum_{k=1}^{L} \mathcal{F}^k\left(\tau_{k,2} - \tau_{k,1}\right) + f^k\left(\tau_{k,2}, \tau_{k,1}\right)$

Besley & Persson (2013): Household Optimization

- Households have preference

$$x_{0,s}^J + u\left(x_{1,s}^J, \ldots, x_{N,s}^J\right) - \phi\left(L_s^J\right) + \alpha_s^J H\left(g_s\right)$$

subject to budget constraint

$$x_{0,s}^J + \sum_{n=1}^{N} p_{n,s}\left(1 + t_{n,s}\right) x_{n,s}^J \leq \omega_s^J \left(1 - t_{L,s}\right) L_s^J + r_s^J + \sum_{k=1}^{L} \left[t_{k,s} e_{k,s} - c\left(e_{k,s}, \tau_{k,s}\right)\right]$$

where r_s^J is a group-specific transfer

- Maximization yields commodity demands $x_{n,s}^J = x_{n,s}$
- Evasion decisions satisfy

$$t_{k,s} = c_e\left(e_{k,s}^*, \tau_{k,s}\right) \quad \text{for } k = 1, \ldots, N, L \text{ if } \tau_{k,s} > 0$$

Besley & Persson (2013): Household Optimization

- Household evasion yelds "profits"

$$q\left(t_{k,s},\tau_{k,s}\right)=t_k e_{k,s}-c\left(e_{k,s},\tau_{k,s}\right)$$

$$Q\left(\boldsymbol{t}_s,\boldsymbol{\tau}_s\right)=\sum_{k=1}^{L}q\left(t_{k,s},\tau_{k,s}\right)$$

- Group J's indirect utility is then

$$V^J\left(\boldsymbol{t}_s,\boldsymbol{\tau}_s,g_s,\omega_s^J,r_s^J\right)=v\left(p_{1,s}\left(1+t_{1,s}\right),\ldots,p_{N,s}\left(1+t_{N,s}\right)\right)$$
$$+v^L\left(\omega_s^J\left(1-t_{L,s}\right)\right)+Q\left(\boldsymbol{t}_s,\tau_s\right)+\alpha_s^J H\left(g_s\right)+$$

- Government chooses the tax rates and spending. Tax revenue

$$B\left(\boldsymbol{t}_s,\boldsymbol{\tau}_s\right)=\sum_{n=1}^{N}t_{n,s}\left(p_{n,s}x_{n,s}-e_{n,s}\right)+\sum_{J=1}^{\mathcal{J}}\xi^J t_{L,s}\left(\omega_s^J L_s^J-e_{L,s}\right)$$

Besley & Persson (2013): Government's Problem

- Government's budget constraint is

$$B\left(\boldsymbol{t}_s, \boldsymbol{\tau}_s\right) + R_s \geq g_s + \sum_{J=1}^{\mathcal{J}} \xi^J r_s^J + m_s$$

$$m_s = \begin{cases} \mathcal{F}\left(\boldsymbol{\tau}_{2,}, \boldsymbol{\tau}_1\right) & \text{if } s = 1 \\ 0 & \text{if } s = 2 \end{cases}$$

  R_s is borrowing/aid/natural resource rents

- Government places weights μ^J on each group, normalized so that $\sum_{J=1}^{\mathcal{J}} \mu^J \xi^J = 1$ and maximizes

$$\sum_{J=1}^{\mathcal{J}} \mu^J \xi^J V^J\left(\boldsymbol{t}_s, \boldsymbol{\tau}_s, g_s, \omega_s^J, r_s^J\right)$$

Besley & Persson (2013): Optimal Taxes

- Commodity taxes satisfy Ramsey-style tax rule.
- Define the tax bases

$$Z_{n,s}\left(\boldsymbol{t}_s, \boldsymbol{\tau}_s\right) = p_{n,s}x_{n,s} - e_{n,s} \quad Z_{L,s}\left(t_{L,s}, \tau_{L,s}\right) = \sum_{J=1}^{\mathcal{J}} \xi^J \omega_s^J L_s^J - e_{L,s}$$

- Ramsey rule is

$$\left(\lambda_s - 1\right) Z_{n,s}\left(\boldsymbol{t}_s, \boldsymbol{\tau}_s\right) + \lambda_s \sum_{n=1}^{N} t_{n,s} \frac{\partial Z_{n,s}\left(\boldsymbol{t}_s, \boldsymbol{\tau}_s\right)}{\partial t_{n,s}} = 0 \text{ if } \tau_{n,s} > 0$$

$$t_{n,s} = 0 \text{ if } \tau_{n,s} = 0$$

- Optimal income tax satisfies

$$-\tilde{Z}_{L,s} + \lambda_s \left[Z_{L,s}\left(t_{L,s}, \tau_{L,s}\right) + t_{L,s} \frac{\partial Z_{L,s}\left(t_{L,s}, \tau_{L,s}\right)}{\partial t_{L,s}} \right] = 0 \quad \text{if } \tau_{L,s} > 0$$

$$t_{L,s} = 0 \quad \text{if } \tau_{L,s} = 0$$

Besley & Persson (2013): Investment in Fiscal Capacity

- Let maximized government welfare be

$$W\left(\boldsymbol{\tau}_s, R_s - m_2; \left\{\mu^J\right\}\right) = \max_{g_s, \boldsymbol{t}_s, t_s^1, \ldots, r_s^J} \left\{ \sum_{J=1}^{\mathcal{J}} \mu^J \xi^J V^J \left(\boldsymbol{t}_s, \boldsymbol{\tau}_s, g_s, \omega_s^J, r_s^J\right) \right\}$$

- Then fiscal capacity investment chooses $\boldsymbol{\tau}_2$ to maximize

$$W\left(\boldsymbol{\tau}_1, R_1 - \mathcal{F}\left(\boldsymbol{\tau}_2, \boldsymbol{\tau}_1\right); \left\{\mu^J\right\}\right) + W\left(\boldsymbol{\tau}_2, R_2; \left\{\mu^J\right\}\right)$$

- If $\tau_{k,1} > 0$ then optimum satisfies

$$\lambda_2 \frac{\partial B\left(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} + \frac{\partial Q\left(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} - \lambda_1 \frac{\partial \mathcal{F}\left(\boldsymbol{\tau}_1, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} \leqslant 0 \quad \text{for } k = 1, 2, \ldots, N, L$$

$$c.s.\ \tau_{k,2} \geq \tau_{k,1} > 0$$

Besley & Persson (2013): Politics

- Introduce politics into this model to see how it affects investments in fiscal capacity
- Citizen-candidate style model (Besley & Coate 1997). Whichever group is in power only cares about its members.
- Group in power in period s is I_s
- Political institutions constrain transfers:

$$r_s^J \geq \theta r_s^I \; \forall J \neq I, \; \theta \in [0,1]$$

- Solving for optimal transfers:

$$r_s^I = \beta^I \left(\xi^I, \theta\right) \left[B\left(\boldsymbol{t}_s, \boldsymbol{\tau}_s\right) + R_s - g_s - m_s\right]$$
$$r_s^O = \beta^O \left(\xi^I, \theta\right) \left[B\left(\boldsymbol{t}_s, \boldsymbol{\tau}_s\right) + R_s - g_s - m_s\right]$$

where

$$\beta^I \left(\xi^I, \theta\right) = \frac{1}{\theta + (1-\theta)\,\xi^I} \quad \beta^O = \frac{\theta}{\theta + (1-\theta)\,\xi^I}$$

Besley & Persson (2013): Politics

- The incumbents choose between public goods and transfers by comparing $\beta^I\left(\xi^I,\theta\right)$ to α_s^I
- If $\alpha_s^I > \beta^I\left(\xi^I,\theta\right)$ then all money spent on g, and $\lambda_s^I = \alpha_s^I$
- If $\alpha_s^I \leq \beta^I\left(\xi^I,\theta\right)$, then money spent on transfers, and $\lambda_s^I = \beta^I\left(\xi^I,\theta\right)$
- Fiscal capacity investments satisfy

$$\lambda_2^I \frac{\partial B\left(\boldsymbol{t}_2^*,\boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} + \frac{\partial Q\left(\boldsymbol{t}_2^*,\boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} - \lambda_1^I \frac{\partial \mathcal{F}\left(\boldsymbol{\tau}_1,\boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} \leqslant 0 \quad \text{for } k = 1,2,\ldots,N,L$$

$$c.s.\ \tau_{k,2} \geq \tau_{k,1} > 0$$

Besley & Persson (2013): Political Turnover

- Assume 2 groups and $\xi^J = 1/2$
- Let $\gamma \in [0,1]$ be the probability incumbent switches between periods
- Now, in period s the value of being incumbent I_s or opposition O_s is

$$W^J\left(\boldsymbol{\tau}_s, R_s - m_s\right) = V_s^J\left(\boldsymbol{t}_s^*\left(\lambda_s^{I_s}, \boldsymbol{\tau}_s\right), \boldsymbol{\tau}_s, g_s^*\left(\lambda_s^{I_s}, \boldsymbol{\tau}_s\right), \omega_s^J, \beta^J(\theta)\, b_s\left(\lambda_s^{I_s}, \boldsymbol{\tau}_s\right)\right)$$

$$b_s\left(\lambda_s^{I_s}, \boldsymbol{\tau}_s\right) = \left[B\left(\boldsymbol{t}_s^*\left(\lambda_s^{I_s}, \boldsymbol{\tau}_s\right), \boldsymbol{\tau}_s\right) + R_s - m_s - g_s^*\left(\lambda_s^{I_s}, \boldsymbol{\tau}_s\right)\right]$$

Besley & Persson (2013): Political Turnover

- Now the incumbent chooses fiscal capacity to maximize

$$W^I\left(\boldsymbol{\tau}_1, R_1 - \mathcal{F}\left(\boldsymbol{\tau}_1, \boldsymbol{\tau}_2\right)\right) + \left(1-\gamma\right) W^I\left(\boldsymbol{\tau}_2, R_2\right) + \gamma W^O\left(\boldsymbol{\tau}_2, R_2\right)$$

- Optimal choice satisfies

$$\left(1-\gamma\right)\frac{\partial W^I\left(\boldsymbol{\tau}_2, R_2\right)}{\partial \tau_{k,2}} + \gamma\frac{\partial W^O\left(\boldsymbol{\tau}_2, R_2\right)}{\partial \tau_{k,2}} - \lambda_1^I\frac{\partial \mathcal{F}\left(\boldsymbol{\tau}_1, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} \leqslant 0$$

$$c.s.\ \tau_{k,2} \geq \tau_{k,1} > 0$$

- Can rewrite as

$$\left[\lambda_2^I - \gamma\left(\lambda_2^I - \lambda_2^O\right)\right]\frac{\partial B\left(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} + \gamma\frac{\partial V_2^O}{\partial \boldsymbol{t}_2^*}\frac{\partial \boldsymbol{t}_2^*}{\partial \tau_{k,2}}$$
$$+\frac{\partial Q\left(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} - \lambda_1^I\frac{\partial \mathcal{F}\left(\boldsymbol{\tau}_1, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} \leqslant 0$$

$$c.s.\ \tau_{k,2} \geq \tau_{k,1}$$

Besley & Persson (2013): Common Interest State

- Can characterize 3 types of states.

1. The *common-interest* state: α_2 is large enough to spend all on g

$$\lambda_2^I = \lambda_2^O = \lambda_2 = \alpha_2 > \beta^I(\theta)$$

- Could be θ very high, or α_2 very high (war?)

$$\lambda_2 \frac{\partial B\left(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} + \frac{\partial Q\left(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} - \lambda_1 \frac{\partial \mathcal{F}\left(\boldsymbol{\tau}_1, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} \leqslant 0$$

$$c.s.\ \tau_{k,2} \geq \tau_{k,1}$$

Besley & Persson (2013): Redistributive State

- Suppose transfers valued more than public goods, $\alpha_2 < \beta^I(\theta)$
- Then $\lambda_2^I = \beta^I(\theta)$. The 2 groups value public money differently.
- Probability of staying in power becomes important. Expected value of period-2 revenues to the period-1 incumbent is

$$\lambda_2^{I_1} = (1-\gamma)\beta^I(\theta) + \gamma\beta^O(\theta)$$

- e.g. $\gamma = \theta = 0 \rightarrow \lambda_2^{I_1} = 2$. Completely redistributive state maximize capacity to redistribute to incumbents

$$2\frac{\partial B(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2)}{\partial \tau_{k,2}} + \frac{\partial Q(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2)}{\partial \tau_{k,2}} - 2\frac{\partial \mathcal{F}(\boldsymbol{\tau}_1, \boldsymbol{\tau}_2)}{\partial \tau_{k,2}} \leqslant 0$$

$$c.s.\ \tau_{k,2} \geq \tau_{k,1}$$

Besley & Persson (2013): Weak State

- If transfers valued more than public goods, but there is also high political instability
- e.g. $\gamma = 1, \theta = 0$ then

$$\frac{\partial V_2^O}{\partial \boldsymbol{t}_2^*} \frac{\partial \boldsymbol{t}_2^* \left(\lambda_2^{I_2}, \boldsymbol{\tau}_2\right)}{\tau_{k,2}} + \frac{\partial Q\left(\boldsymbol{t}_2^*, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} - \lambda_1 \frac{\partial \mathcal{F}\left(\boldsymbol{\tau}_1, \boldsymbol{\tau}_2\right)}{\partial \tau_{k,2}} \leqslant 0$$

$$c.s.\ \tau_{k,2} \geq \tau_{k,1}$$

- All three terms are negative. The incumbent invests nothing in fiscal capacity since it will only be used against them

Outline

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Tax Evasion: Theory and Evidence from Rich Countries

- Allingham & Sandmo 1972 (& Yitzhaki 1974) *Income Tax Evasion: A Theoretical Analysis*
- Chetty (AEJ:Pol 2009) *Is the Taxable Income Elasticity Sufficient to Calculate Deadweight Loss? The Implications of Evasion and Avoidance*
- Kleven, Knudsen, Kreiner, Pedersen & Saez (Ecma 2011) *Unwilling or Unable to Cheat? Evidence from a Tax Audit Experiment in Denmark*
- Dwenger, Kleven, Rasul & Rincke (AEJ:Pol 2016) *Extrinsic and Intrinsic Motivations for Tax Compliance: Evidence from a Field Experiment in Germany*
- Artavanis, Morse & Tsoutsoura (QJE 2016) *Measuring Income Tax Evasion using Bank Credit: Evidence from Greece*
- Alstadsæter, Johannesen & Zucman (WP 2017) *Tax Evasion and Inequality*

The Canonical Model: Allingham & Sandmo (1972)

- Tax evasion: misreporting tax liability in an *illegal* way
- Tax avoidance: exploiting loopholes to minimize tax liability, *without* breaking the law
- A bit of a false taxonomy: Many tax avoidance schemes have never been tested in a court, and may well be illegal...
- Classical model is Allingham & Sandmo (JPubE 1972) extended by Yitzhaki (1974)
- Builds on Becker's (1968) theory of crime
- Takes true income as given, focus only on decision of what to report to the authorities

Allingham & Sandmo (1972): Setup

- Consider individual with true income W facing linear tax t on reported income.
- The individual chooses to evade an amount E
- If they are not caught, their net income is

$$Y = W - t\,(W - E)$$

- If they are caught, they pay a penalty rate $\theta > t$ on the evaded amount and have net income

$$Z = (1 - t)\,W - (\theta - t)\,E$$

- They are audited with probability p

Allingham & Sandmo (1972): Solution

- Individual maximizes expected utility

$$V = (1-p)\,U\,(Y) + pU\,(Z)$$

- FOCs yield

$$\frac{U'\,(Z)}{U'\,(Y)} = \frac{1-p}{p}\frac{t}{\theta - t}$$

- Comparative statics:

$$\frac{\partial E}{\partial \theta} < 0$$
$$\frac{\partial E}{\partial p} < 0$$

Allingham & Sandmo (1972) - Yitzhaki (1974)

- Effect of tax rate in A-S model:

$$\frac{\partial E}{\partial t} = \underbrace{-\frac{W-E}{1-t}\frac{\partial E}{\partial W}}_{\text{Income Effect}<0} + \underbrace{S}_{\text{Substitution Effect}>0}$$

- Substitution effect (consumption cheaper in unaudited state) seems unintuitive, drives ambiguous prediction.
- Yitzhaki (1974): This is because penalty is on evaded income not evaded tax. If instead penalty is $\theta t E$, then

$$\frac{U'(Z)}{U'(Y)} = \frac{1-p}{p(\theta-1)}$$

- No more substitution effect, only income effect

Outline

Tax Evasion: Theory and Evidence from Rich Countries

- Allingham & Sandmo 1972 (& Yitzhaki 1974) *Income Tax Evasion: A Theoretical Analysis*
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Chetty (2009): Overview

- How does evasion change how we think about efficiency cost of income taxes?
- Feldstein (1999) argues that elasticity of taxable income is *sufficient statistic* for deadweight loss of income tax.
- Is this still true when there's evasion?
- Provide simple model to think this through.
- General answer: No, now there are 2 statistics that are jointly sufficient.

Chetty (2009): Benchmark: No Evasion

- Individuals work l hours at wage w to maximize

$$\max_{l} u(c,l) = c - \psi(l)$$

$$s.t.\ c = y + (1-t)\,wl$$

- Social Welfare

$$W(t) = \underbrace{\{y + (1-t)\,wl - \psi(l)\}}_{u(c^*,l^*)} = twl$$

- Envelope theorem: $\frac{du(c^*,l^*)}{dt} = \frac{\partial u(c^*,l^*)}{\partial t} = wl \equiv TI$ so

$$\frac{dW(t)}{dt} = -wl + wl + t\frac{d[wl]}{dt}$$

$$= t\frac{dTI}{dt}$$

Chetty (2009): Evasion With Real Cost

- Add to the previous model the ability to shelter e dollars at convex cost $g(e)$. NB $g(e)$ is a real, social cost of evasion
- Individuals choose l and e

$$\max_{l,e} u(c,l,e) = c - \psi(l) - g(e)$$

$$s.t.\ c = y + (1-t)(wl - e) + e$$

- Social welfare is now

$$W(t) = \{y + (1-t)(wl-e) + e - \psi(l) - g(e)\} + t(wl - e)$$

- Envelope theorem $\rightarrow$

$$\frac{dW(t)}{dt} = -(wl-e) + (wl-e) + t\frac{d[wl-e]}{dt} = t\frac{dTI}{dt}$$

- Feldstein result survives

Chetty (2009): Evasion With Transfer Cost

- Now add sheltering a la Allingham Sandmo. Audit probability $p(e)$, $p'(e) > 0$.
- If caught, pay fine $F(e,t)$
- $\rightarrow$ private cost $z(e,t) = p(e)[te + F(e,t)]$ assume strictly convex in e
- Individuals choose l and e

$$\max_{l,e} u(c,l,e) = c - \psi(l)$$
$$s.t.\ c = y + (1-t)(wl - e) + e - z(e,t)$$

- Social Welfare

$$W(t) = \{y + (1-t)(wl - e) + e - z(e,t) - \psi(l)\}$$
$$+ z(e,t) + t(wl - e)$$

Chetty (2009): Evasion With Transfer Cost

- Envelope theorem $\rightarrow$

$$\begin{aligned}\frac{dW(t)}{dt} &= -(wl-e) - \frac{\partial z}{\partial t} + (wl-e) + \frac{\partial z}{\partial t} + \frac{\partial z}{\partial e}\frac{\partial e}{\partial t} + t\frac{d[wl-e]}{dt} \\ &= t\frac{dwl}{dt} + \frac{de}{dt}\left(\frac{\partial z}{\partial e} - t\right)\end{aligned}$$

- Evasion choice FOC: $\frac{\partial z}{\partial e} = t \rightarrow dW(t)/dt = dLI/dt$ where $LI = wl$ is real income

- ETI no longer sufficient, need *real* income elasticity

Chetty (2009): Both Types of Evasion

$$\max_{l,e} u(c,l,e) = c - \psi(l) - g(e)$$

$$s.e.\ c = y + (1-t)(wl - e) + e - z(e,t)$$

- Social welfare is

$$W(t) = \{y + (1-t)(wl-e) + e - z(e,t) - \psi(l) - g(e)\} + z(e,t) + t(wl-e)$$

- Envelope theorem $\rightarrow$

$$\frac{dW(t)}{dt} = t\frac{dLI}{dt} + \frac{de}{dt}\left(\frac{\partial z}{\partial e} - t\right)$$

- Evasion choice FOC is $t = z'(e) + g'(e)$

$$\frac{dW(t)}{dt} = t\left(\mu\frac{dTI}{dt} + (1-\mu)\frac{dLI}{dt}\right)$$

where $\mu = g'(e)/t$

Allingham-Sandmo in the Field

- Allingham-Sandmo does not predict actual tax evasion rates very well:
- Alm, McClelland & Schulze calibrate A-S to the US data. With coeff of RRA $\gamma = 3$, they get 13% compliance (waaaaaay off)
- Slemrod (2007) estimates 43% compliance for self-reported income in the US
- Calibrations require $\gamma = 5$ to get 44% compliance, $\gamma = 10$ to get 71% compliance
- Suggests the theory is incomplete.

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Kleven et al. (2011): Overview

- One possible reason Allingham-Sandmo predicts evasion poorly: Detection probabilities are endogenous, and vary by type of income
- Extend A-S model to include endogenous detection probabilities and third-party reported income
- Perform random audits and field experiment sending audit threat letters
- Takeaways:
  1. Very little evasion on third-party reported income
  2. Tax rates positively affect evasion of self-reported income
  3. prior audits and threat letters reduce self-reported income evasion

Kleven et al. (2011): Model

- Simple AS model: Risk-neutral taxpayer has true income $\bar{y}$, reports income y, evades $e \equiv \bar{y} - y$.
- Probability of detection $p(e)$ with $p'(e) > 0$
- If evasion is detected, taxpayer pays evaded tax plus penalty proportional to evaded tax $\theta\tau e$

$$u = (1 - p(e)) \cdot [\bar{y}(1 - \tau) + \tau e] + p(e)[\bar{y}(1 - \tau) - \theta\tau e]$$

- Interior optimum for e satisfies

$$p(e)(1 + \varepsilon)(1 + \theta) = 1$$

where $\varepsilon \equiv p'(e)\, e/p \geq 0$ is elasticity of detection probability

Kleven et al. (2011): Model

- Incorporate third-party reporting in a simple way. True income is

$$\bar{y} = \bar{y}_t + \bar{y}_s$$

  where $\bar{y}_t$ is third-party reported income, and $\bar{y}_s$ is self-reported income.

- Assume very hard to evade third-party reported income, but easier for self-reported income. $\Rightarrow$
  1. $p(e)$ low for $e < \bar{y}_s$
  2. $p(e)$ high for $e > \bar{y}_s$
  3. $p(e)$ increases rapidly around $e = \bar{y}_s$

Kleven et al. (2011): Model

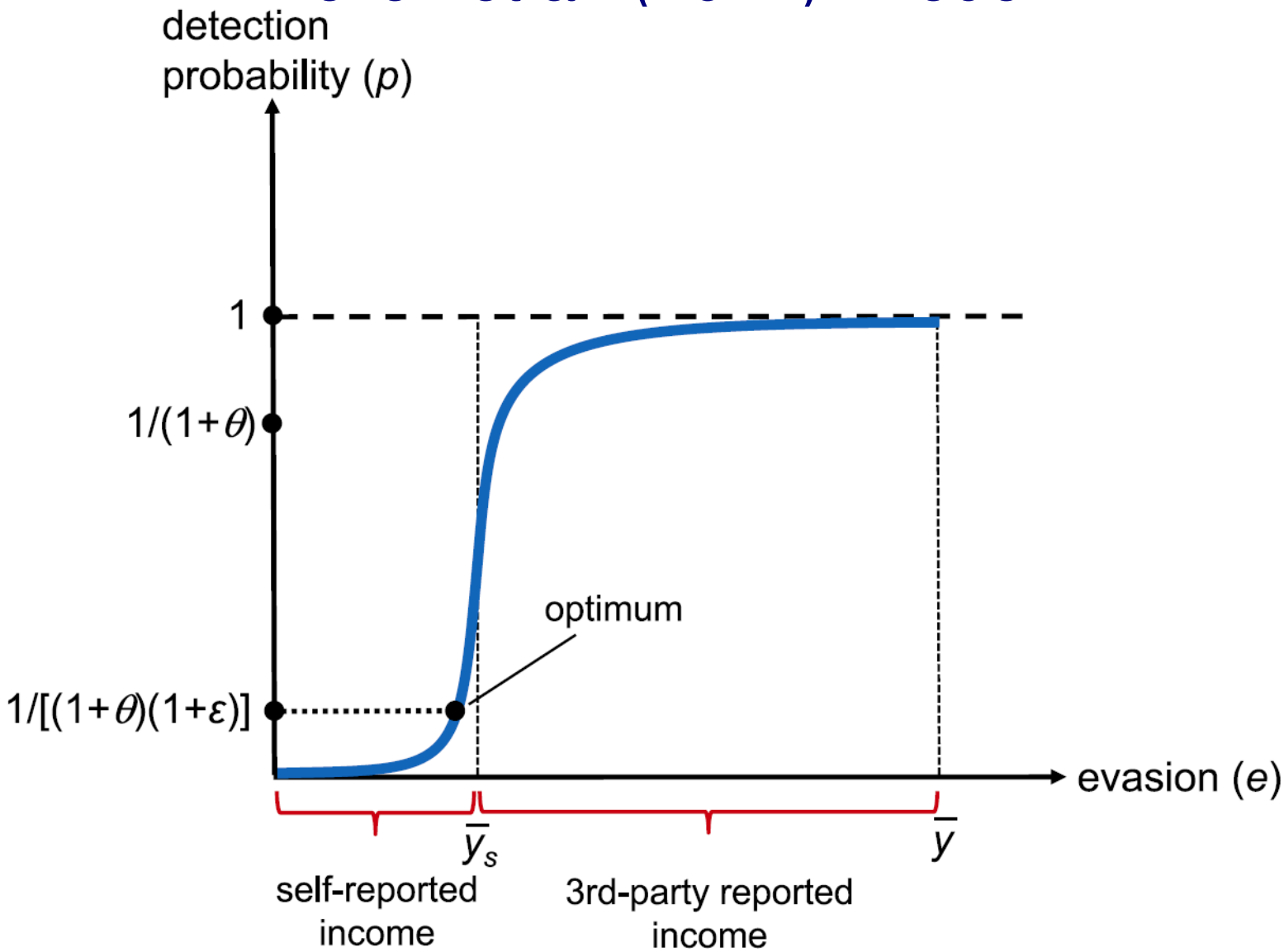


FIGURE 1.——Probability of detection under third-party reporting.

Kleven et al. (2011): Experimental Design

- Conduct a field experiment in Denmark in 2007
- 88% of population liable to taxes, all required to file a return
- Tax administration (SKAT) receives tax returns, and separately receives third-party reports from employers, banks etc.
- Local, regional national taxes all administered by SKAT

Kleven et al. (2011): Tax System

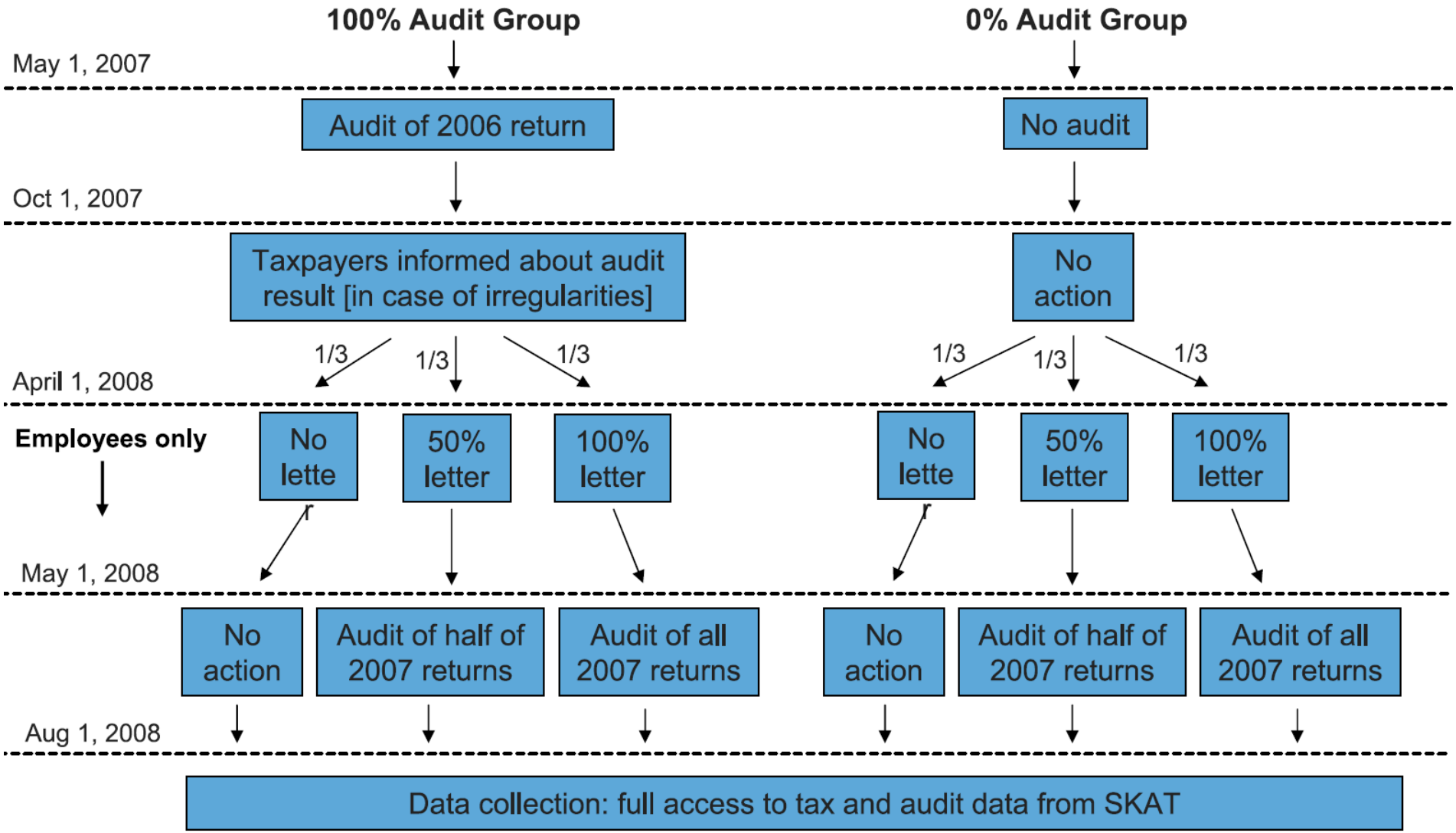
A. Income Concepts

Income Concept	Definition
1. Labor income	Salary, wages, honoraria, fees, bonuses, fringe benefits, business earnings
2. Personal income	Labor income (1) + social transfers, grants, awards, gifts, received alimony − payroll tax, and certain pension contributions
3. Capital income	Interest income, rental income, business capital income − interest on debt (mortgage, bank loans, credit cards, student loans)
4. Deductions	Commuting costs, union fees, unemployment contributions, other work related expenditures, charitable contributions, alimony paid
5. Taxable income	= Personal income (2) + capital income (3) − deductions (4)
6. Stock income	Dividends and realized capital gains from corporate stock

B. Tax Rates and Tax Bases

Tax Type[a]	Tax Base	Bracket (DKK)[b]	Tax Rate
Payroll tax	Labor income	All income	8.0%
		38,500–265,500	5.5%
National income tax	Personal income +	265,500–318,700	11.5%
	max(capital income, 0)	318,700–	26.5%[c]
Regional income tax	Taxable income	38,500–	32.6%[d]
Stock income tax	Stock income	0–44,400	28.0%
		44,400–	43.0%

Kleven et al. (2011): Experimental Design



Kleven et al. (2011): Audit Results (1)

AUDIT ADJUSTMENTS DECOMPOSITION[a]

		A. Total Income Reported				B. Third-Party vs. Self-Reported Income			
		Pre-Audit Income	Audit Adjustment	Under-reporting	Over-reporting	Third-Party Income	Third-Party Under-reporting	Self-Reported Income	Self-Reported Under-reporting
		1	2	3	4	5	6	7	8
I. Net Income and Total Tax									
Net income	Amounts	206,038	4532	4796	−264	195,969	612	10,069	4183
		(2159)	(494)	(493)	(31)	(1798)	(77)	(1380)	(486)
	% Nonzero	98.38	10.74	8.58	2.16	98.57	2.31	38.18	7.39
		(0.09)	(0.22)	(0.20)	(0.10)	(0.08)	(0.11)	(0.35)	(0.19)
Total tax	Amounts	69,940	1980	2071	−91				
		(1142)	(236)	(235)	(11)				
	% Nonzero	90.76	10.59	8.41	2.18				
		(0.21)	(0.22)	(0.20)	(0.10)				
II. Positive and Negative Income									
Positive income	Amounts	243,984	3776	3943	−167	223,882	516	20,102	3427
		(2511)	(485)	(485)	(27)	(1860)	(76)	(1693)	(478)
	% Nonzero	98.24	5.80	4.78	1.02	98.15	1.60	19.53	3.41
		(0.09)	(0.17)	(0.15)	(0.07)	(0.10)	(0.09)	(0.28)	(0.13)
Negative income	Amounts	−37,946	756	853	−97	−27,913	97	−10,033	756
		(1014)	(71)	(69)	(14)	(406)	(12)	(862)	(68)
	% Nonzero	79.09	6.45	5.13	1.32	78.21	0.75	29.49	4.99
		(0.29)	(0.18)	(0.16)	(0.08)	(0.29)	(0.06)	(0.33)	(0.16)

Kleven et al. (2011): Audit Results (2)

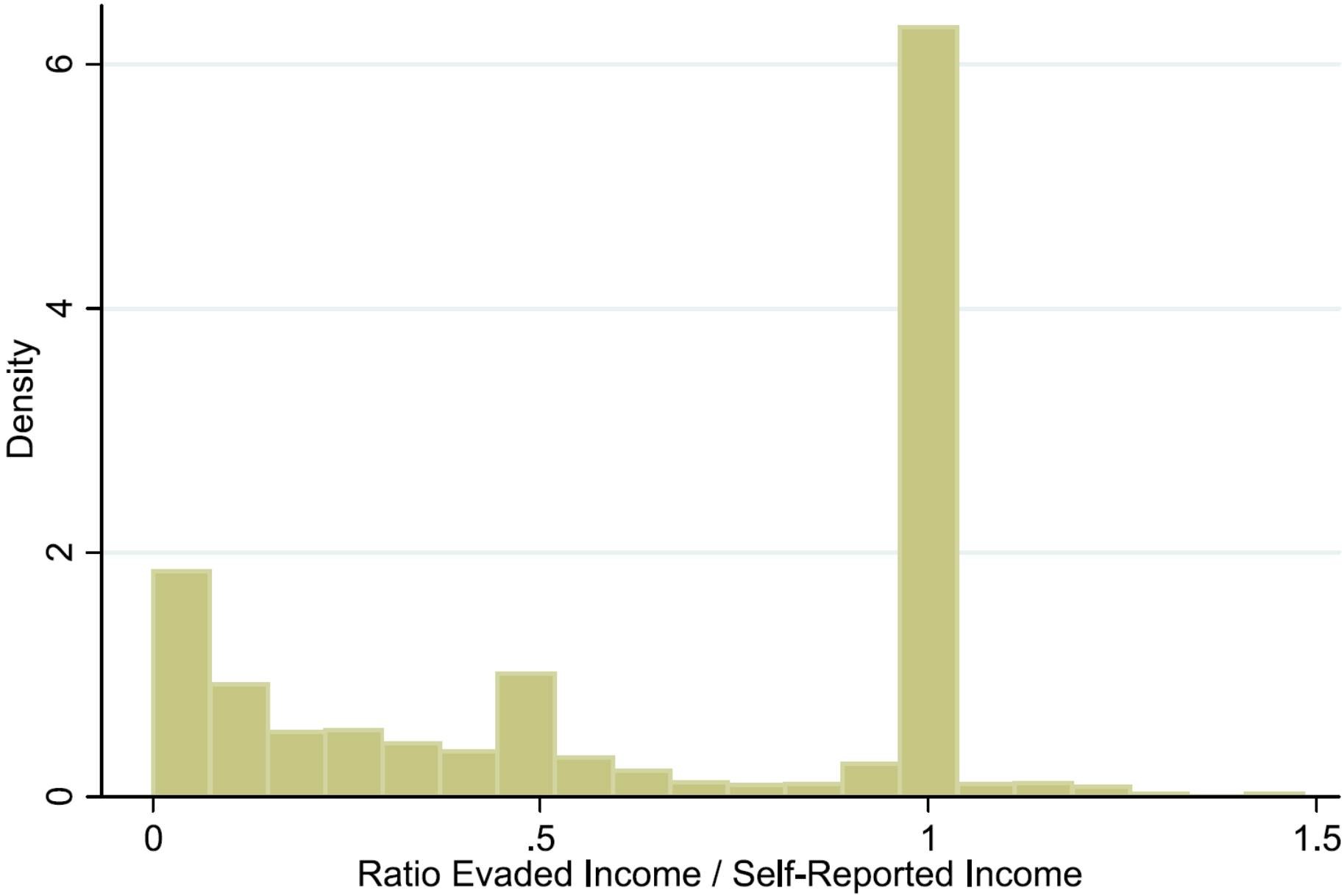
		A. Total Income Reported				B. Third-Party vs. Self-Reported Income			
		Pre-Audit Income	Audit Adjustment	Under-reporting	Over-reporting	Third-Party Income	Third-Party Under-reporting	Self-Reported Income	Self-Reported Under-reporting
		1	2	3	4	5	6	7	8
III. Income Components									
Personal income	Amounts	210,178	2327	2398	−71	211,244	463	−1066	1936
		(1481)	(399)	(399)	(11)	(1385)	(74)	(548)	(392)
	% Nonzero	95.22	2.49	1.99	0.50	95.20	1.30	11.95	0.82
		(0.15)	(0.11)	(0.10)	(0.05)	(0.15)	(0.08)	(0.23)	(0.06)
Capital income	Amounts	−11,075	254	286	−32	−14,556	98	3481	188
		(340)	(49)	(49)	(6)	(602)	(11)	(542)	(47)
	% Nonzero	93.93	2.10	1.69	0.41	94.91	0.79	12.29	1.28
		(0.17)	(0.10)	(0.09)	(0.05)	(0.16)	(0.06)	(0.23)	(0.08)
Deductions	Amounts	−9098	148	197	−49	−5666	18	−3432	179
		(104)	(17)	(15)	(7)	(48)	(3)	(85)	(15)
	% Nonzero	60.07	3.45	2.56	0.89	57.61	0.31	22.60	2.49
		(0.35)	(0.13)	(0.11)	(0.07)	(0.35)	(0.04)	(0.30)	(0.11)

Kleven et al. (2011): Audit Results (3)

		A. Total Income Reported				B. Third-Party vs. Self-Reported Income			
		Pre-Audit Income	Audit Adjustment	Under-reporting	Over-reporting	Third-Party Income	Third-Party Under-reporting	Self-Reported Income	Self-Reported Under-reporting
		1	2	3	4	5	6	7	8
III. Income Components (Continued)									
Stock income	Amounts	5635	259	281	−22	3783	30	1852	251
		(1405)	(45)	(45)	(8)	(976)	(12)	(943)	(43)
	% Nonzero	22.47	0.95	0.80	0.15	22.44	0.07	2.45	0.75
		(0.30)	(0.07)	(0.06)	(0.03)	(0.30)	(0.02)	(0.11)	(0.06)
Self-employment	Amounts	10,398	1544	1633	−89	1164	4	9234	1630
		(812)	(280)	(279)	(26)	(177)	(2)	(816)	(279)
	% Nonzero	7.63	3.43	3.02	0.41	1.40	0.04	7.66	3.00
		(0.19)	(0.13)	(0.12)	(0.05)	(0.08)	(0.01)	(0.19)	(0.12)

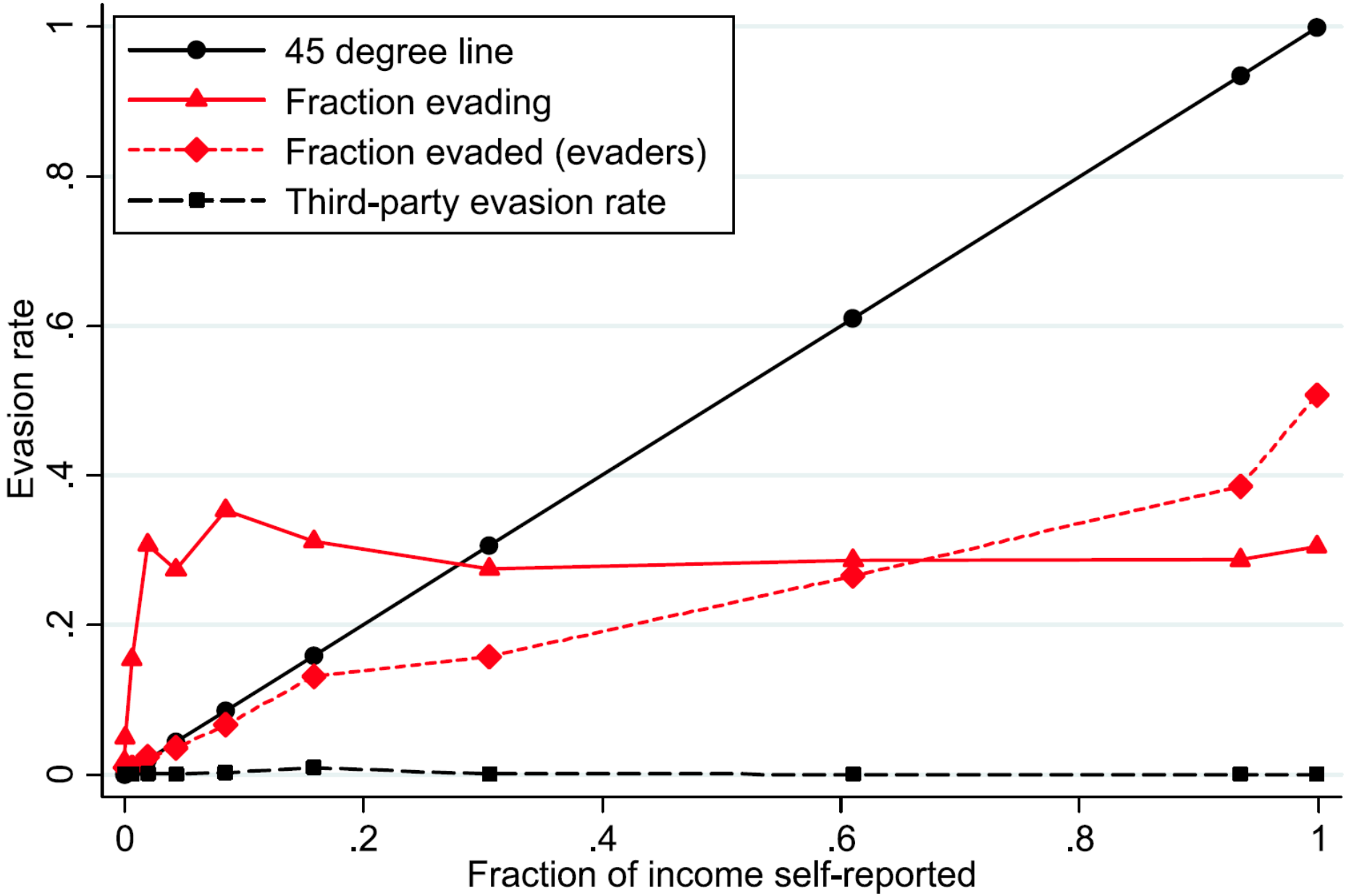
Kleven et al. (2011): Audit Results (4)

A. Histogram Evaded Income/Self-Reported Income

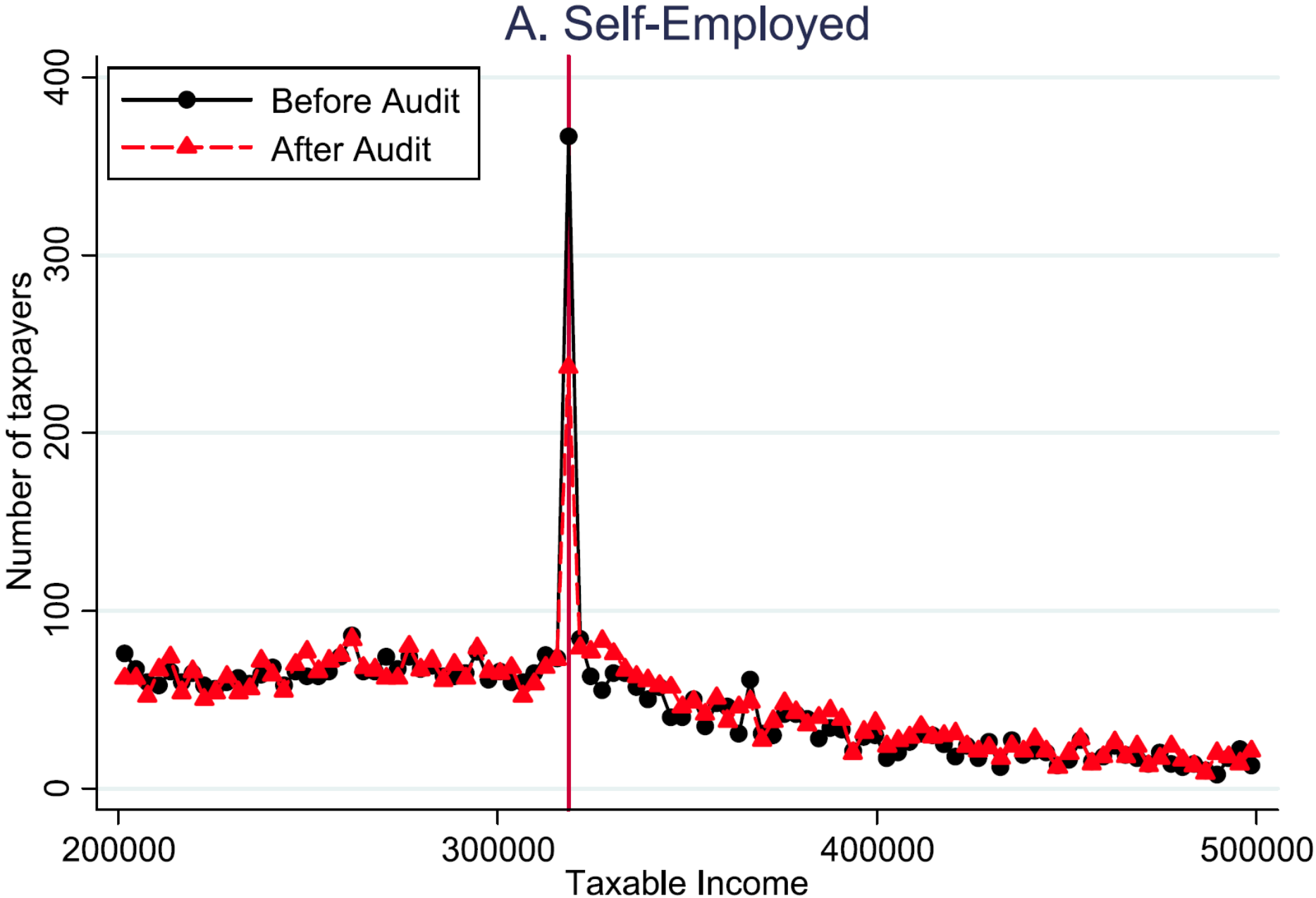


Kleven et al. (2011): Audit Results (5)

B. Evasion by Fraction Income Self-Reported



Kleven et al. (2011): Audit Results (6)



Kleven et al. (2011): Prior Audit Effects (1)

	Baseline Audit Adjustment	Change in Reported Income (Panels A1 and B1) and Probability of Income Increase (Panels A2 and B2) from 2006 to 2007			IV Effect of Audit Adjustment on Income Change
		Total Income	Self-Reported Income	Third-Party Reported Income	
	1	2	3	4	5
A. Full Sample					
A1. Amounts [difference between the 100% and the 0% audit groups]					
Net income	8491	2557	2331	225	0.301
	(827)	(787)	(658)	(691)	(0.098)
Total tax	3295	1375			0.417
	(257)	(464)			(0.144)
A2. Probability of audit adjustment and income increase [difference between the 100% and the 0% audit groups]					
Net income	19.09	0.89	2.11	0.24	0.047
	(0.28)	(0.48)	(0.48)	(0.48)	(0.025)
Total tax	19.17	0.99			0.052
	(0.28)	(0.49)			(0.025)
Number of observations	41,571	41,571	41,571	41,571	41,571
B. Sample Limited to Those Receiving No Threat-of-Audit Letter					
B1. Amounts [difference between the 100% and the 0% audit groups]					
Net income	12,835	2904	3086	−182	0.226
	(1310)	(1117)	(1008)	(962)	(0.091)
Total tax	5019	1732			0.345
	(406)	(677)			(0.137)

Kleven et al. (2011): Prior Audit Effects (2)

	Baseline Audit Adjustment	Change in Reported Income (Panels A1 and B1) and Probability of Income Increase (Panels A2 and B2) from 2006 to 2007			IV Effect of Audit Adjustment on Income Change
		Total Income	Self-Reported Income	Third-Party Reported Income	
	1	2	3	4	5
B. Sample Limited to Those Receiving No Threat-of-Audit Letter (Continued)					
B2. Probability of audit adjustment and income increase [difference between the 100% and the 0% audit groups]					
Net income	25.75	0.73	2.12	−0.52	0.028
	(0.39)	(0.61)	(0.61)	(0.61)	(0.024)
Total tax	25.93	0.98			0.038
	(0.39)	(0.61)			(0.024)
Number of observations	26,180	26,180	26,180	26,180	26,180

Kleven et al. (2011): Threat of Audit Effects

THREAT-OF-AUDIT LETTER EFFECTS ON INDIVIDUAL UPWARD ADJUSTMENTS TO REPORTED INCOME[a]

	No Letter Group	Differences Letter Group vs. No-Letter Group									50% Letter – No Letter	100% Letter – 50% Letter
	Both 0% and 100% Audit Groups	Both 0% and 100% Audit Groups			0% Audit Group Only			100% Audit Group Only			Both 0% and 100% Audit Groups	
	Baseline	Any Adjustment	Upward Adjustment	Downward Adjustment	Any Adjustment	Upward Adjustment	Downward Adjustment	Any Adjustment	Upward Adjustment	Downward Adjustment	Upward Adjustment	Upward Adjustment
	1	2	3	4	5	6	7	8	9	10	11	12
A. Average Amounts of Individual Upward Adjustments												
Net income	–497	94	84	10	74	77	–3	115	92	23	58	52
	(31)	(42)	(22)	(34)	(55)	(29)	(45)	(64)	(35)	(52)	(26)	(26)
Total tax	–322	67	50	17	57	46	11	77	54	23	32	36
	(24)	(32)	(18)	(26)	(43)	(24)	(34)	(49)	(28)	(39)	(21)	(21)
Number of obs.	9397	24,788	24,788	24,788	14,145	14,145	14,145	10,643	10,643	10,643	24,788	24,788
B. Probability of Upward Adjustments (in percent)												
Net income	13.37	1.63	1.56	0.07	2.29	1.52	0.76	0.98	1.60	–0.62	1.10	0.93
	(0.35)	(0.47)	(0.28)	(0.40)	(0.62)	(0.37)	(0.53)	(0.73)	(0.44)	(0.61)	(0.33)	(0.33)
Total tax	13.69	1.52	1.57	–0.05	2.03	1.65	0.37	1.02	1.49	–0.47	1.03	1.07
	(0.35)	(0.48)	(0.29)	(0.40)	(0.63)	(0.37)	(0.54)	(0.73)	(0.44)	(0.61)	(0.33)	(0.33)
Number of obs.	9397	24,788	24,788	24,788	14,145	14,145	14,145	10,643	10,643	10,643	24,788	24,788

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Dwenger et al. (2016): Overview

- Perhaps A-S predicts poorly because people don't understand the incentives they face?
- Or because people comply for *non-pecuniary* reasons?
  - moral sentiments
  - guilt
  - reciprocity
  - social norms
- Label all of these *intrinsic motivation*
- Run a field experiment to contrast impact with *extrinsic motivation* (financial penalties for non-compliance)
- Study local church tax in Bavaria, Germany

Dwenger et al. (2016): Setting

- All members of protestant and catholic churches must pay tax
- local tax collected by individual parishes
- Everyone who is baptised is liable when they turn 18 (even though <8% actually attend church)
- progressive tax schedule from €5 to €100 based on broad income
- Each May, churches mail people to self-assess and deposit their tax liability
  - at baseline no deterrence
- Overpayment is encouraged, treated as donations
  - identify intrinsically motivated people as overpayers at baseline

Dwenger et al. (2016): Model

- Model merging A-S with warm-glow (Andreoni 1988, 1990)
- Taxpayers have true income $\bar{z}$ and face tax schedule $T(\bar{z})$. Report z and $T(z)$.
- Utility $u(c, T(z), s)$ c is consumption, $T(z)$ to capture warm glow, governed by parameter s.
- u'_T/u'_C increasing in s, 0 if $s = 0$. s is heterogeneous in population with cdf $F(s)$. $s = 0 \rightarrow$A-S
- Taxpayers choose z to maximize

$$\begin{aligned}&(1-p)\,u(\bar{z}-T(z), T(z), s)\\ &+pu(\bar{z}-T(z)-I\{z<\bar{z}\}(1+\theta)[T(\bar{z})-T(z)], T(z), s)\end{aligned}$$

where p is audit probability, θ is penalty

Dwenger et al. (2016): Model

- Three types of taxpayers
  1. *evaders:* $T(z) < T(\bar{z})$
  2. *compliers*: $T(z) = T(\bar{z})$
  3. *donors*: $T(z) > T(\bar{z})$
- Policy changes create intensive margin (changes in z within type) and extensive margin (taxpayers changing types) responses.
- Intensive margin response:

$$(1-p)\,u'_{c_N} + p\,(1 - I\{z < \bar{z}\}\,(1+\theta))\,u'_{c_A} = \mathsf{E}\left[u'_T\right]$$

where u'_{c_N} and u'_{c_A} are marginal utilities of consumption in non-audited and audited states

Dwenger et al. (2016): Model

- Intensive margin comparative statics: $p \uparrow \rightarrow z \uparrow$ for evaders, no effect on donors
- Extensive margin: $s < \bar{s}_1 \rightarrow$evader; $\bar{s}_1 \leq s \leq \bar{s}_2 \rightarrow$ complier; $\bar{s}_2 < s \rightarrow$donor. Cutoffs satisfy

$$\frac{u_T'\left(\bar{z} - T\left(\bar{z}\right), T\left(\bar{z}\right), \bar{s}_1\right)}{u_c'\left(\bar{z} - T\left(\bar{z}\right), T\left(\bar{z}\right), \bar{s}_1\right)} = 1 - p\left(1 + \theta\right)$$
$$\frac{u_T'\left(\bar{z} - T\left(\bar{z}\right), T\left(\bar{z}\right), \bar{s}_2\right)}{u_c'\left(\bar{z} - T\left(\bar{z}\right), T\left(\bar{z}\right), \bar{s}_2\right)} = 1$$

- Comparative statics: $p \uparrow \rightarrow \bar{s}_1 \downarrow$, no effect on $\bar{s}_2 \Rightarrow$ fewer evaders, more compliers

Dwenger et al. (2016): Experiment

- Experiment with 11 (!) treatment arms
  - T1. Control
- Tax Simplification and misperceptions
  - T2. Shorter, clearer message. Legal obligation, payment deadlines and schedule more salient
  - T3. T2 + paragraph saying $p = 0$
- Deterrence
  - T4. T2 + $p = 0.1$
  - T5. T2 + $p = 0.2$
  - T6. T2 + $p = 0.5$
  - T7. T2 + $p = 0.5$ if pay less than €10

Dwenger et al. (2016): Experiment

- Compliance Rewards

  T8. T2 + social recognition (in newspaper) of timely compliance

  T9. T2 + private raffle for €250

  T10. T2 + private raffle for €1,000

  T11. T2 + newspaper + €1,000 raffle

Dwenger et al. (2016): Analysis

- Data. Link church records (z) with tax records $(\bar{z})$ on 39,782 individuals
- Extensive margin: Estimate LPM

$$\Pr(i \text{ evades}) = \alpha + \beta I\{T_i = j\} + \pi E_{i,pre} + \lambda_S + u_i$$

where $I\{T_i = j\}$ indicates treatment j, $E_{i,pre}$ denotes evasion in previous years, λ_s are stratum FEs

- Total responses

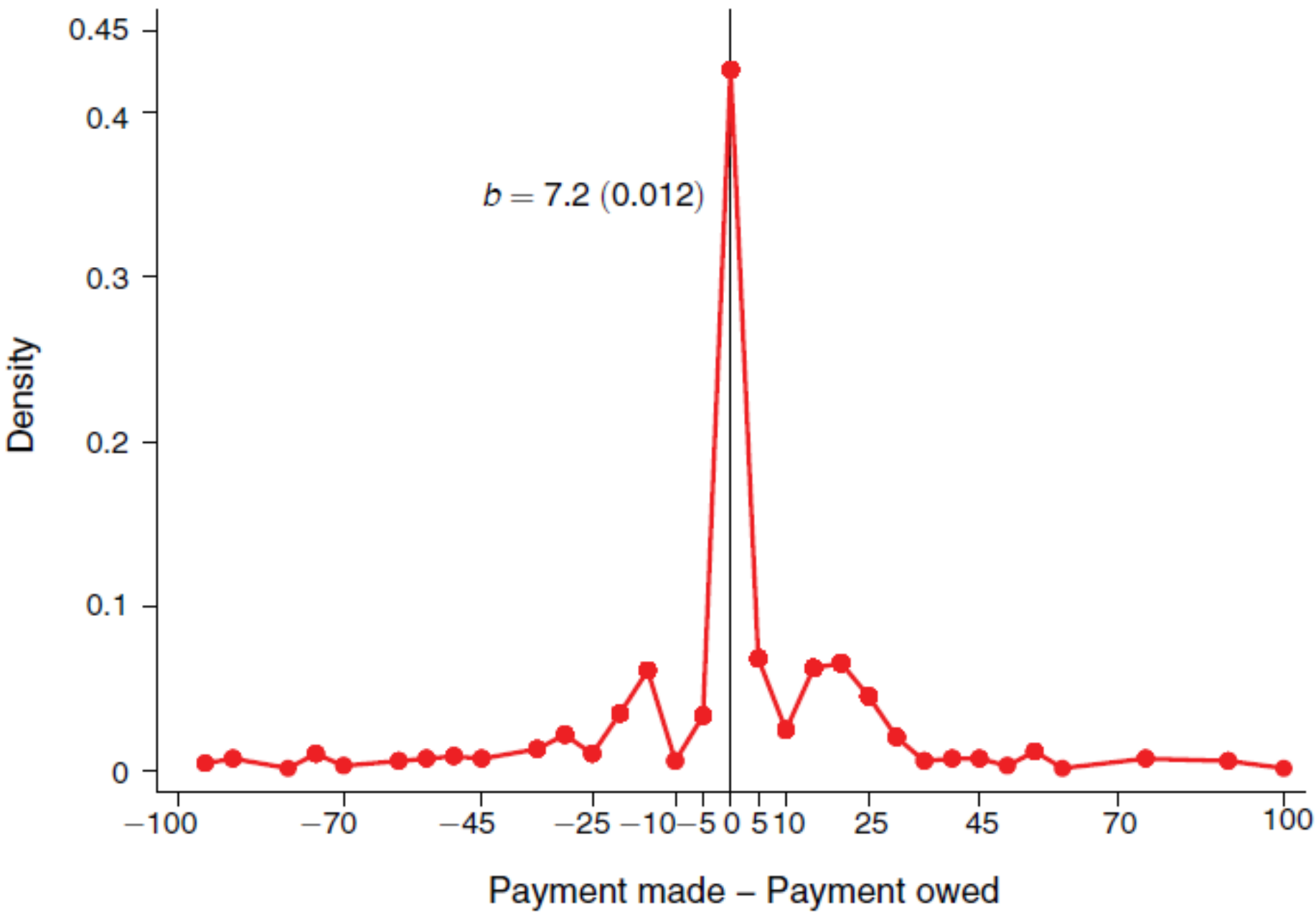
$$y_i = \delta + \gamma I\{T_i = j\} + \theta \bar{y}_{i,pre} + \lambda_s + \varepsilon_i$$

where $\bar{y}_{i,pre}$ is average pre-treatment tax

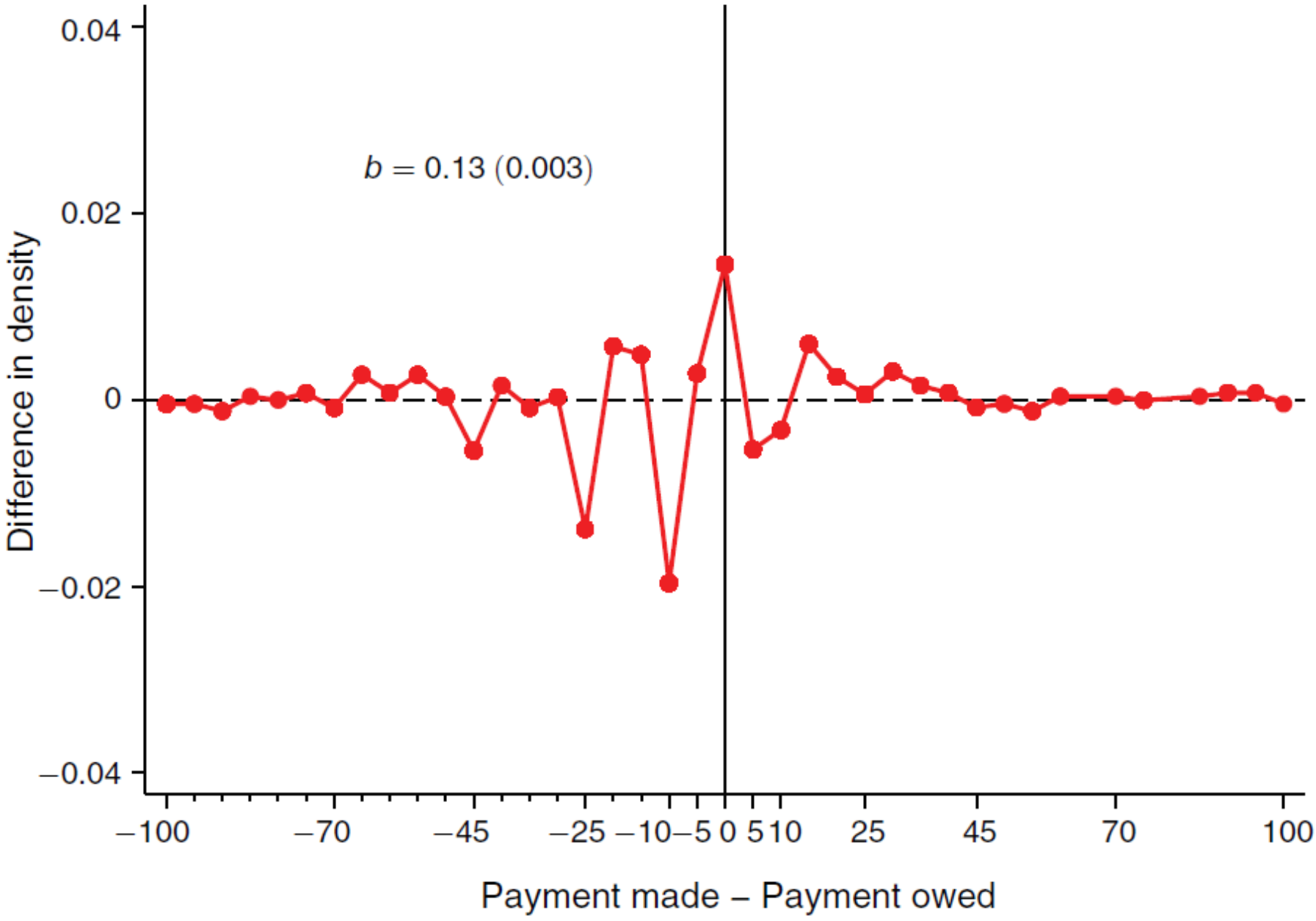
TABLE 1—COMPLIANCE UNDER ZERO DETERRENCE

Control group, means	Full sample (1)	Evaders (extrinsically motivated) (2)	Compliers/donors (intrinsically motivated) (3)
Number of individuals	2,532	2,004	528
Percentage of all individuals	100%	79.1%	20.9%
Full evaders	72.7%	91.9%	—
Partial evaders	6.4%	8.08%	—
Compliers	11.6%	—	55.5%
Donors	9.3%	—	44.5%
Payment amount	€10.32	€1.87	€42.40

Notes: The sample of individuals are all those assigned to the T1 control group in 2012 (2,532 individuals). The column headings refer to behavior in 2012, the year of the field experiment. Evaders are defined as those who pay strictly less than their legal tax liability, compliers are those who pay exactly their legal tax liability, and donors are those who pay strictly more than their legal tax liability.


Panel A. Bunching at exact compliance (duty-to-comply) control letter
0.45
0.4
0.3
0.2
0.1
0
Density
b = 7.2 (0.012)
−100
−70
−45
−25
−10
−5
0
5
10
25
45
70
100
Payment made – Payment owed

Panel B. Duty-to-comply versus attention simplification letter—control letter



Control group, means	Full sample			
	Probability of evading (1)	Probability of donating (2)	Payment amount (3)	Probability of payment increase (4)
Panel A. Tax simplification				
Simplification versus control				
Effect of tax simplification	−2.45	−0.438	9.73	33.61
	(0.971)	(6.90)	(3.73)	(10.25)
Average outcome in comparison group	79.29%	9.24%	€10.29	7.89%
Observations	5,076	5,076	5,076	5,076
Panel B. Misperception				
Zero audit probability versus simplification				
Effect of correcting misperception	0.942	−7.23	−0.766	−10.60
	(0.889)	(5.65)	(3.05)	(6.75)
Average outcome in comparison group	77.30%	9.75%	€11.65	10.92%
Observations	7,641	7,641	7,641	7,641
Panel C. Deterrence				
Positive audit probability versus zero audit probability				
Effect of deterrence	−3.13	13.71	10.45	26.93
	(0.660)	(4.59)	(2.37)	(5.84)
Average outcome in comparison group	78.04%	8.93%	€11.63	9.42%
Observations	12,692	12,692	12,692	12,692
Panel D. Compliance rewards				
Reward versus simplification				
Effect of compliance rewards	0.259	−0.040	1.24	−9.48
	(0.821)	(5.23)	(2.86)	(6.21)
Average outcome in comparison group	77.30%	9.75%	€11.65	10.92%
Observations	12,632	12,632	12,632	12,632

	Baseline evaders (extrinsically motivated)				Baseline donors (intrinsically motivated)			
	Probability of evading (5)	Probability of donating (6)	Payment amount (7)	Probability of payment increase (8)	Probability of evading (9)	Probability of donating (10)	Payment amount (11)	Probability of payment increase (12)
Panel A. Tax simplification								
Simplification versus control								
Effect of tax simplification	−2.66	6.58	43.40	64.82	−5.25	−4.04	−6.65	−37.29
	(0.747)	(22.86)	(10.60)	(13.69)	(19.67)	(6.97)	(4.85)	(19.38)
Average outcome in comparison group	94.98%	1.91%	€3.13	6.12%	17.32%	62.34%	€39.94	15.58%
Observations	4,007	4,007	4,007	4,007	476	476	476	476
Panel B. Misperception								
Zero audit probability versus simplification								
Effect of correcting misperception	1.53	−8.89	−9.83	−11.03	−16.75	1.52	8.79	32.37
	(0.715)	(17.47)	(6.75)	(7.55)	(17.63)	(5.78)	(4.78)	(28.02)
Average outcome in comparison group	92.35%	2.18%	€4.84	10.53%	15.92%	61.63%	€40.16	8.57%
Observations	6,049	6,049	6,049	6,049	723	723	723	723
Panel C. Deterrence								
Positive audit probability versus zero audit probability								
Effect of deterrence	−3.12	36.89	33.67	29.81	−0.093	7.07	2.10	30.85
	(0.536)	(15.22)	(6.28)	(6.64)	(15.48)	(4.22)	(3.25)	(19.16)
Average outcome in comparison group	93.80%	1.93%	€4.05	9.00%	12.55%	61.72%	€45.08	10.67%
Observations	9,979	9,979	9,979	9,979	1,261	1,261	1,261	1,261
Panel D. Compliance rewards								
Reward versus simplification								
Effect of compliance rewards	1.27	5.24	−5.46	−15.58	−11.64	2.02	4.87	48.34
	(0.664)	(16.17)	(6.33)	(6.90)	(15.11)	(4.95)	(3.83)	(25.27)
Average outcome in comparison group	92.35%	2.18%	€4.84	10.53%	15.92%	61.63%	€40.16	8.57%
Observations	9,909	9,909	9,909	9,909	1,247	1,247	1,247	1,247

	Full sample			
	Probability of evading (1)	Probability of donating (2)	Payment amount (3)	Probability of payment increase (4)
Panel A. Deterrence				
Positive audit probability versus zero audit probability				
Deterrence, pooled effect	−2.45	−0.438	9.73	33.61
	(0.971)	(6.90)	(3.73)	(10.25)
Deterrence, individual effects				
Audit probability = 0.1	−3.29	5.38	9.52	29.76
	(0.898)	(6.08)	(3.20)	(8.05)
Audit probability = 0.2	−3.11	17.61	11.48	26.81
	(0.923)	(6.44)	(3.37)	(8.11)
Audit probability = 0.5	−2.99	18.27	10.38	24.17
	(0.912)	(6.31)	(3.30)	(8.01)
Average outcome in comparison group	78.04%	8.93%	€11.63	9.42%
Observations	12,692	12,692	12,692	12,692
Panel B. Compliance rewards				
Reward versus simplification				
Compliance rewards, pooled effect	0.259	−0.040	1.24	−9.48
	(0.821)	(5.23)	(2.86)	(6.21)
Compliance rewards, individual effects				
Social reward	0.185	2.97	0.245	−11.60
	(1.03)	(6.68)	(3.51)	(7.71)
Small private reward	0.450	−4.59	−1.15	−10.88
	(1.03)	(6.74)	(3.56)	(7.74)
Large private reward	1.02	−3.30	2.12	−15.30
	(1.00)	(6.60)	(3.98)	(7.63)
Social and private reward combined	−0.618	4.75	3.74	−0.15
	(1.04)	(6.57)	(3.73)	(7.89)
Average outcome in comparison group	77.30%	9.75%	€11.65	10.92%
Observations	12,632	12,632	12,632	12,632

	Baseline evaders (extrinsically motivated)				Baseline donors (intrinsically motivated)			
	Probability of evading (5)	Probability of donating (6)	Payment amount (7)	Probability of payment increase (8)	Probability of evading (9)	Probability of donating (10)	Payment amount (11)	Probability of payment increase (12)
Panel A. Deterrence								
Positive audit probability versus zero audit probability								
Deterrence, pooled effect	−2.66	6.58	43.40	64.82	−5.25	−4.04	−6.65	−37.29
	(0.747)	(22.86)	(10.60)	(13.69)	(19.67)	(6.97)	(4.85)	(19.38)
Deterrence, individual effects								
Audit probability = 0.1	−3.09	14.43	31.69	34.91	15.80	−2.07	2.91	41.68
	(0.741)	(19.43)	(8.73)	(9.19)	(21.44)	(5.76)	(4.38)	(26.31)
Audit probability = 0.2	−3.60	44.22	42.19	29.86	7.45	10.92	−0.544	22.62
	(0.773)	(21.67)	(8.89)	(9.17)	(19.63)	(5.39)	(3.94)	(23.67)
Audit probability = 0.5	−2.69	52.86	27.48	24.55	−25.90	12.08	4.41	29.25
	(0.749)	(22.28)	(9.23)	(9.10)	(21.44)	(5.66)	(4.11)	(26.60)
Average outcome in comparison group	93.80%	1.93%	€4.05	9.00%	12.55%	61.72%	€45.08	10.67%
Observations	9,979	9,979	9,979	9,979	1,261	1,261	1,261	1,261
Panel B. Compliance rewards								
Reward versus simplification								
Compliance rewards, pooled effect	1.27	5.24	−5.46	−15.58	−11.64	2.02	4.87	48.34
	(0.664)	(16.17)	(6.33)	(6.90)	(15.11)	(4.95)	(3.83)	(25.27)
Compliance rewards, individual effects								
Social reward	1.02	17.93	−6.38	−16.84	−11.96	3.17	3.50	40.87
	(0.824)	(21.07)	(7.99)	(8.57)	(19.62)	(6.35)	(4.66)	(34.04)
Small private reward	1.22	2.66	−10.10	−17.50	−11.95	−4.56	5.15	56.00
	(0.825)	(20.60)	(7.87)	(8.50)	(18.48)	(6.32)	(4.57)	(32.76)
Large private reward	2.09	−7.38	−10.57	−21.24	−4.55	2.72	3.16	35.00
	(0.794)	(19.69)	(7.59)	(8.34)	(19.25)	(6.32)	(5.08)	(32.38)
Social and private reward combined	0.777	7.66	4.93	−6.95	−18.58	7.38	7.89	62.16
	(0.841)	(20.47)	(8.34)	(8.75)	(20.02)	(6.37)	(5.24)	(34.60)
Average outcome in comparison group	92.35%	2.18%	€4.84	10.53%	15.92%	61.63%	€40.16	8.57%
Observations	9,909	9,909	9,909	9,909	1,247	1,247	1,247	1,247

Outline

Tax Evasion: Theory and Evidence from Rich Countries

- Allingham & Sandmo 1972 (& Yitzhaki 1974) *Income Tax Evasion: A Theoretical Analysis*
- Chetty (AEJ:Pol 2009) *Is the Taxable Income Elasticity Sufficient to Calculate Deadweight Loss? The Implications of Evasion and Avoidance*
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Artavanis *et al.* (2016): Overview

- Seminal paper on measurement of evasion: Pissarides & Weber (EJ 1989)
- All households report food expenditure truthfully
  - Some households (3rd-party reported) report income truthfully $\rightarrow$estimate Engel curve
  - Applying inverse Engel curve to other households $\rightarrow$ estimate of evasion
- Artavanis-Morse-Tsoutsoura insight:
  - Semi-formality: Firm is formal, but hides income.
  - Banks still lend, but base their lending on their inference of *true income*
- $\Rightarrow$ if we can reverse-engineer banks' inference, we can predict level of tax evasion

Artavanis *et al.* (2016): Data

- Data from “a large Greek bank”.
- Universe of consumer credit applications
  - all variables on application form
- Tax authority data
  - zip-code $\times$ occupation $\times$ income decile data on reported income

Artavanis *et al.* (2016): Methodology

- Once applicant is deemed eligible, amount of credit is

$$\text{credit decision} = f\left(Y^{True}, Risk, SOFT\right)$$

- true income Y^{True}, credit score $Risk$, "soft information"

$$credit_{ij} = \beta_{1j} Y_{ij}^{True} + Risk_i \Phi + SOFT_{ij} \Psi$$

- Assume: wage workers don't evade, self employed evade differentially across industries. Reported income Y_{ij}^{R} relates to true income through

$$Y_{ij}^{True} = \begin{cases} Y_{ij}^{R} & \text{if } i \text{ is wage worker} \\ \lambda_j Y_{ij}^{R} & \text{if } i \text{ is self-employed} \end{cases}$$

Artavanis *et al.* (2016): Methodology

- Defining $SE_i = I\{\text{self-employed}\}$:

$$credit_{ij} = \beta_{1j} Y_{ij}^R (1 - SE_i) + (\beta_{1j}\lambda_j) Y_{ij}^R SE_i + Risk_i \Phi + SOFT_{ij} \Psi$$

- So estimate

$$credit_{ij} = \beta_{1j} Y_{ij}^R (1 - SE_i) + \beta_{2j} Y_{ij}^R SE_i + f.e.^{CreditGrade} + SOFT_{ij} \Psi + \varepsilon_{ij}$$

where $SOFT_{ij}$ includes wealth, neighborhood info, income risk

- $\Rightarrow \lambda_j = \beta_{2j} / \beta_{1j}$

Artavanis *et al.* (2016): Methodology

- λ_j identified if E $\left[\varepsilon_{ij} SE_i | Y_{ij}^R, Risk_i, SOFT_{ij}\right] = 0$

1. Wage workers don't evade
   - Restrict to workers at large companies
2. $dcredit/dY_{ij}^R$ same for wage and SE (conditional on risk)
   - saturate model, add year, industry*SE and bank FEs
3. credit depends on hidden and true income in same way
   - evasion is a norm, can't garnish wages for debts.
4. unobservables orthogonal to Y_{ij}^R
   - no ex-post differences in defaults
5. $credit_{ij}$ is bank's supply, not demand-driven debt.
   - focus on constrained borrowers, requested amt > approved amt

Dependent Variable: Credit Capacity = Outstanding Debt + Approved Loan								
	(1)	(1a)	(2)	(2a)	(3)	(3a)	(4)	(4a)
	OLS	λ	OLS	λ	OLS	λ	Quantile	λ
Income*Wage Worker	0.3185***		0.3235***		0.3391***		0.3610***	
	[0.0467]		[0.0491]		[0.0544]		[0.0023]	
Income*SE	0.5575***	1.75***	0.5755***	1.78***	0.6257***	1.84***	0.6490***	1.79***
	[0.0602]		[0.0569]		[0.0514]		[0.0025]	
IncomeRisk					1,811		-663	
					[2,983]		[671]	
SE*IncomeRisk					1,564		878	
					[3,197]		[821]	
Lag(Income Growth)					1,729		-8,501***	
					[9,857]		[1,434]	
SE*Lag(Income Growth)					8,336		9,814***	
					[10,517]		[1,810]	
Real Estate Wealth					0.9400***		0.1968***	
					[0.3193]		[0.0576]	
SE*Real Estate Wealth					-0.1045		0.0608	
					[0.5807]		[0.1255]	
Credit Grade F.E.	Yes		Yes		Yes		Yes	
Industry*SE F.E.	Yes		Yes		Yes		Yes	
Branch F.E.	No		Yes		Yes		Yes	
Year F.E.	Yes		Yes		Yes		Yes	
Adj. R^2	0.100		0.118		0.120		0.140	
Tax Evasion Rate		42.85%		43.82%		45.65%		44.13%

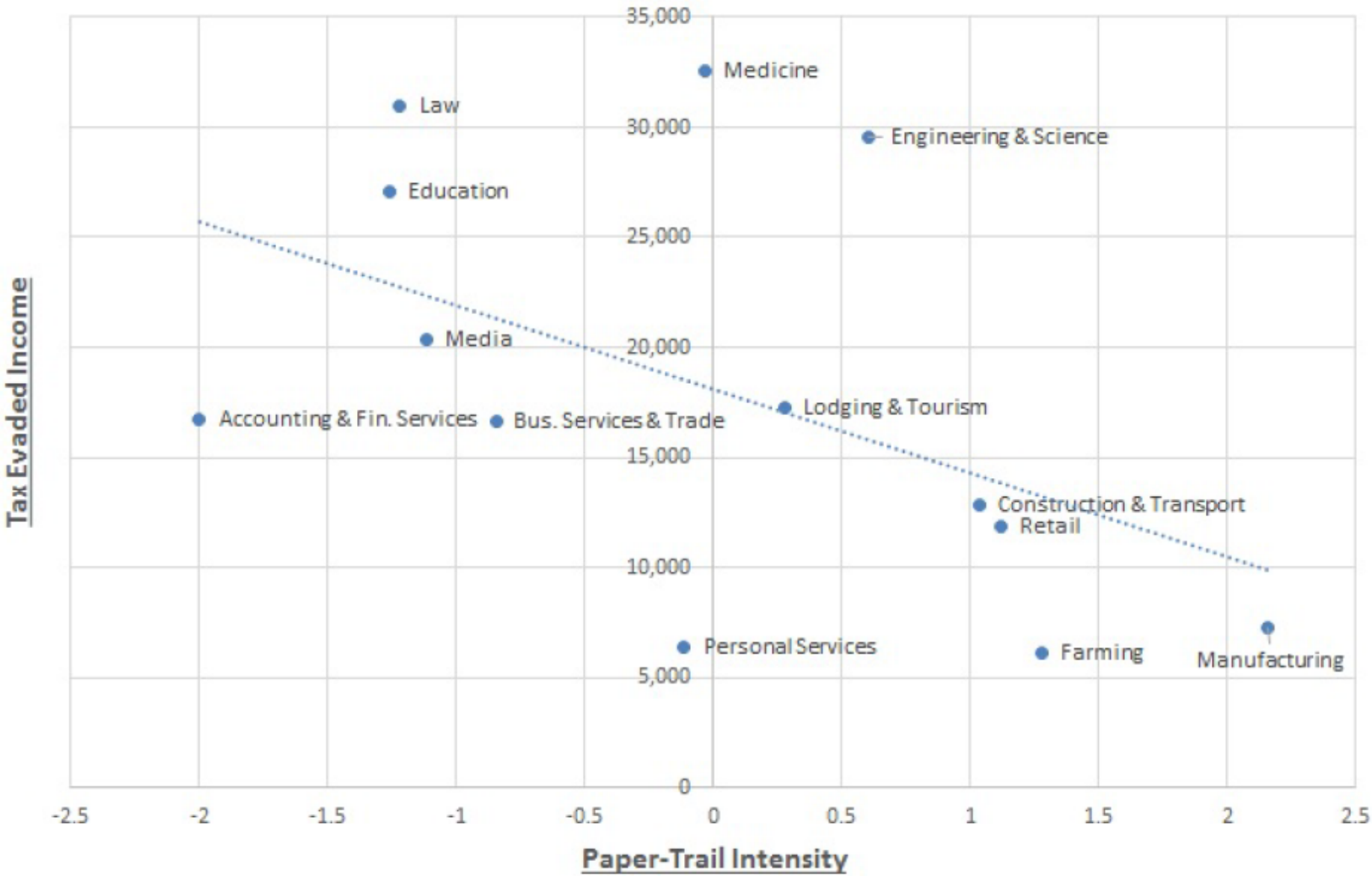
Artavanis *et al.* (2015): Results

The table presents aggregate estimates of tax evasion at the economy level. The lambda multiples (λ) are from Table II. The aggregate reported income for the self-employed is from the annual bulletin of the Ministry of Finance. A range of economy-wide tax evaded income for the self-employed individuals and foregone taxes is calculated based on low and high estimated lambda multiples from Table II. Estimations based on the median lambda multiple are provided in parentheses. Foregone taxes are estimated under a 40% tax rate. Total and primary (in parentheses) deficits are from Eurostat. Amounts are in billions of euros.

		Low	Median	High
	Lambda Estimate:	1.75	1.79	1.84
	Reported Income (Self-Employed)	Tax Evaded Income Low-High (Median)	Foregone Taxes Low-High (Median)	Deficit (Primary)
Year 2006	28.8	21.6 - 24.2 (22.8)	8.64 - 9.68 (9.10)	8.0 (3.6)
Year 2007	30.4	22.8 - 25.5 (24.0)	9.12 - 10.21 (9.60)	14.8 (5.0)
Year 2008	32.4	24.6 - 27.6 (25.9)	9.84 - 11.02 (10.36)	23.3 (12.1)
Year 2009	35.7	26.8 - 29.9 (28.2)	10.71 - 12.00 (11.28)	35.4 (24.3)

		Dependent Variable: Credit Capacity = Outstanding Debt + Approved Loan								
		OLS			OLS			Quintile		
		(1)	(1.a)	(1.b)	(2)	(2.a)	(2.b)	(3)	(3.a)	(3.b)
		Estimate	λ	Tax-Evaded Income	Estimate	λ	Tax-Evaded Income	Estimate	λ	Tax-Evaded Income
Income*SE	Income*WageWorker	0.308***			0.313***			0.366***		
		[0.0487]			[0.0529]			[0.00399]		
	*Accounting & Finance	0.526***	1.71*	14,477	0.600***	1.92	18,732	0.670***	1.83*	16,971
		[0.138]			[0.233]			[0.0279]		
	*Bus.Services & Trade	0.627***	2.04***	17,654	0.690***	2.20***	20,508	0.620***	1.69***	11,833
		[0.0656]			[0.0821]			[0.00940]		
	*Constr. & Transport	0.571***	1.85***	11,555	0.649***	2.07***	14,508	0.705***	1.93***	12,522
		[0.0600]			[0.0959]			[0.0202]		
	*Education	0.781***	2.54***	24,689	1.028***	3.29***	36,687	0.821***	2.24***	19,971
		[0.105]			[0.228]			[0.0608]		
	*Engineering & Science	0.756***	2.46***	28,306	0.996***	3.18***	42,477	0.703***	1.92***	17,913
		[0.129]			[0.212]			[0.0198]		
	*Farming	0.182	not sig	–	0.0910	not sig	–	0.552***	1.51*	6,121
		[0.125]			[0.0799]			[0.0103]		
	*Law	0.716***	2.33***	29,415	0.871***	2.79***	39,557	0.762***	2.08***	23,965
		[0.116]			[0.119]			[0.0193]		
	*Lodging & Tourism	0.496***	1.61	9,952	0.866***	2.77***	28,700	0.660***	1.80**	13,059
		[0.186]			[0.178]			[0.0240]		
	*Manufacturing	0.403***	1.31	5,382	0.393***	1.26	4,457	0.617***	1.69	11,975
		[0.0884]			[0.112]			[0.0123]		
	*Media & Entert.	0.587***	1.91*	15,039	0.904***	2.89***	31,290	0.691***	1.89**	14,718
		[0.158]			[0.155]			[0.0566]		
	*Medicine	0.683***	2.22***	29,346	0.811***	2.59**	38,275	0.826***	2.25***	30,021
		[0.129]			[0.233]			[0.0142]		
	*Personal Services	0.343***	1.11	1,661	0.470***	1.50	7,329	0.620***	1.69	10,131
		[0.111]			[0.176]			[0.0714]		
	*Retail	0.468***	1.52**	10,342	0.480***	1.53**	10,635	0.634***	1.73**	14,588
		[0.0451]			[0.0630]			[0.0103]		

Artavanis *et al.* (2015): Results



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Alstadsæter et al. (2017): Overview

- Who evades taxes? Is it the ultra-rich (panama papers) or the poor (self-employed/benefit fraud)?
- Combine financial leaks, amnesties, and tax data in Scandinavia to study distribution of evasion.
- Find that
  - evasion is higher amongst the rich (25-30% vs 3% in the overall population)
  - evasion and avoidance aren't good substitutes
- Provide a model of tax evasion intermediaries to rationalize results
- Implies that
  - high fiscal returns to clamping down on evasion
  - measured wealth inequality understated

Alstadsæter et al. (2017): Data

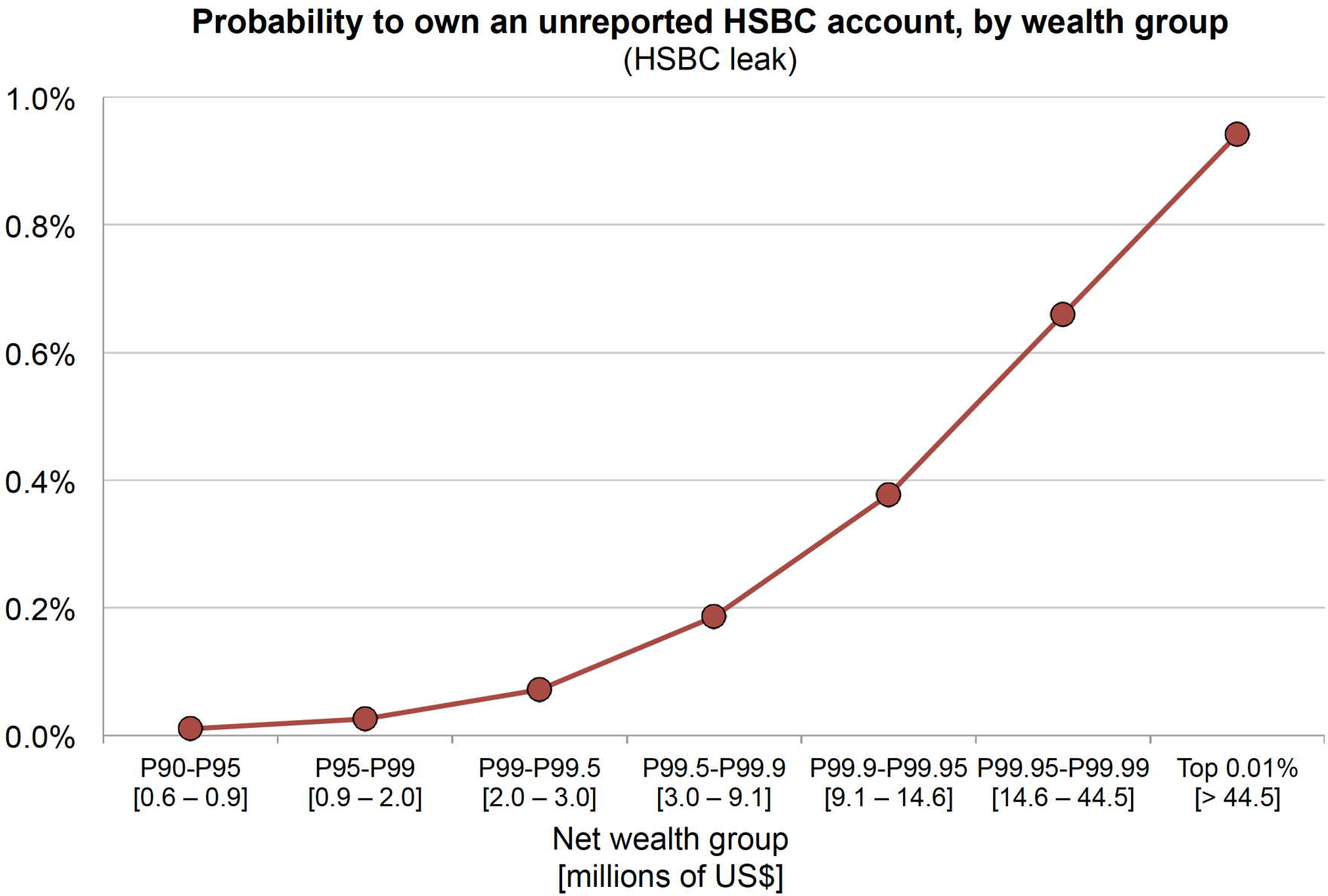
1. HSBC Switzerland Leak
   - 1.1 In 2007, an engineer at HSBC Private Bank Switzerland leaked details of 30,142 clients' accounts to French tax authorities.
   - 1.2 Contains beneficial ownership information linking owners to wealth even if held through shell companies
   - 1.3 HSBC a big player in offshore wealth management.
   - 1.4 Link to Scandinavian tax data: Match 520 households who did not declare the accounts.
2. Panama Papers Leak
   - 2.1 2016 leak of names & addresses of owners of shell companies created by Mossack Fonseca
   - 2.2 Match to 165 taxpayers in Norway & Sweden
3. Tax Amnesty Participants in Norway and Sweden
   - 3.1 1,422 in NO; 6,811 in SE
4. Tax microdata from Denmark, Norway & Sweden

Alstadsæter et al. (2017): Wealth Distribution

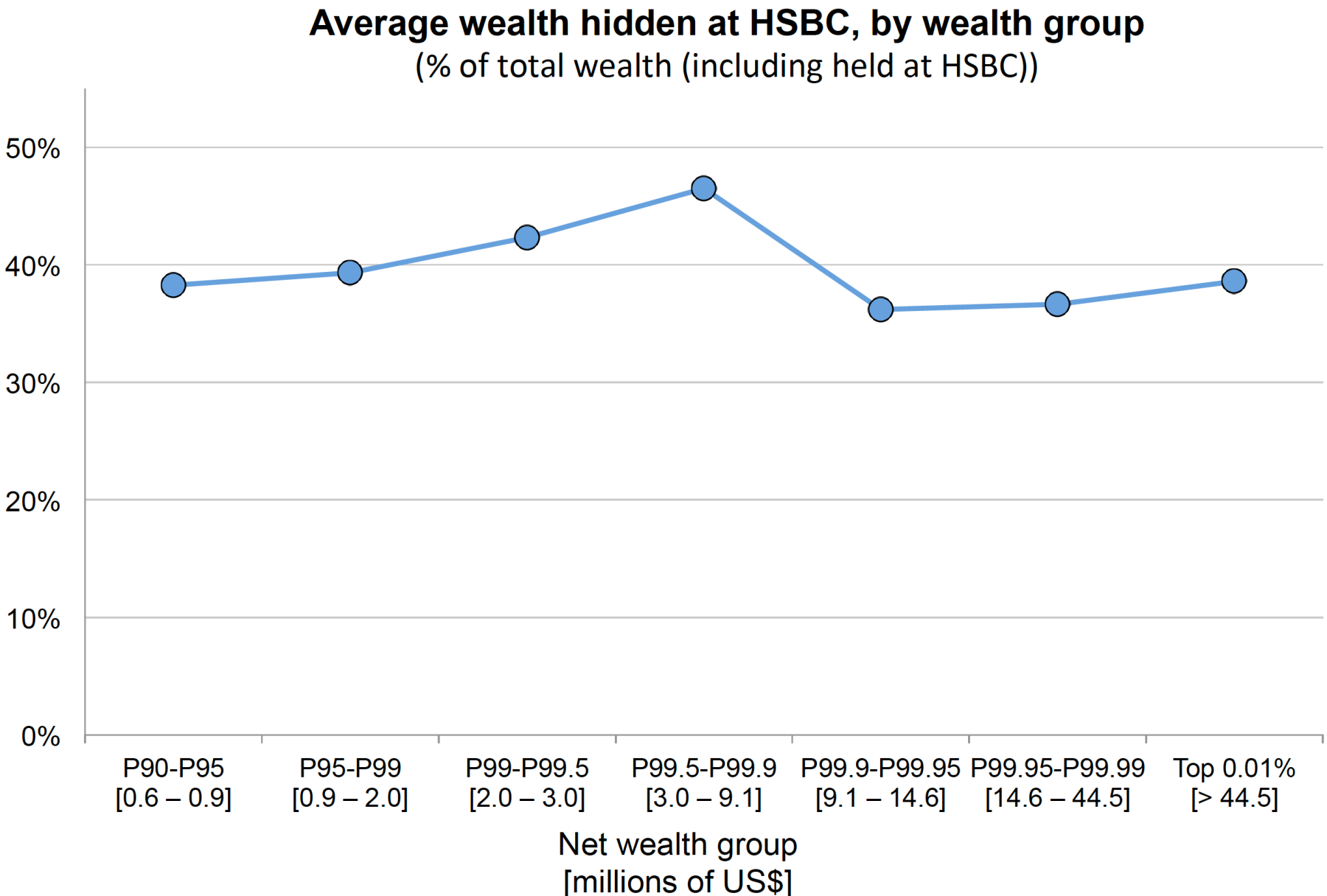
- Construct full distribution of wealth
- Distribute aggregate wealth in national accounts amongst households

1. 3rd-party reports from banks, insurers etc of end-of-year market value of clients' wealth
2. land/real-estate assets valued using transaction prices
3. Impute non-coporate business assets and unlisted equities by capitalizing business/dividend inocome on tax returns

Alstadsæter et al. (2017): Leaks Results

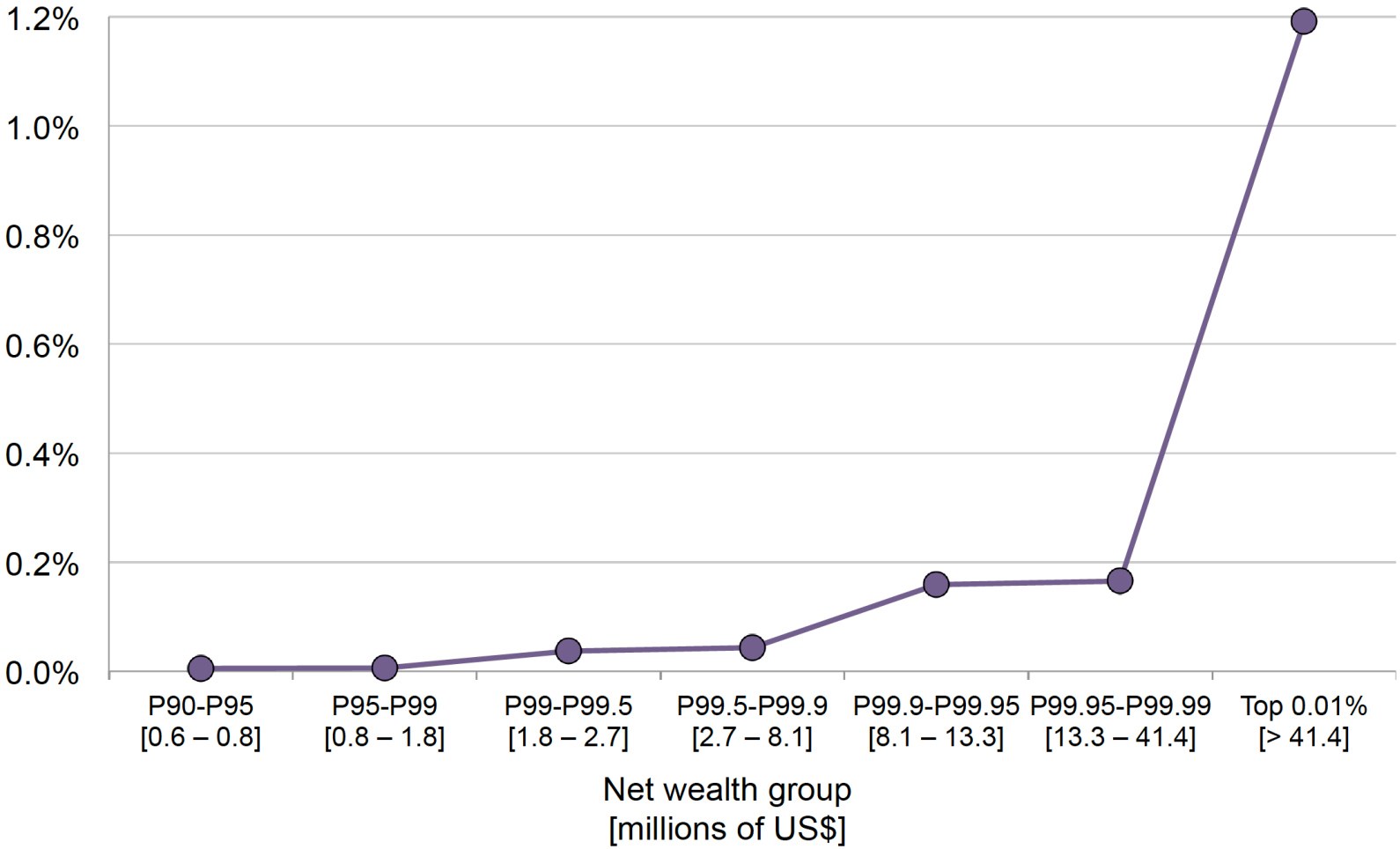


Alstadsæter et al. (2017): Leaks Results



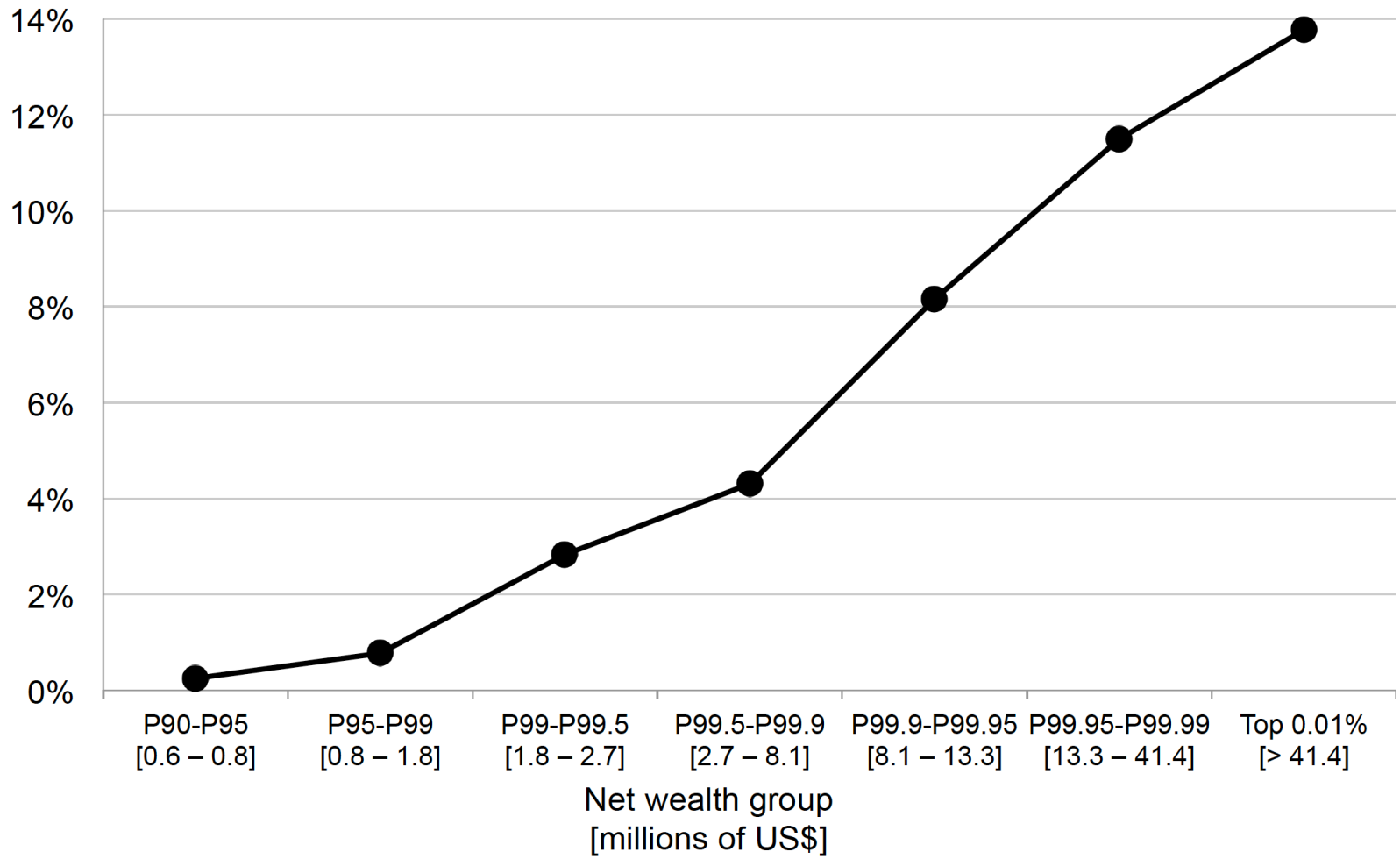
Alstadsæter et al. (2017): Leaks Results

Figure 4: Probability to appear in the Panama Papers, by wealth group



Alstadsæter et al. (2017): Amnesty Results

Figure 5: Probability to use a tax amnesty, by wealth group

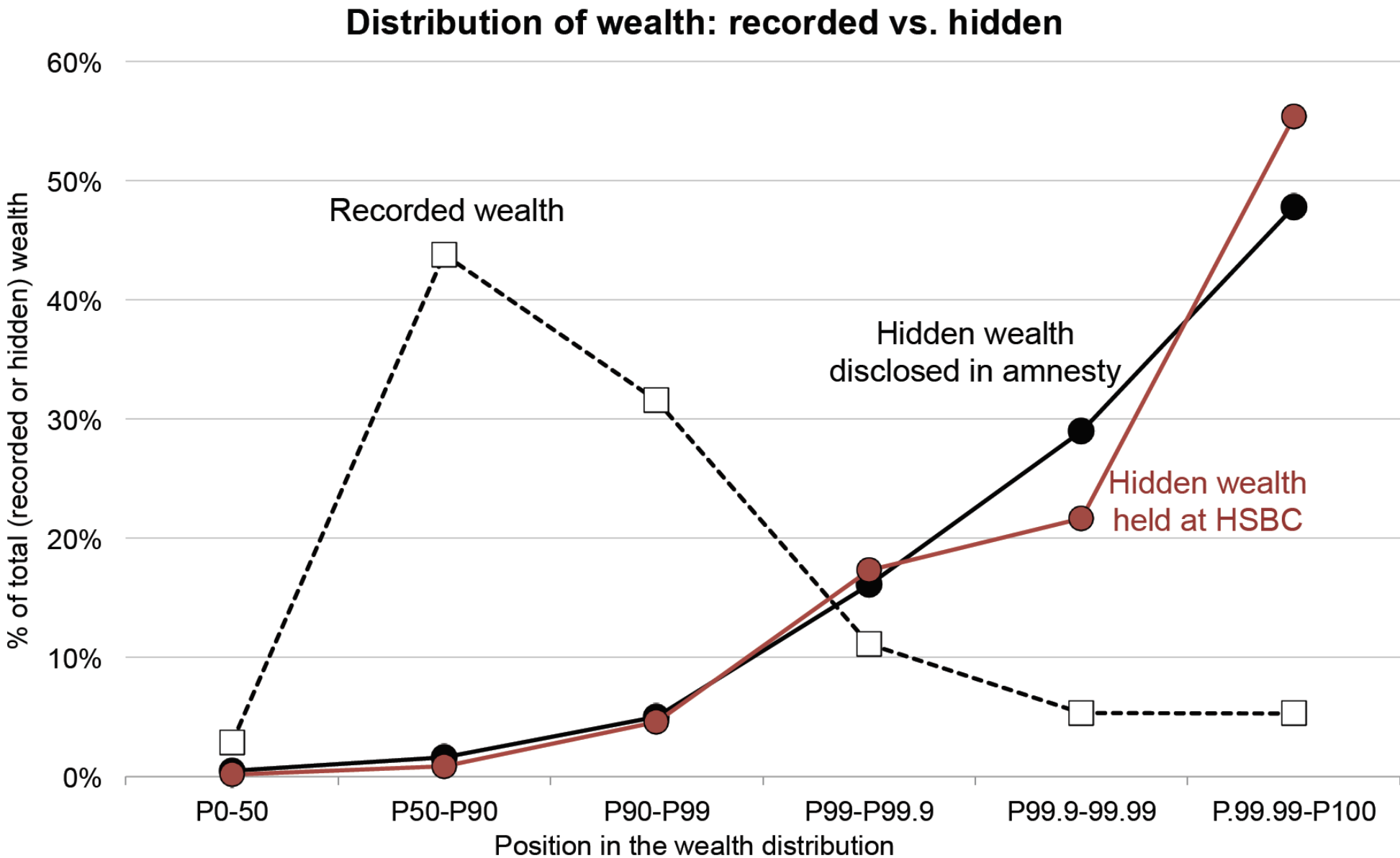


Alstadsæter et al. (2017): Tax Evasion

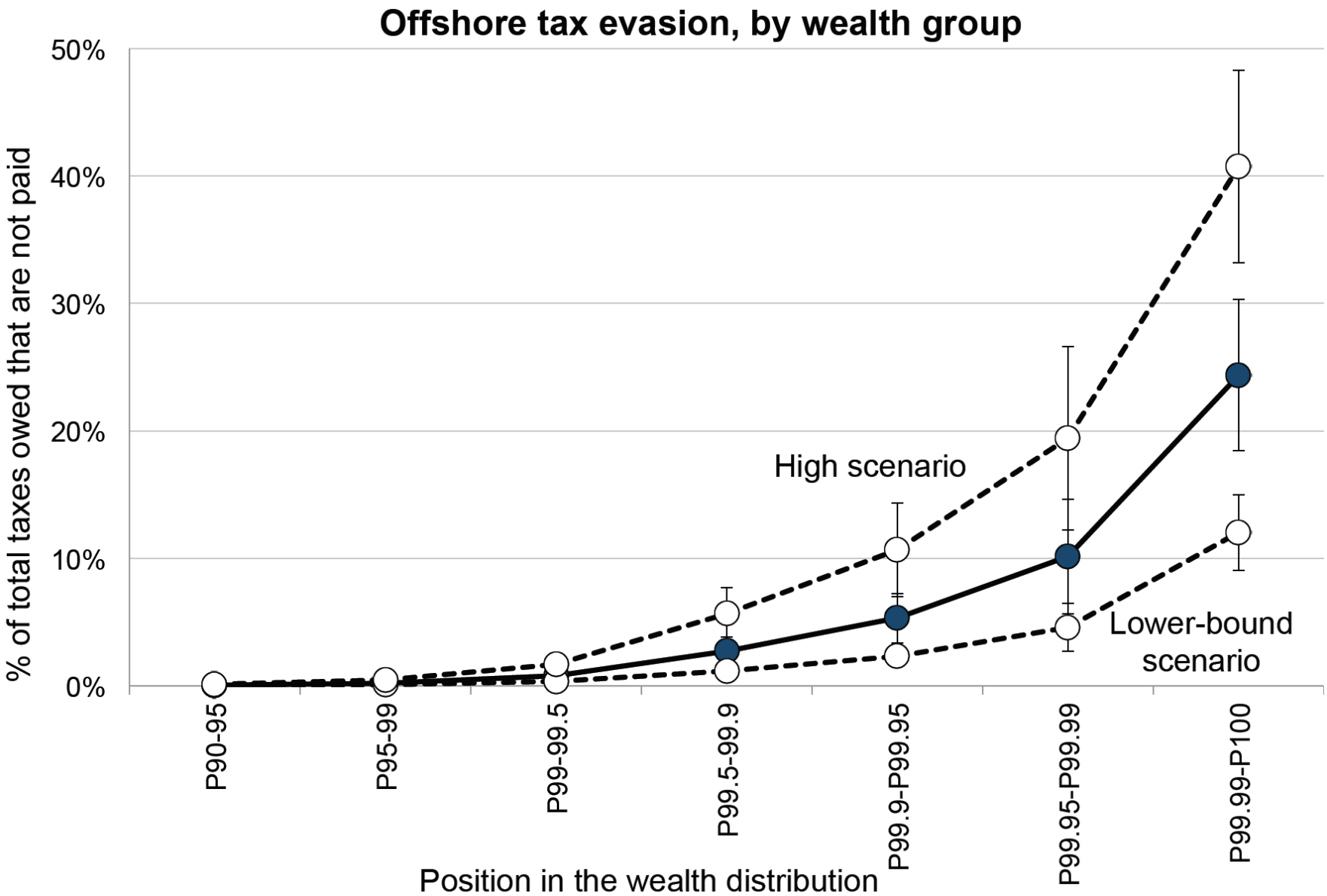
- Can we use this to try and estimate how much tax is missing from each group?
- Their approach:

1. Estimate total amount of offshore wealth
   - Zucman (2013) estimates $5.6 trn of offshore wealth in the world. Use Swiss bilateral bank deposit data to allocate to Scandinavian countries. $\rightarrow$1.6% of Scandinavian wealth is in tax havens.
2. Estimate distribution of offshore wealth across wealth groups
   - Use distributions in leak/amnesty data.
3. Estimate how much offshore wealth is hidden vs declared
   - To match aggregates and HSBC investigations assume 10% is reported
4. Compute amount of taxes due on hidden wealth
   - Assume 4.5% taxable rate of return plus tax simulator to estimate tax due.

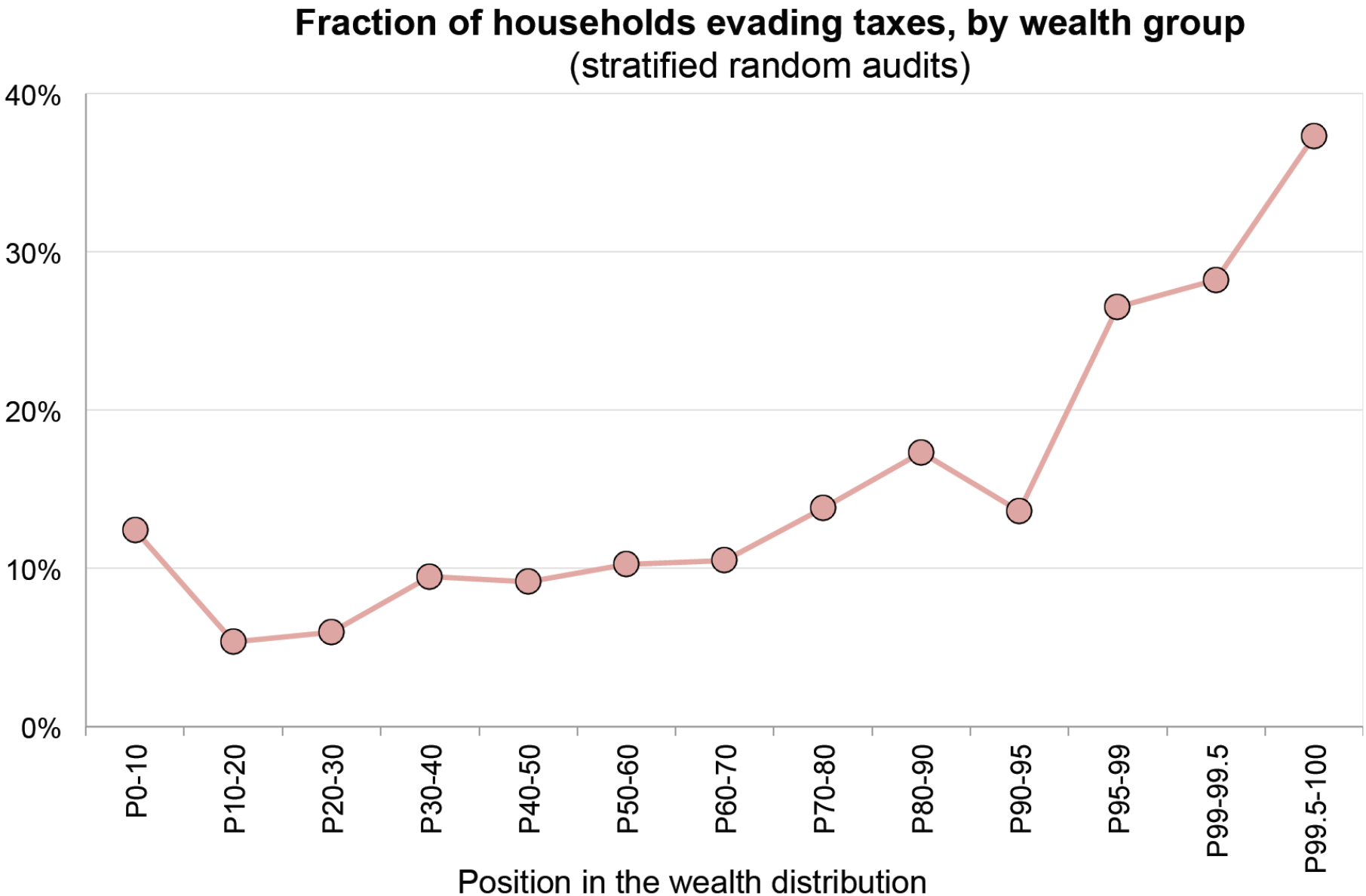
Alstadsæter et al. (2017): Wealth Distribution



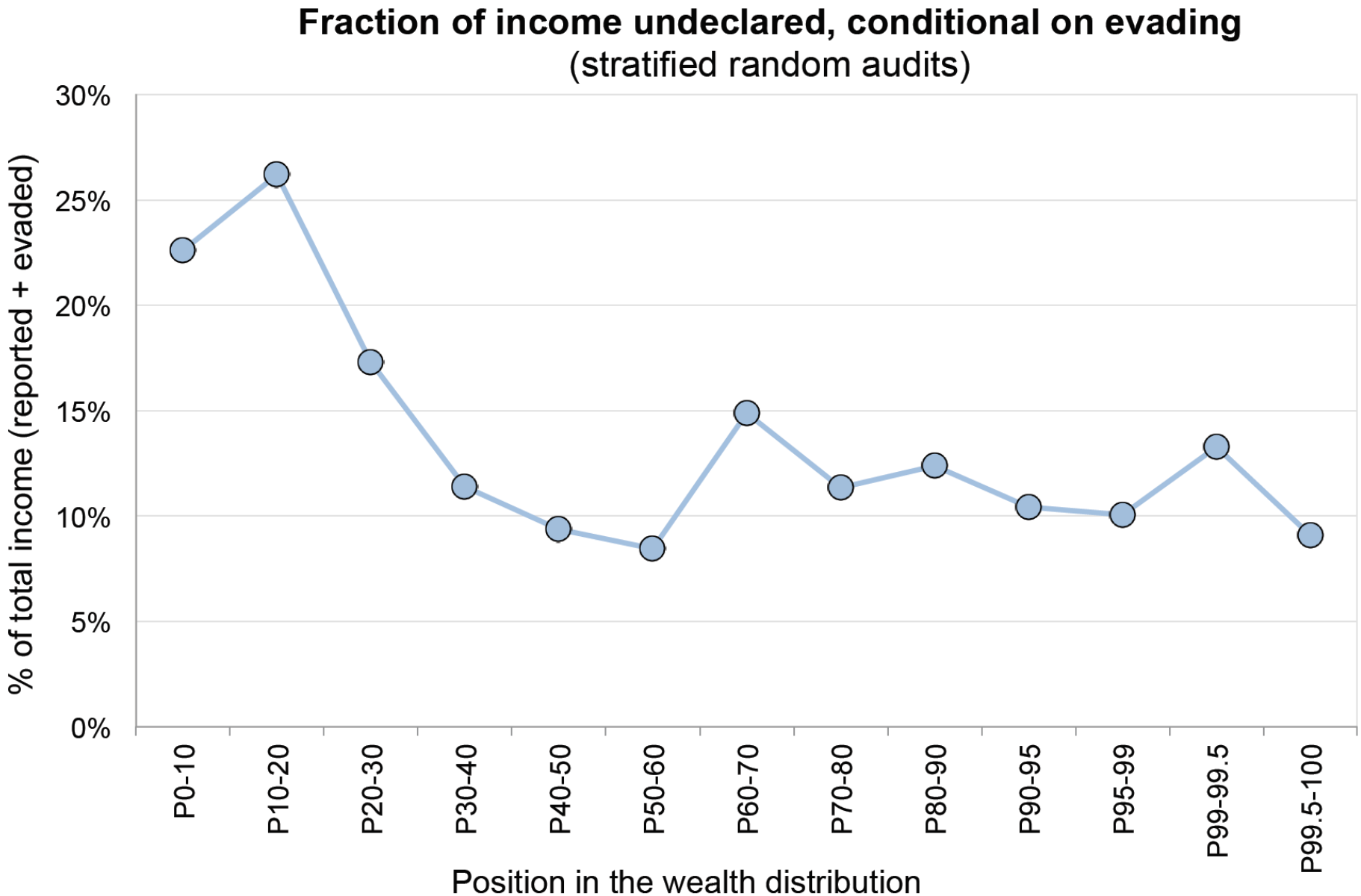
Alstadsæter et al. (2017): Tax Evaded



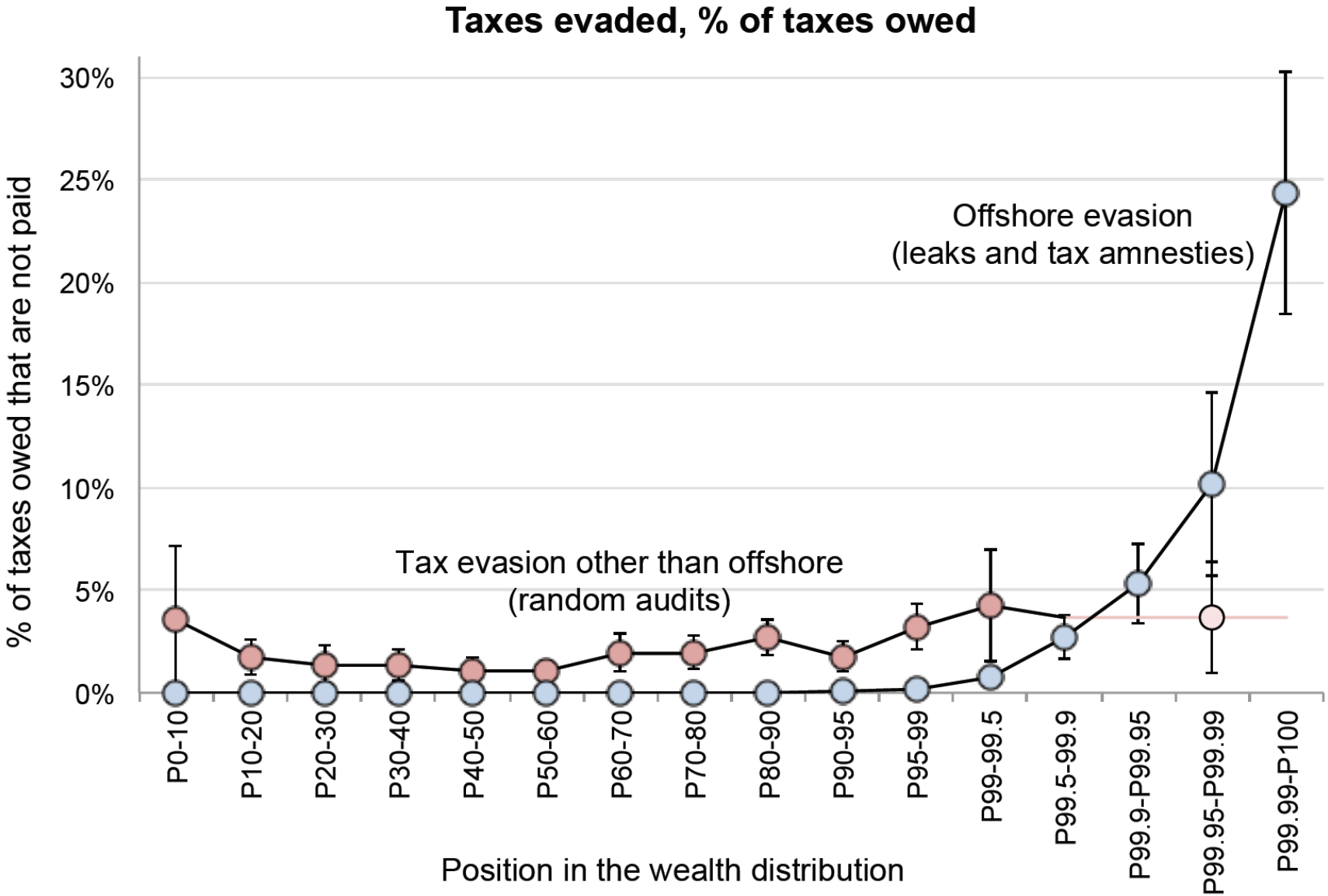
Alstadsæter et al. (2017): Random Audits Comparison



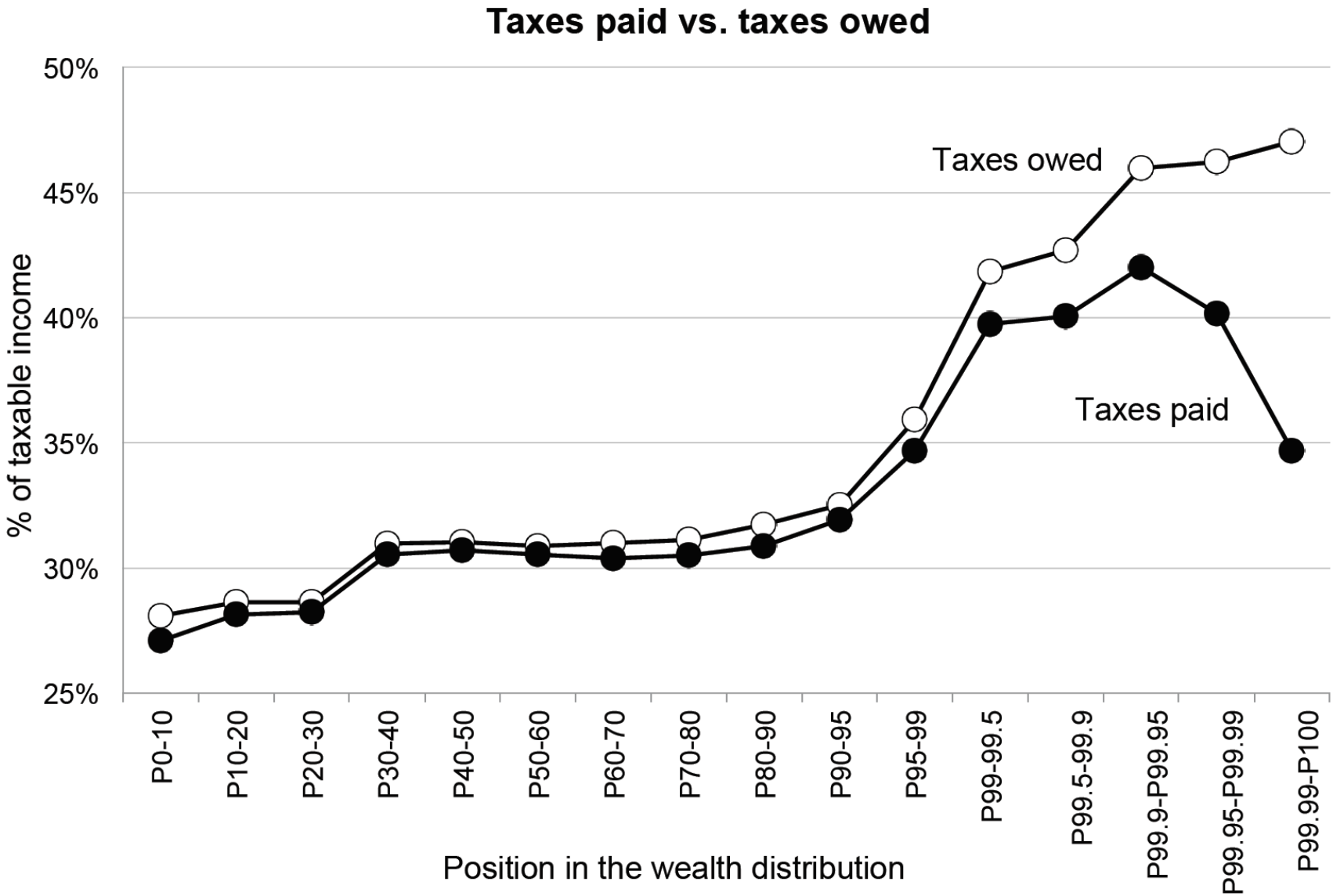
Alstadsæter et al. (2017): Random Audits Comparison



Alstadsæter et al. (2017): Total Tax Evasion



Alstadsæter et al. (2017): Effective Tax Rates



Alstadsæter et al. (2017): Model

- Allingham-Sandmo model would predict less evasion by wealthy, they have higher probability of detection
- Extend the model to have a bank providing evasion services.
- Households have wealth $y \sim f(y)$ and wtp θ per dollar of hidden wealth.
- Bank serves s clients. Detected w/pr λs and pays fine of ϕ per dollar of assets it manages. Charges price $p(y)$

$$\pi = \int yp(y)\, s(y)\, f(y)\, dy - \lambda s \phi \int ys(y)\, f(y)\, dy$$

- Monopolist $\rightarrow$ optimal price $p^*(y) = \theta$ (why?)

Alstadsæter et al. (2017): Model

- Now profits are

$$\pi = \theta k(s) - \lambda s \phi k(s)$$

where $k(s)$ is wealth of s wealthiest households

- So profit-maximizing s^* satisfies

$$\theta = \left(1 + \frac{1}{\epsilon_k(s^*)}\right) \phi \lambda s^*$$

where $\epsilon_k(s) = sk'(s)/k(s)$

- *Proposition 1: the wealthiest s^* households evade at price θ. All others do not evade.*

Alstadsæter et al. (2017): Model

- Assume further that $f(y)$ is pareto with parameter $a > 1$ $\left(F(y) = 1 - \left(\underline{y}/y\right)^a\right)$ then we can state

- *Proposition 2: The share s^* of households who evade taxes (i) falls with the probability of detection λ (ii) falls with the penalty rate ϕ, and (iii) falls as wealth becomes more unequally distributed (i.e. as the Pareto coefficient falls)*

- NB that even though the number of evaders drops when inequality rises, the fraction of total wealth that is hidden increases.

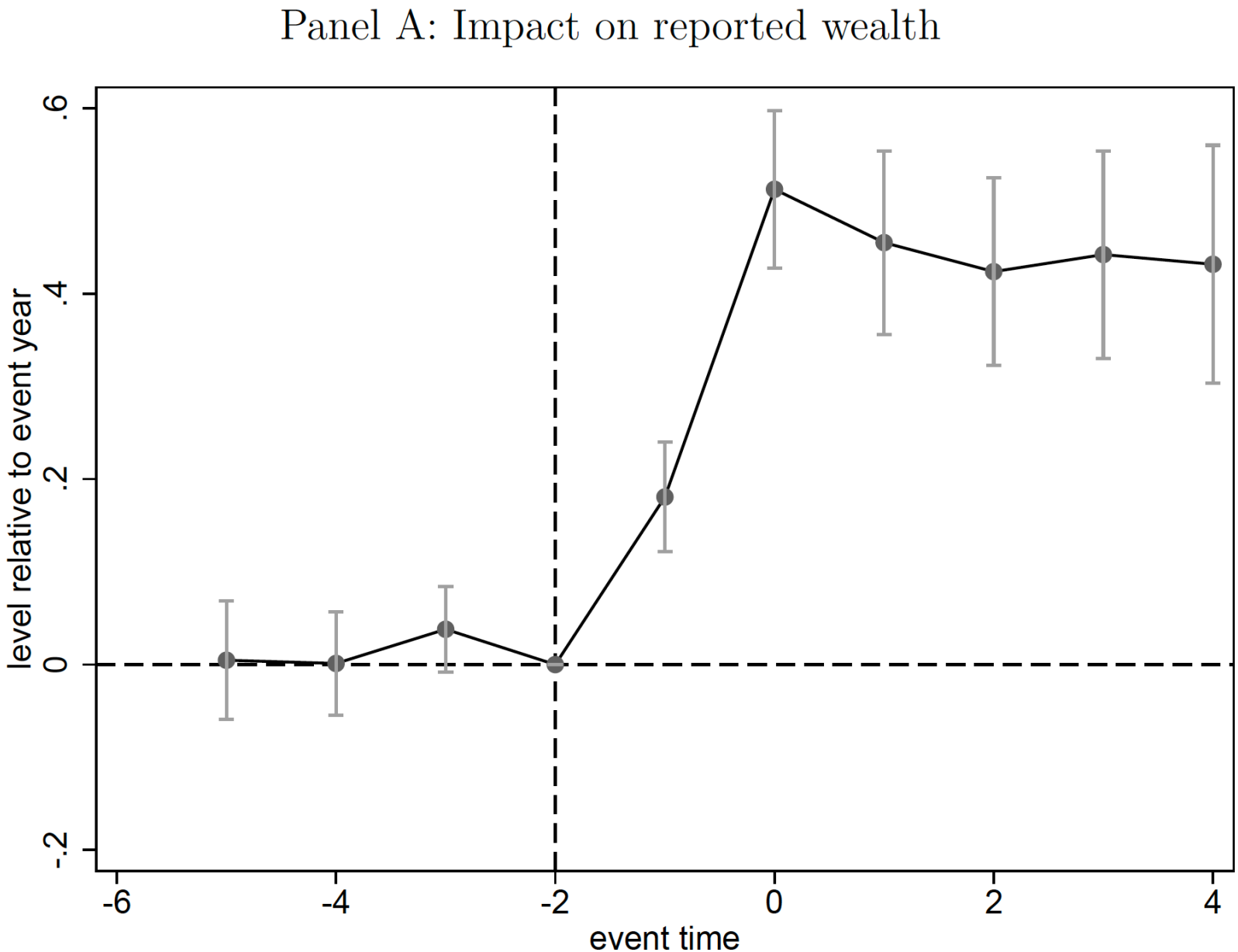
Alstadsæter et al. (2017): Substitution to Avoidance?

- Event study approach.
- Sample:
  - All Amnesty users
  - All non-disclosers in top 10% and random 10% of the other 90%
- Estimate

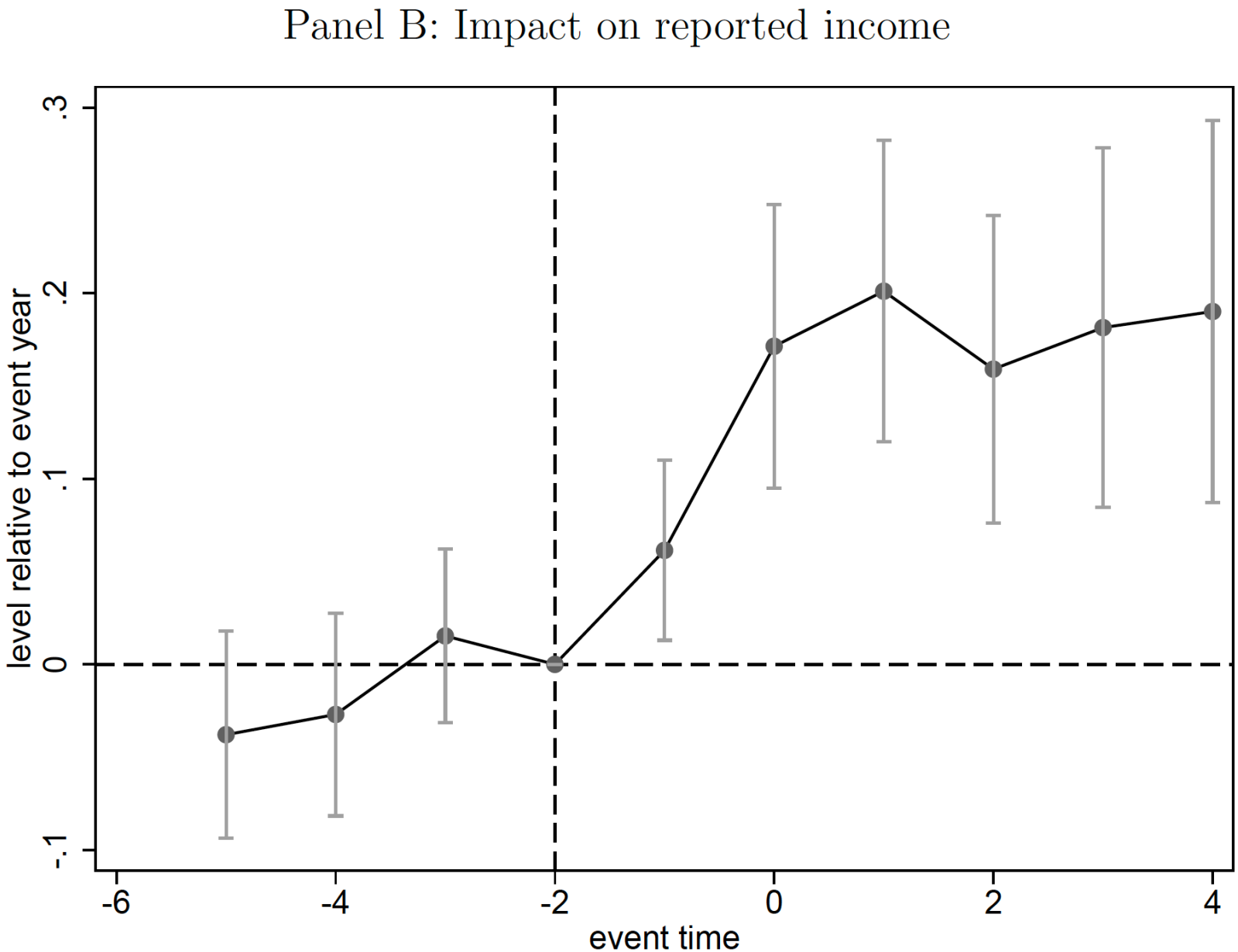
$$\log(Y_{it}) = \alpha_i + \gamma_t + X'_{it}\psi + \sum \beta_k D^k_{it} + u_{it}$$

  where α_i, γ_t are indiv/yr FEs, X_{it} contains wealth, income, age groups and D^k_{it} are event-time (year - year used amnesty) dummies
- Omitted year is $t-2$ since assets disclosed can be incorporateed into $t-1$ return.

Alstadsæter et al. (2017): Event Study-Wealth

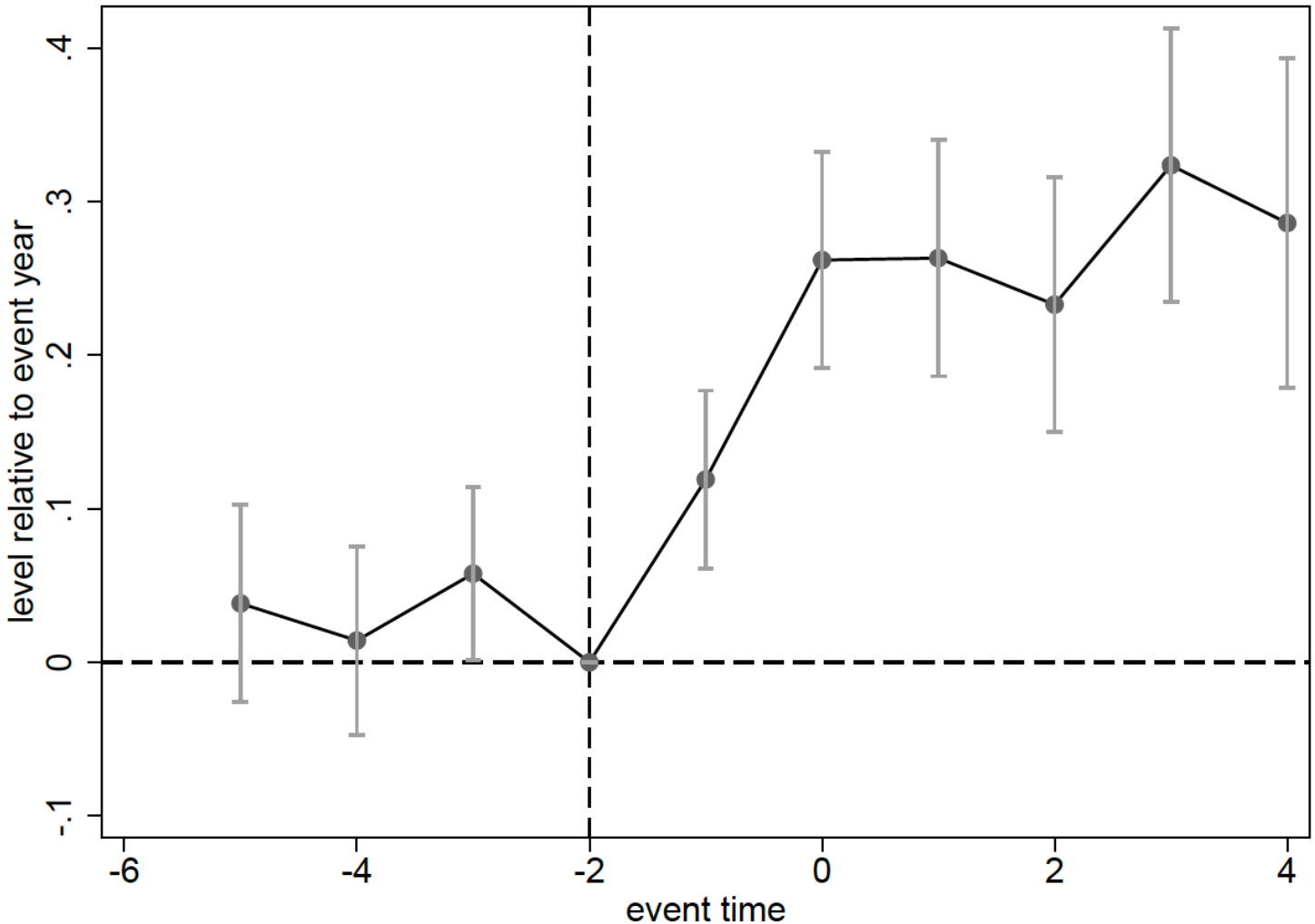


Alstadsæter et al. (2017): Event Study-Income

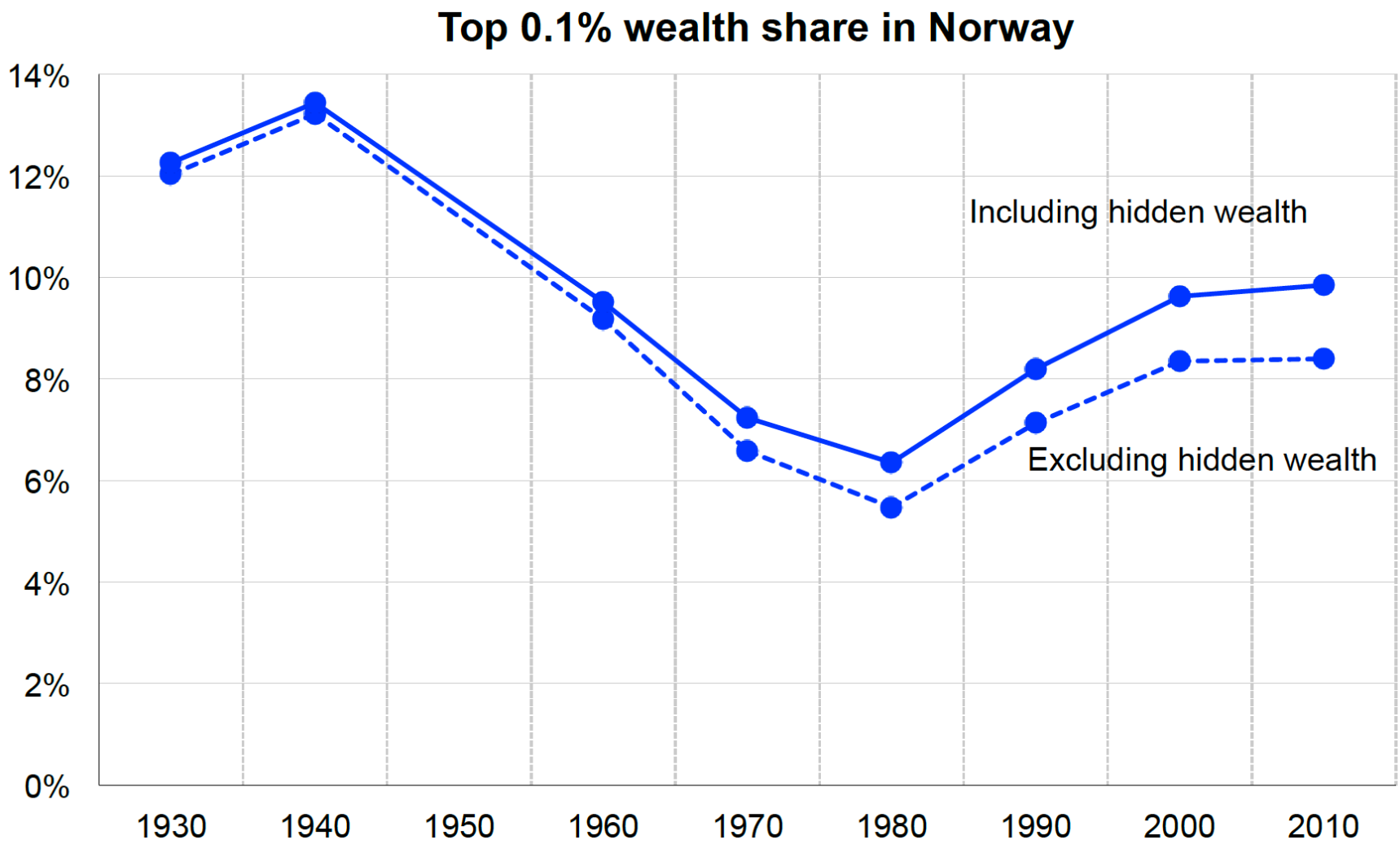


Alstadsæter et al. (2017): Event Study-Taxes

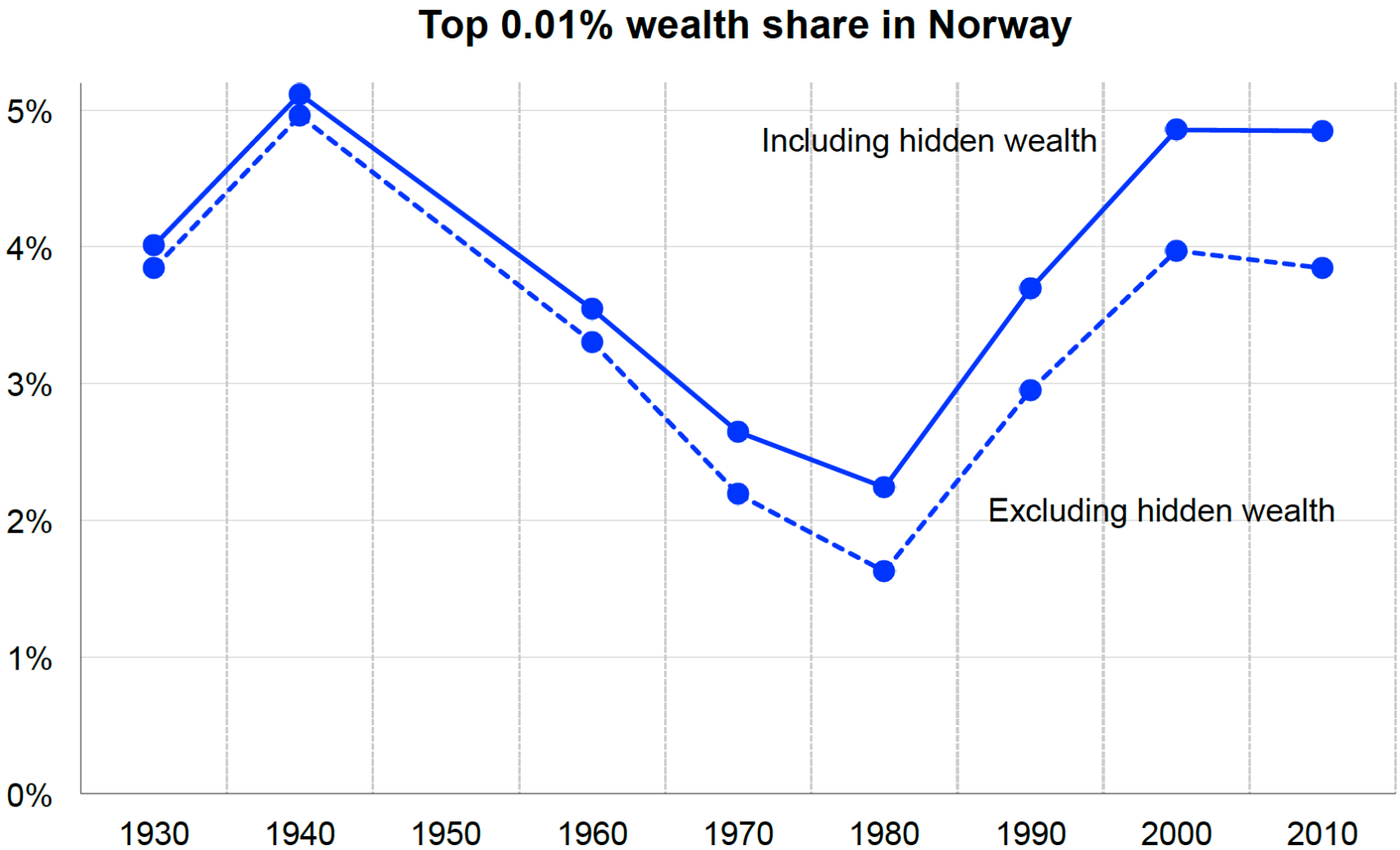
Figure 10: The impact of using a tax amnesty on taxes paid



Alstadsæter et al. (2017): Implication for Measured Wealth Inequality



Alstadsæter et al. (2017): Implication for Measured Wealth Inequality



Outline

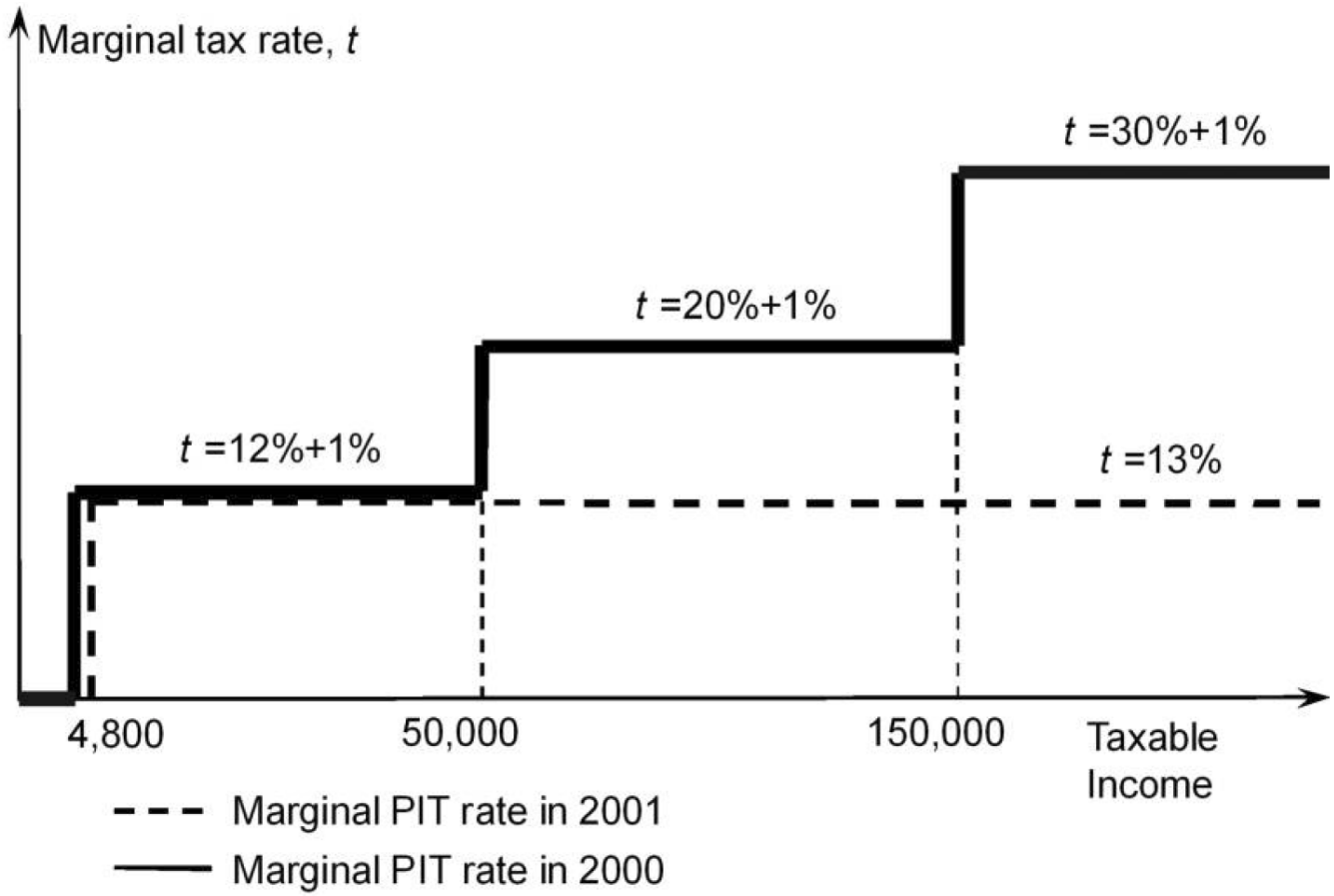
Outline

Taxing Individuals in Developing Countries

- Gorodnichenko, Martinez-Vazquez & Peters (JPE 2009) *Myth and Reality of Flat Tax Reform*
- Jensen (WP 2016) *Employment Structure and the Rise of the Modern Tax System*

Gorodnichenko et al. (2009): Overview

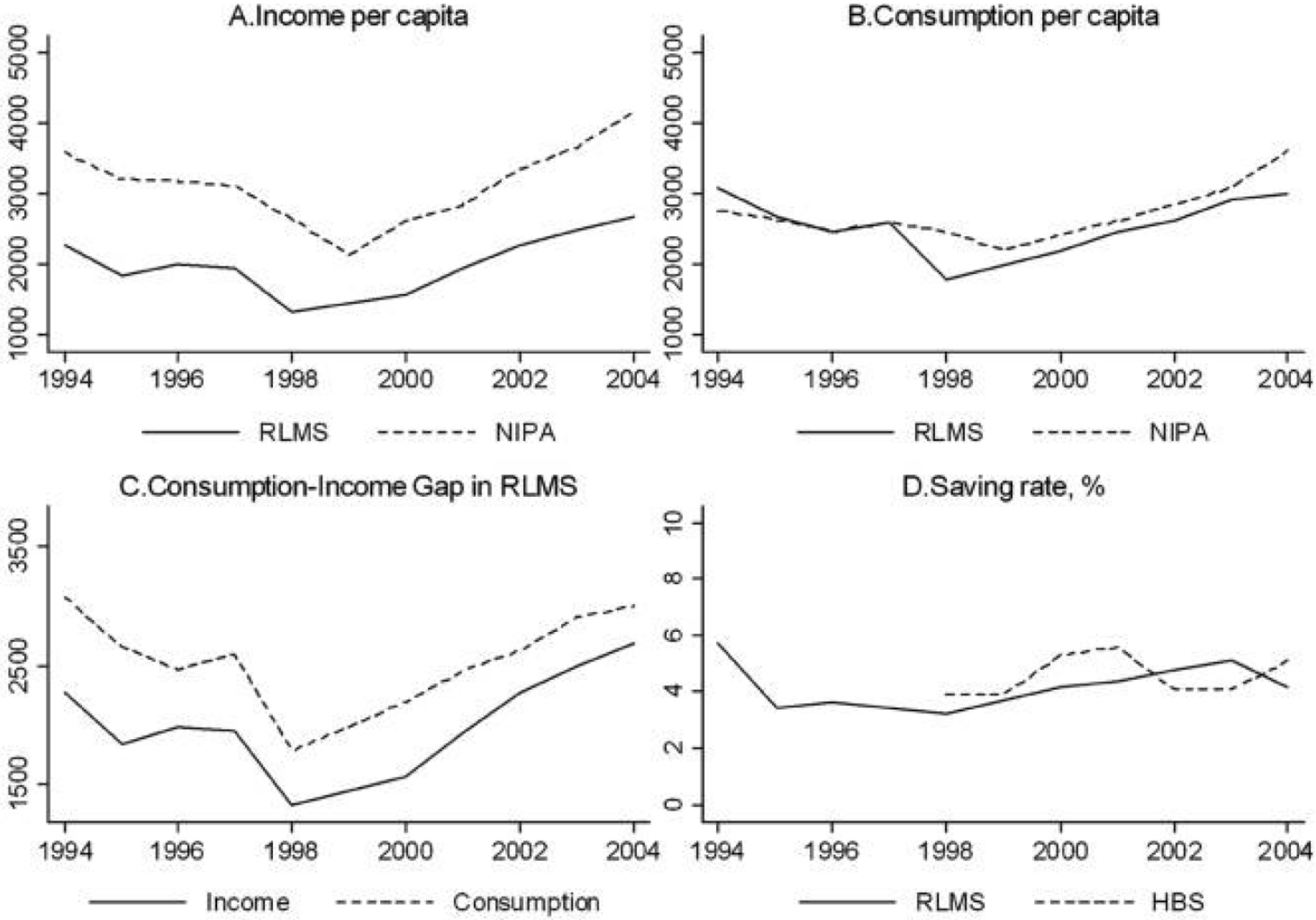
- In 2001 Russia replaces progressive income tax with a flat one
- Use household survey data and D-i-D approach to estimate evasion response
- Measure of evasion: Gap between income and consumption



Gorodnichenko et al. (2009): Data

- Use 1998 and 2000-2004 waves of Russian Longitudinal Monitoring Survey (RLMS)
- Detailed consumption data on last 30 days' consumption
  - 50+ food items
  - alcohol & tobacco
  - clothes, fuel
  - entertainment, education...
- Combine these into "nondurable expenditures" C1
- Add in transfers to other households (alimony etc.) $\rightarrow$ C2
- All hh members' income in money, goods, in kind $\rightarrow$ Y1
- Add in lump-sum payments in last 30 days $\rightarrow$ Y2
- Add in income from selling agricultural output $\rightarrow$Y3

Gorodnichenko et al. (2009): Aggregate Comparison



Gorodnichenko et al. (2009): Conceptual Framework

- Let household h's true income at time t be Y_{ht}^*
- However, reported income is only $Y_{ht}^R = \Gamma_{ht} Y_{ht}^*$
- Model misreporting as $\Gamma\left(S_{ht}\right) = \exp\left(-\gamma S_{ht} + \text{error}\right)$ where S_{ht} includes job, worker characteristics, government policies
- Model true income as $Y_{ht}^* = H_{ht} Y_{ht}^P$ where Y_{ht}^P is permanent income
- $H_{ht} = H\left(X_{1,ht}\right) = \exp\left(\eta X_{1,ht} + \text{error}\right)$ where $X_{1,ht}$ captures life-cycle factors like age, schooling employment, #children etc.

Gorodnichenko et al. (2009): Conceptual Framework

- Model expenditure on non-durables as $C_{ht} = \Theta_{ht} Y_{ht}^P$
- Where $\Theta_{ht} = \Theta\left(X_{2,ht}\right) = \exp\left(\theta X_{2,ht} + \text{error}\right)$ where $X_{2,ht}$ contains # of hh members, # of children, age, schooling etc.
- Together these assumptions imlpy

$$\ln Y_{ht}^R - \ln Y_{ht}^* = -\gamma S_{ht} + \text{error}$$
$$\ln Y_{ht}^* - \ln Y_{ht}^P = \eta X_{1,ht} + \text{error}$$
$$\ln C_{ht} - \ln Y_{ht}^P = \theta X_{2,ht} + \text{error}$$

- Don't observe Y_{ht}^* or Y_{ht}^P, but combining assumptions

$$\ln C_{ht} - \ln Y_{ht}^R = \gamma S_{ht} + \beta X_{ht} + u_h + \varepsilon_{ht}$$

where X_{ht} combines $X_{1,ht}$ and $X_{2,ht}$

TAX EVASION FUNCTION, FIXED EFFECTS

	ln C1 − ln Y1	ln C2 − ln Y1	ln C1 − ln Y2	ln C2 − ln Y2
	Panel A			
Number of household members	−.010	−.033**	.018	−.005
	(.013)	(.013)	(.013)	(.013)
Number of senior household members, 60+	−.210***	−.200***	−.180***	−.169***
	(.022)	(.022)	(.022)	(.022)
Number of children in household (<18)	.088***	.076***	.034	.023
	(.022)	(.022)	(.021)	(.021)
Year = 1998	−.026	−.025	−.026	−.025
	(.020)	(.020)	(.020)	(.020)
Year = 2001	−.142***	−.139***	−.140***	−.137***
	(.017)	(.017)	(.018)	(.018)
Year = 2002	−.221***	−.213***	−.216***	−.208***
	(.018)	(.018)	(.018)	(.018)
Year = 2003	−.208***	−.203***	−.217***	−.213***
	(.018)	(.018)	(.018)	(.018)
Year = 2004	−.268***	−.262***	−.265***	−.260***
	(.018)	(.018)	(.018)	(.018)

Household head characteristics:				
Age	−.004***	−.004***	−.002**	−.001*
	(.001)	(.001)	(.001)	(.001)
Years of schooling	−.006	−.004	−.007*	−.005
	(.004)	(.004)	(.004)	(.004)
Married	−.093***	−.087***	−.060**	−.053**
	(.024)	(.024)	(.023)	(.023)
Currently works	−.298***	−.278***	−.151***	−.130**
	(.055)	(.054)	(.052)	(.052)
Years of tenure	.003**	.003***	.002*	.002**
	(.001)	(.001)	(.001)	(.001)
Works at enterprise	−.076*	−.083*	−.081*	−.089**
	(.046)	(.045)	(.044)	(.044)
Works in private sector	−.105***	−.105***	−.085***	−.084***
	(.021)	(.021)	(.021)	(.021)
Log (firm size)	−.020***	−.019***	−.016***	−.015***
	(.006)	(.006)	(.006)	(.006)
Observations (households)	24,129	24,129	24,723	24,723
	(6,135)	(6,135)	(6,202)	(6,202)
R^2 overall	.05	.04	.03	.03
	Panel B			
After-reform trend (2001 = 1)	−.067***	−.066***	−.066***	−.065***
	(.005)	(.005)	(.005)	(.005)

Gorodnichenko et al. (2009): Evasion and Perceptions

TABLE 3
CONSUMPTION-INCOME GAP AND ATTITUDES TOWARD TAXES, 1998 AND 2002

	ln C1− ln Y1	ln C2− ln Y1	ln C1− ln Y2	ln C2− ln Y2
Evasion perception index (at the district level; 38 PSUs)	.244**	.246**	.368***	.370***
	(.119)	(.119)	(.118)	(.118)
Year = 2002	−.173***	−.162***	−.170***	−.160***
	(.020)	(.020)	(.020)	(.020)
Observations	7,539	7,539	7,806	7,806
R^2	.09	.07	.05	.04

Gorodnichenko et al. (2009): Diff in Diff

- To estimate impact of 2001 reform. Diff in Diff strategy

$$\ln C_{ht} - \ln Y_{ht}^{R} = \gamma S_{ht} + \beta X_{ht} + \mu d_{ht}^{\text{treat}} + \alpha \left(d_{ht}^{\text{treat}} \times D_p \right) + \psi D_p + u_h + \varepsilon_{ht}$$

  where $d_{ht}^{\text{treat}} = I\left\{\tau_{ht} < \tau_{ht-1}\right\}$ and D_p indicates post-reform years

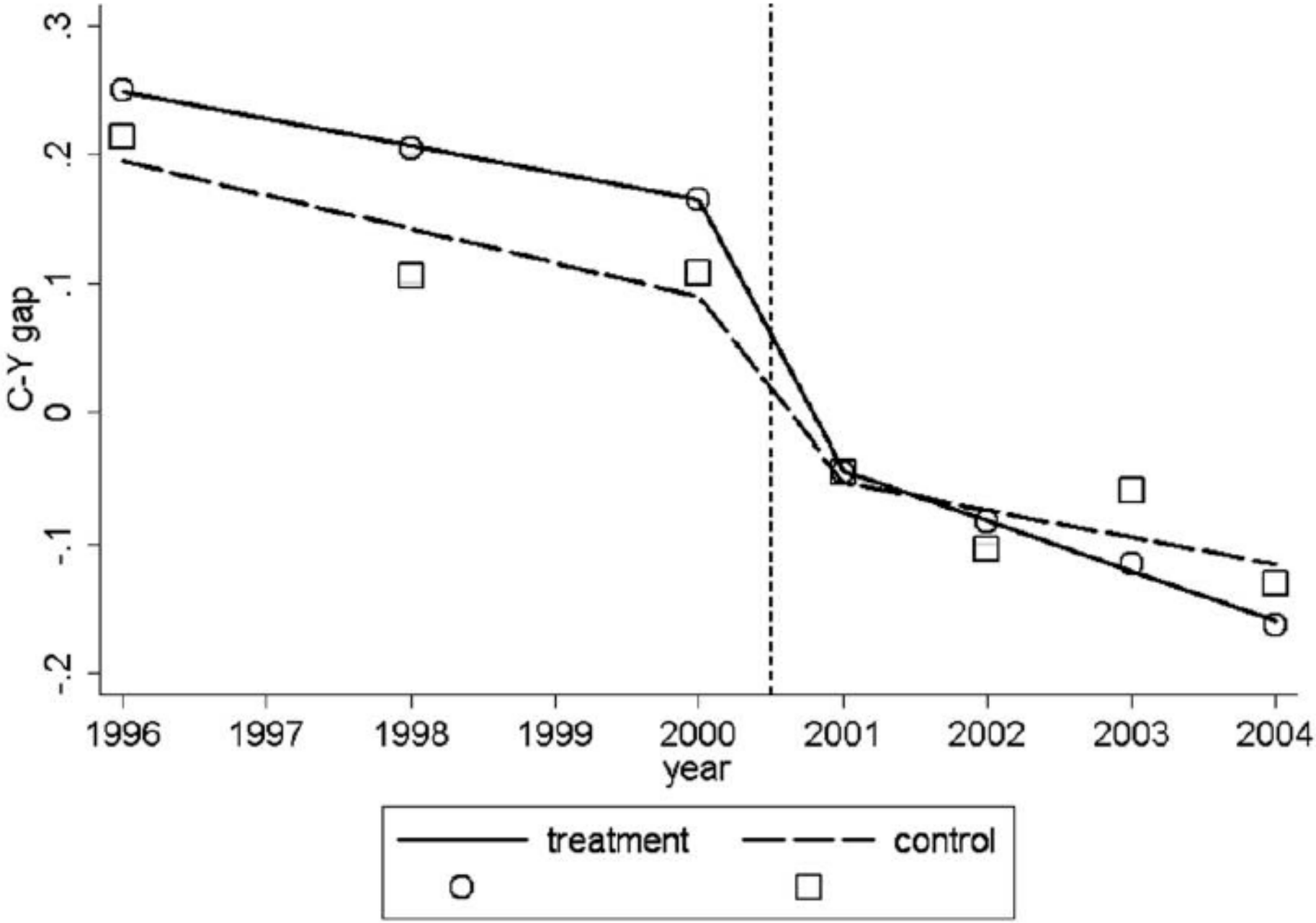
- Note, potential endogeneity of d_{ht}^{treat}. Income choices put people in range to be affected. Instead, use post-reform income. Tax is flat, so no tax reasons to locate above or below threshold
- Transitory fluctuations in Y also an issue: Instead use 4-year average of contractual earnings to assign treatment.

TAX EVASION FUNCTION: DIFFERENCE-IN-DIFFERENCE APPROACH, FIXED EFFECTS

	ln C1− ln Y1	ln C2− ln Y1	ln C1− ln Y2	ln C2− ln Y2
Number of household members	−.016	−.037***	.014	−.007
	(.014)	(.014)	(.014)	(.014)
Number of senior household members, 60+	−.181***	−.173***	−.159***	−.152***
	(.027)	(.027)	(.026)	(.026)
Number of children in household, <18	.087***	.077***	.034	.024
	(.022)	(.022)	(.022)	(.022)
Year = 1998	−.020	−.016	−.028	−.025
	(.025)	(.025)	(.025)	(.025)
Year = 2002	−.073***	−.068***	−.072***	−.066***
	(.020)	(.020)	(.020)	(.019)
Year = 2003	−.076***	−.073***	−.080***	−.077***
	(.020)	(.020)	(.019)	(.019)
Year = 2004	−.136***	−.129***	−.128***	−.120***
	(.021)	(.021)	(.020)	(.020)
Household head characteristics: Age	−.004***	−.003***	−.002**	−.001
	(.001)	(.001)	(.001)	(.001)

Years of schooling	−.007	−.006	−.010**	−.009*
	(.005)	(.005)	(.005)	(.005)
Married	−.070***	−.071***	−.031	−.030
	(.027)	(.027)	(.026)	(.026)
Currently works	−.293***	−.277***	−.158***	−.142***
	(.055)	(.055)	(.052)	(.051)
Years of tenure	.002*	.002*	.001	.002
	(.001)	(.001)	(.001)	(.001)
Works at enterprise	−.083*	−.084*	−.081*	−.083*
	(.046)	(.046)	(.043)	(.043)
Works in private sector	−.100***	−.099***	−.085***	−.083***
	(.021)	(.021)	(.021)	(.021)
Log (firm size)	−.019***	−.018***	−.014**	−.013**
	(.006)	(.006)	(.006)	(.006)
After-reform dummy (D_p)	−.103***	−.104***	−.106***	−.107***
	(.031)	(.031)	(.031)	(.031)
$d^{treat} \times D_p$	−.109***	−.108***	−.105***	−.102***
	(.033)	(.033)	(.033)	(.033)
Observations (households)	17,081	17,081	17,444	17,444
	(4,174)	(4,174)	(4,184)	(4,184)
R^2 overall	.06	.05	.04	.04

Gorodnichenko et al. (2009): Results



Gorodnichenko et al. (2009): Heterogeneity

TREATMENT EFFECT IN THE DIFFERENCE-IN-DIFFERENCE APPROACH: HETEROGENEOUS RESPONSE

Alternative Specifications	ln C1− ln Y1	ln C2− ln Y1	ln C1− ln Y2	ln C2− ln Y2
State vs. public sector:				
$d^{treat} \times D_p$ (state sector is omitted)	.001	−.017	−.014	−.030
	(.054)	(.054)	(.052)	(.052)
$d^{treat} \times D_p \times$ private	−.229***	−.192**	−.236***	−.201**
	(.080)	(.080)	(.079)	(.079)
Observations	17,287	17,287	17,684	17,684
Blue collar vs. white collar:				
$d^{treat} \times D_p \times$ private (blue-collar workers are omitted)	−.111	−.073	−.133	−.097
	(.103)	(.103)	(.099)	(.099)
$d^{treat} \times D_p \times$ private × white collar	−.302**	−.308**	−.295**	−.297**
	(.123)	(.125)	(.124)	(.124)
Observations	17,287	17,287	17,684	17,684

Gorodnichenko et al. (2009): Welfare

- Use the setup in Chetty (2009) to characterize DWL

	B. Russian Case	
Deadweight loss, $DWL_W = -0.5t\epsilon_W/[1-(e/wl)]$ (% taxable income)		
Point estimate, DWL_W^M	2.17%	1.41%
Lower bound, DWL_W^L	X	.64%
Upper bound, DWL_W^U	X	2.17%

NOTE.—See Sec. VII for details on notation and definitions.

Outline

Taxing Individuals in Developing Countries

- Gorodnichenko, Martinez-Vazquez & Peters (JPE 2009) *Myth and Reality of Flat Tax Reform*
- Jensen (WP 2016) *Employment Structure and the Rise of the Modern Tax System*

Jensen (2016): Overview

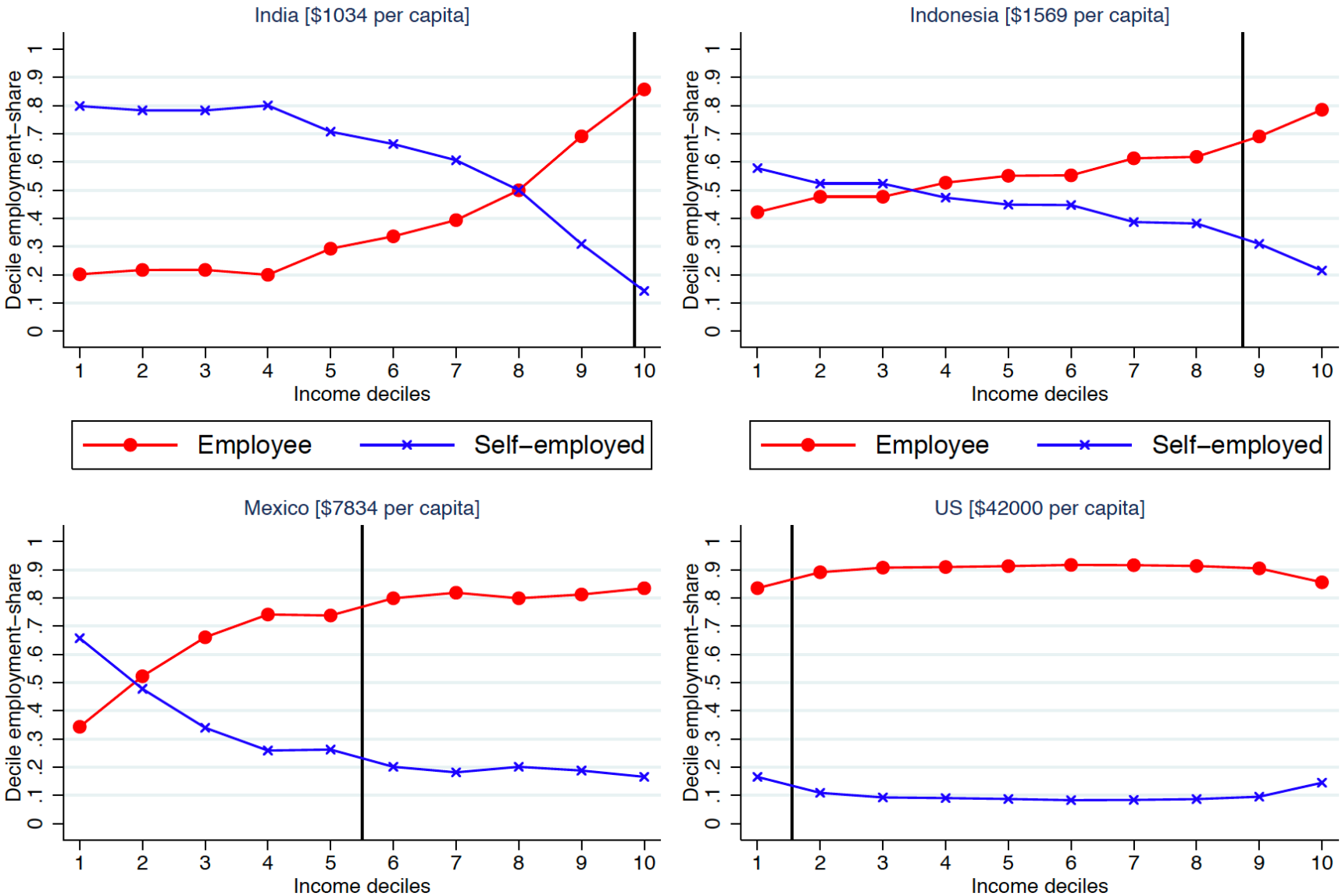
- Why do Low- and Middle- income countries rely so much less on direct (income) taxes?
- Gather household-level data on many countries over many years and show
  - the share of self-employed people falls with development
  - the gradient with income gets flatter with development
  - The income tax exemption tax threshold moves down the income distribution as this happens.
- To deal with endogeneity, look at historical US experience.
  - Instrument for employee share with exogenous timing of passage of Industrial Development Bonds that exogenously shift workers into manufacturing.
  - Shows same, striking, patterns.

Jensen (2016): Data

1. Household microdata from 90 countries around the world containing
   - information on type of work
   - earnings information (not expenditure proxies)
2. Historical data on the US
   - Census microdata 1950–2010
   - 1870 & 1935 from historians (Williamson & Lindert)
   - state income tax schedules
   - BLS serveys of employment by industry and type of work 1939–2002
   - Dates of passage and implementation of IDBs

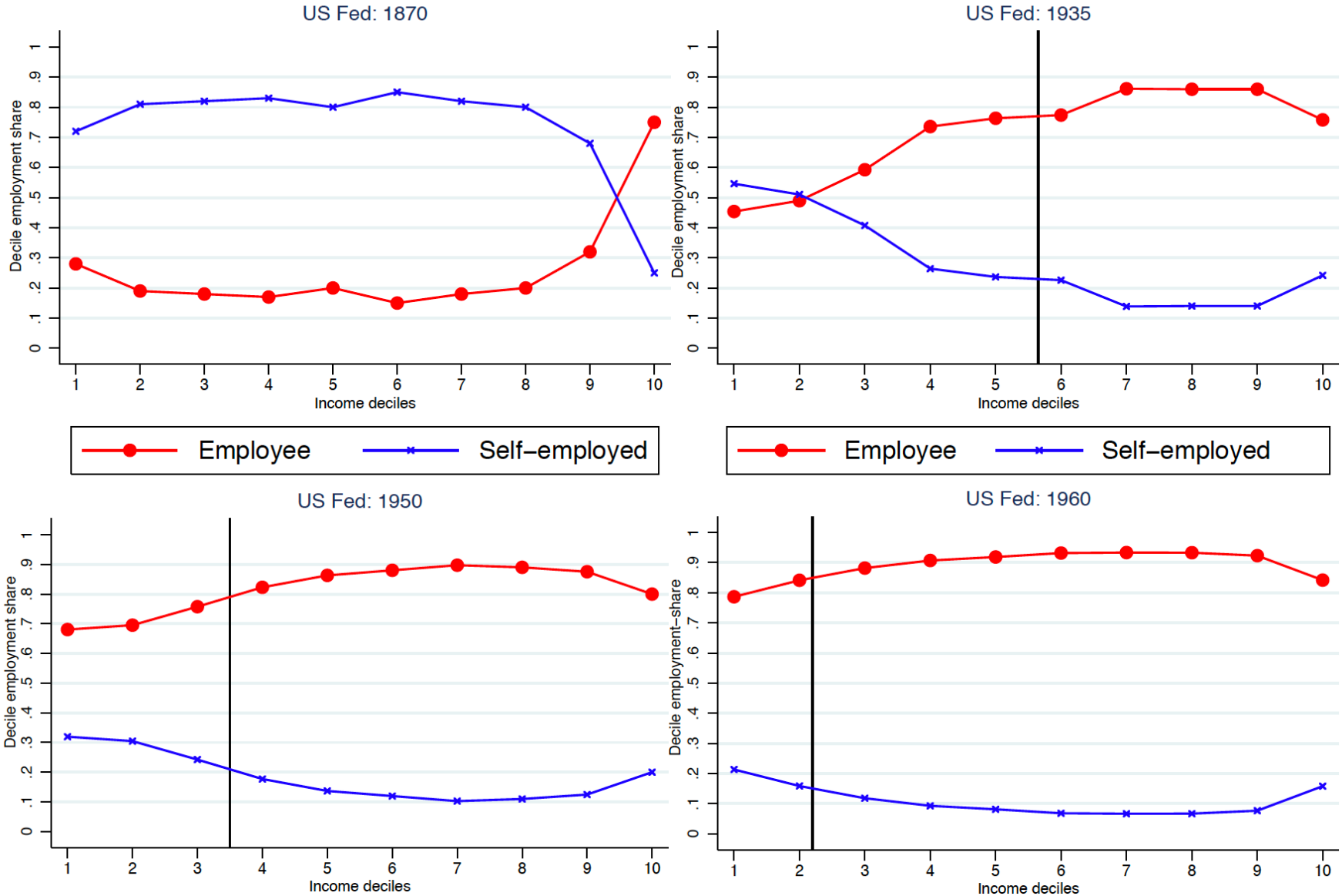
Jensen (2016): Stylized Facts

Panel A: cross country

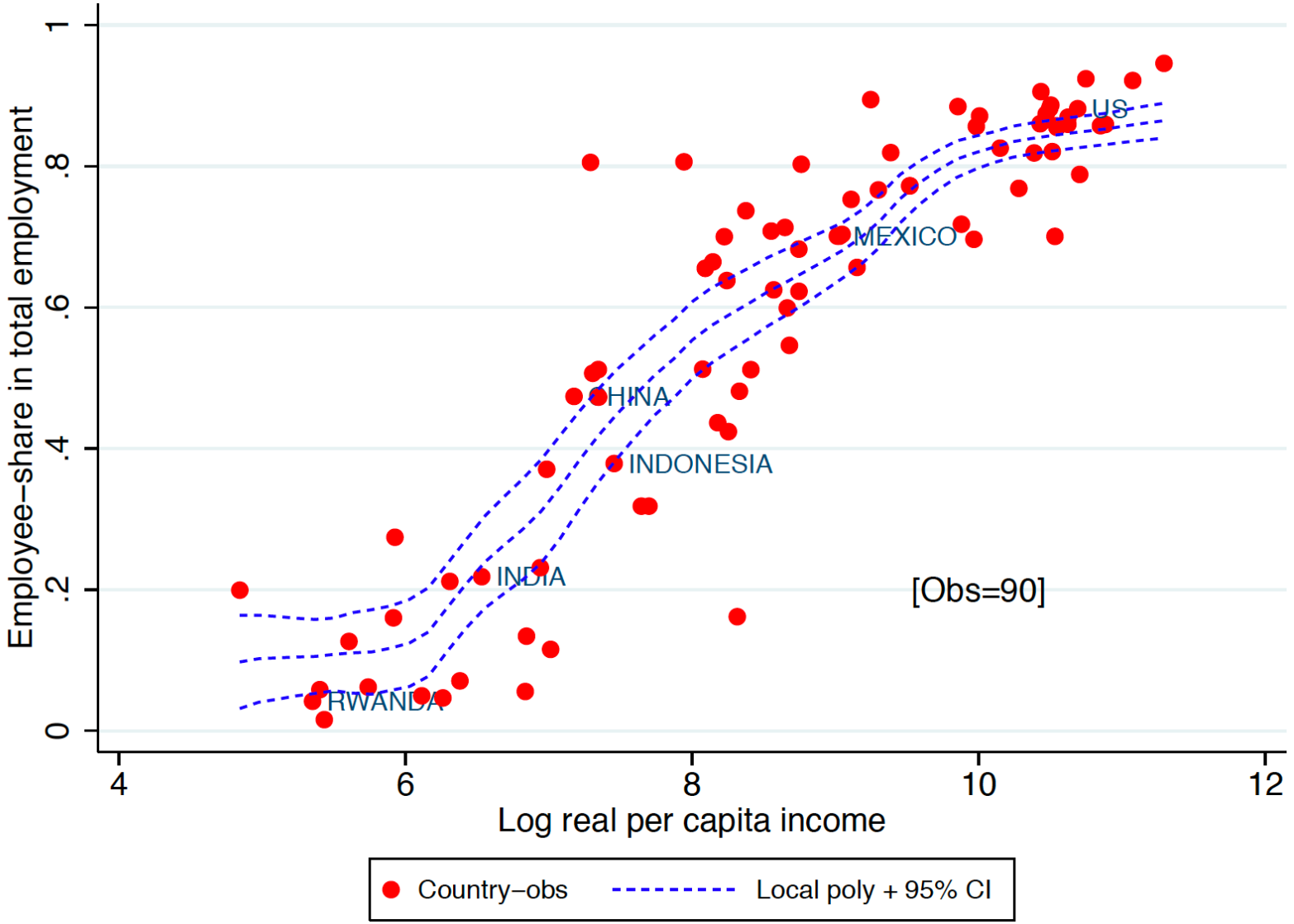


Jensen (2016): Stylized Facts

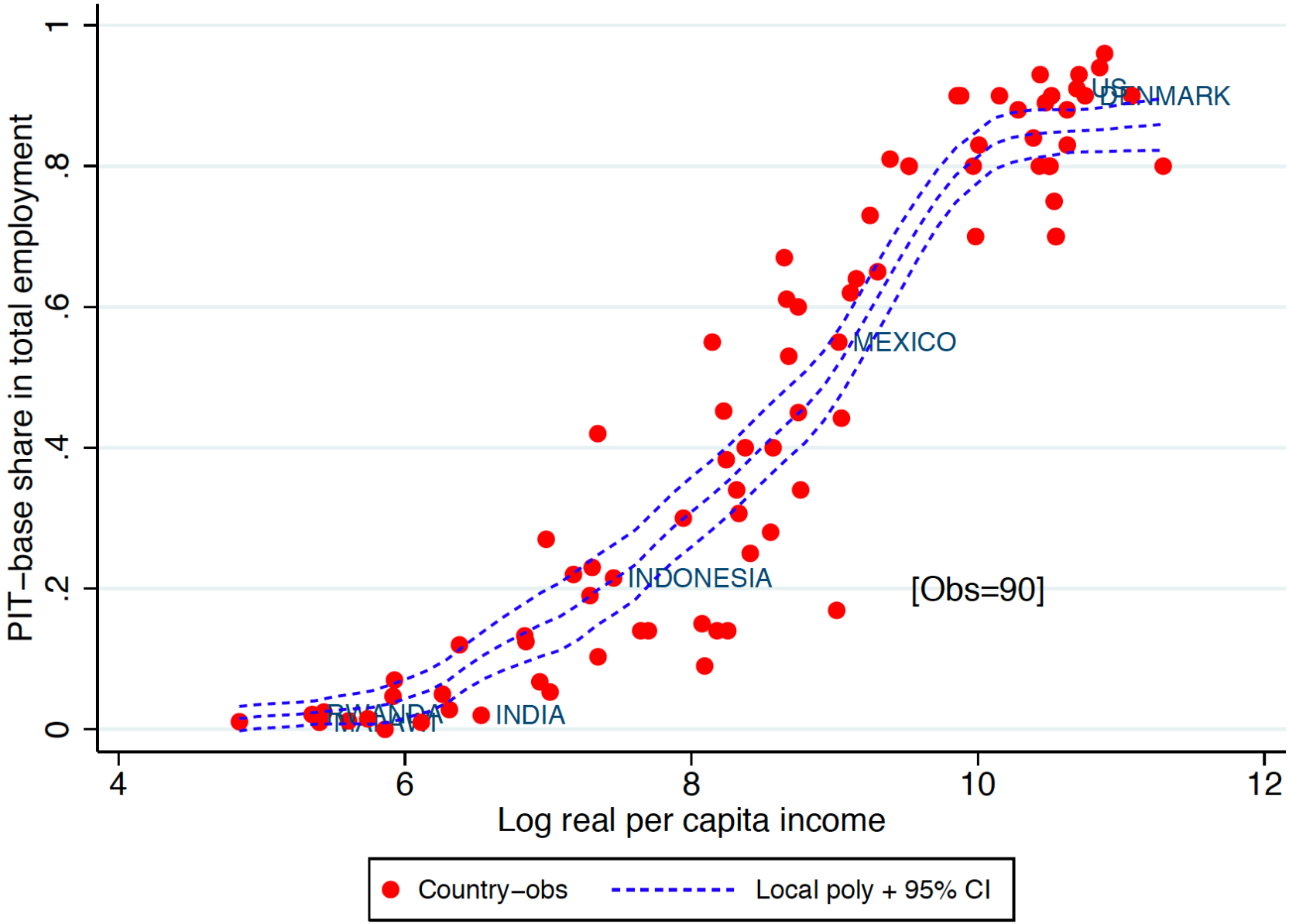
Panel B: within country over time US 1870-1960



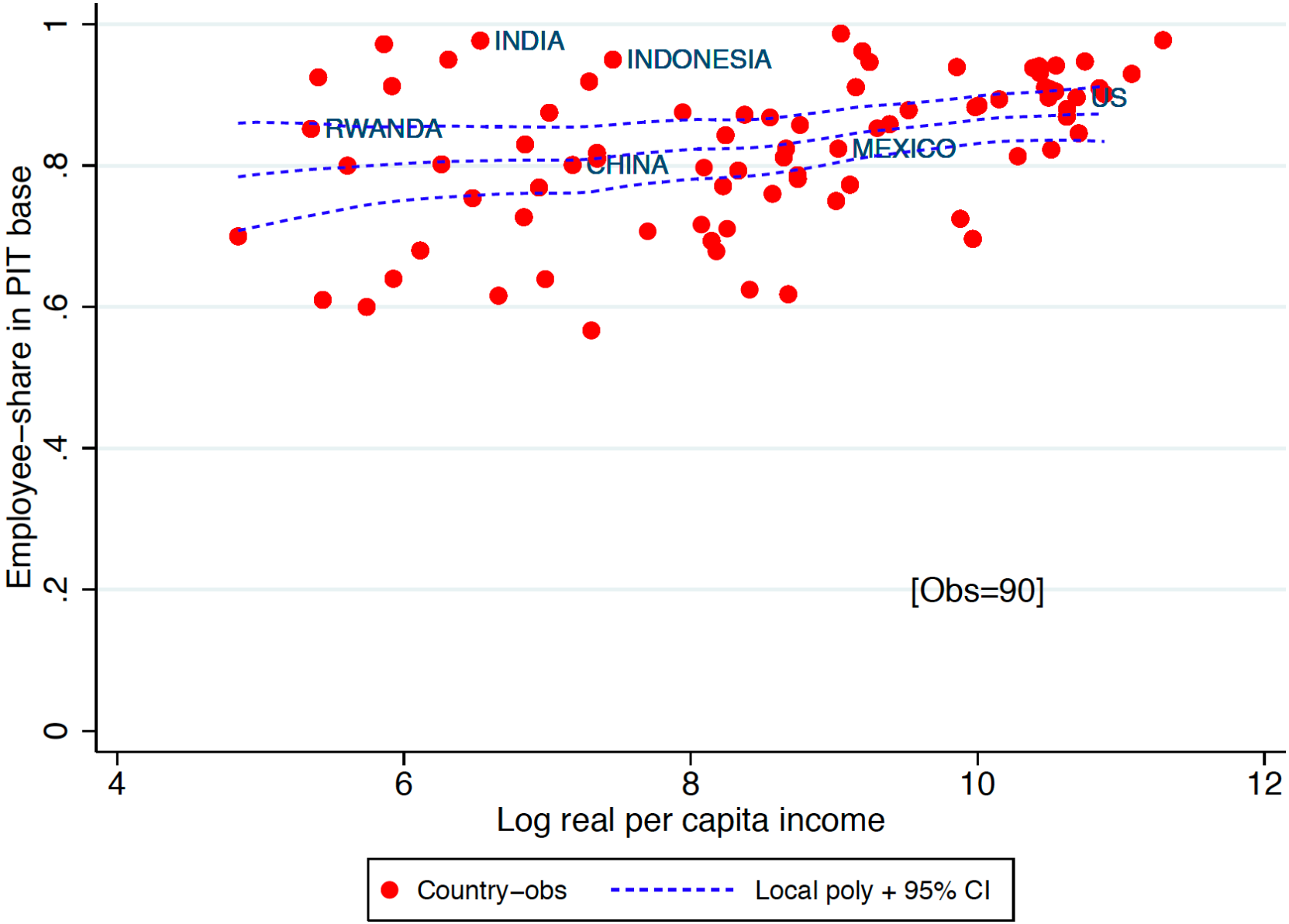
Jensen (2016): Stylized Facts



Jensen (2016): Stylized Facts



Jensen (2016): Stylized Facts

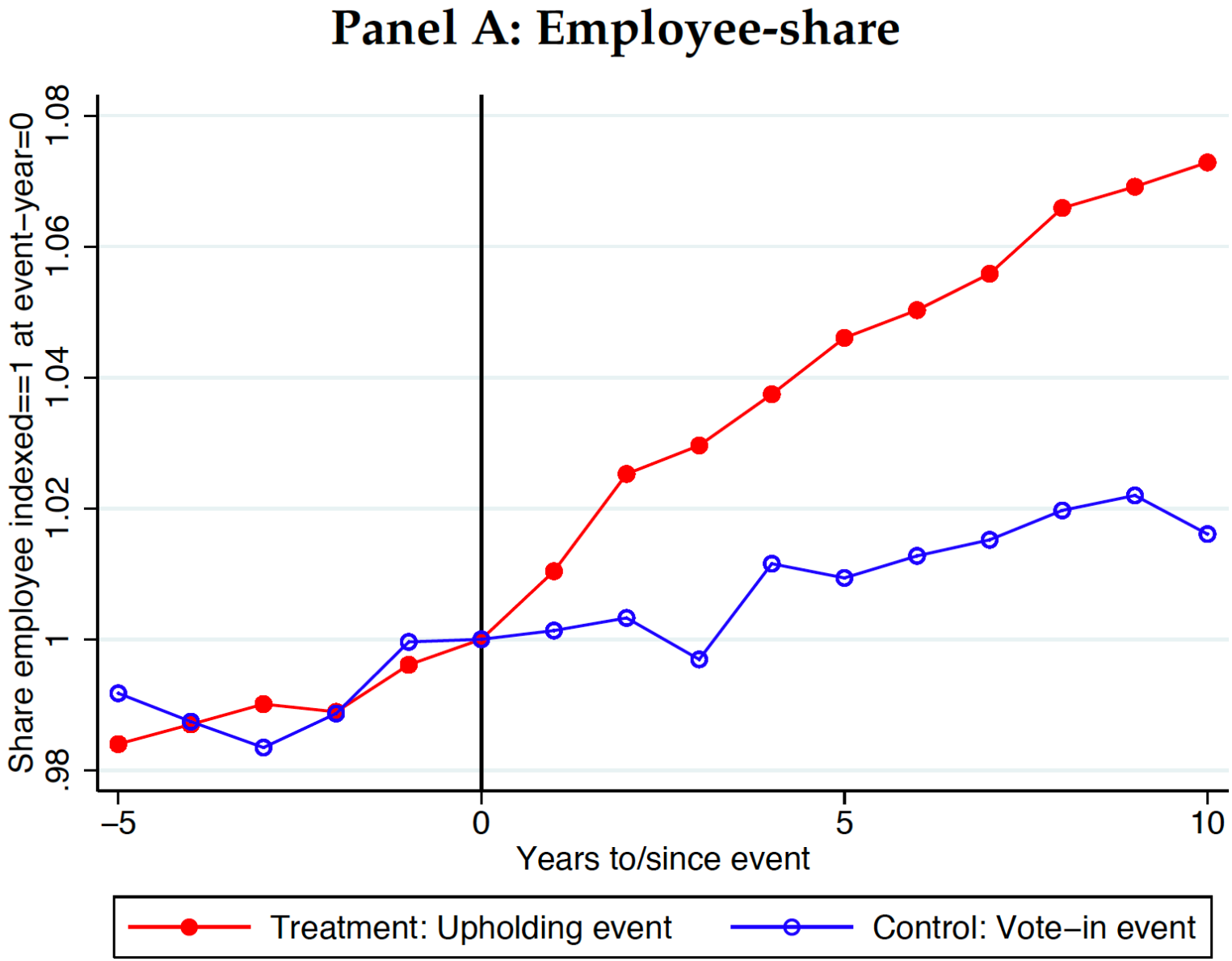


Jensen (2016): Causal Evidence

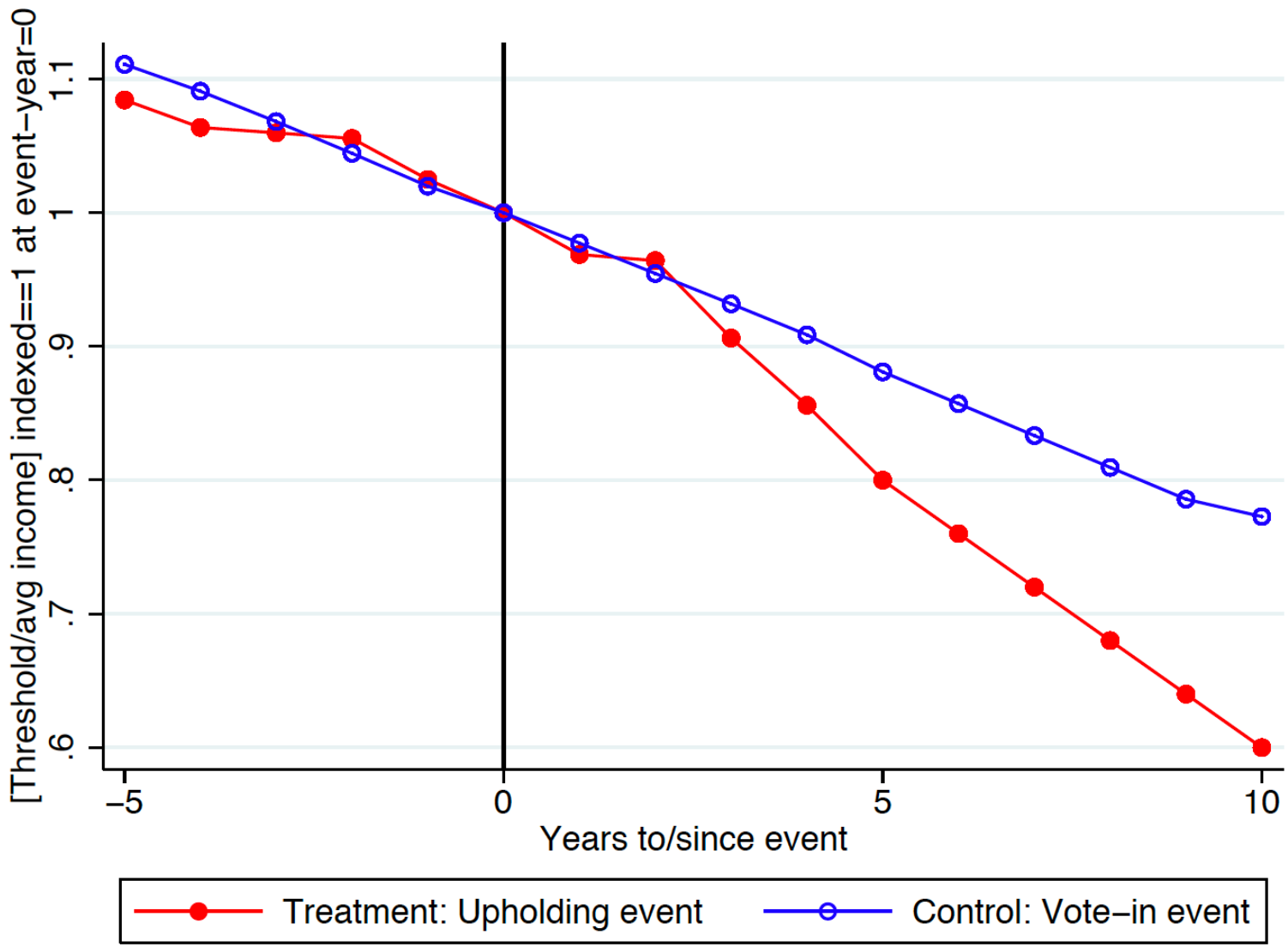
- These cross-country and over-time patterns are compelling, but are they causal?
- Do countries move their tax thresholds *because* they have fewer self-employed workers?
- Use timing of implementation of Industrial Development Bonds.
- Each state votes on whether to issue a bond. However, not implemented until each state's highest court confirms it is constitutional. When this happens is uncertain.
  - $\rightarrow$ Look at time trends around implementation date.

$$y_{st} = \beta + \alpha \mathbf{1}\left(\text{Vote in}\right)_{st} + \theta \mathbf{1}\left(\text{Upheld}\right)_{st} + \lambda \mathbf{X}_{st} + \mu_s + \gamma_t + \phi_s \cdot t + \varepsilon_{st}$$

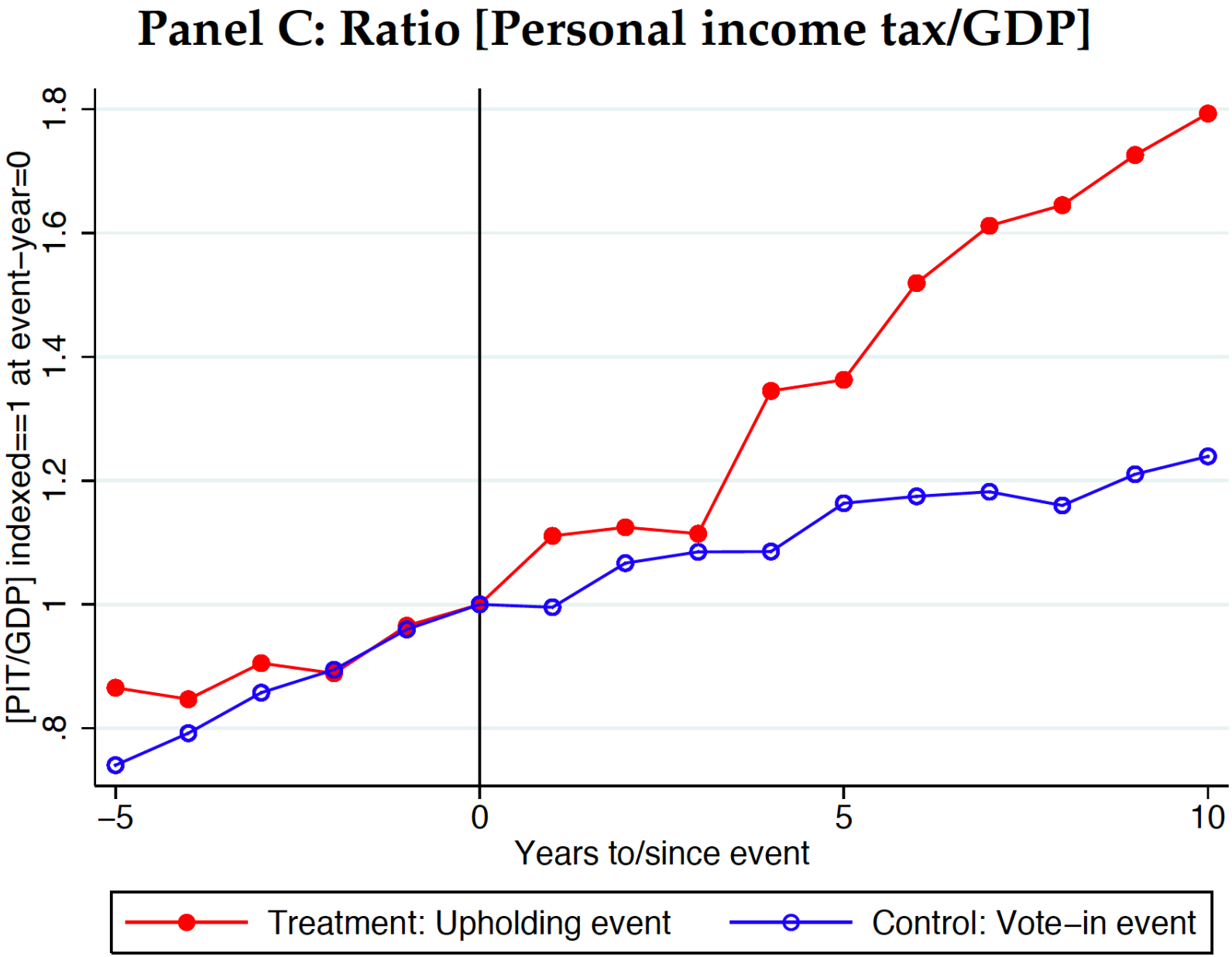
Jensen (2016): Results



Jensen (2016): Results



Jensen (2016): Results



Jensen (2016): Results

	Employee share impact on tax base: Size of tax base (PIT exemption threshold/average earnings)			Composition of tax base [Employee-share above threshold]
	(1)	(2)	(3)	(4)
1(Vote in)	-.1400			-.0052
	(.1140)			(.0119)
1(Upheld)	-.7218			-.0054
	(.3296)**			(.0185)
Employee-share		-20.318	-29.588	
		(5.832)***	(12.157)**	
1st stage F-test			7.79	
p-value			(.0012)	
Implied elasticity tax base - emp share	-6.678	-5.200	-7.548	
Number of states	48	48	48	48
Number of state-years	2931	2931	2931	2931
R-squared	0.7869	0.8111		0.7737
Method	OLS	OLS	IV	OLS

Jensen (2016): Results

	Personal Income Tax/GDP			CorpIncT/GDP	GenSalesT/GDP	SelectSalesT/GDP	LicenceT/GDP
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1(Vote in)	.0007			-.0001	-.0007	-.0005	.0003
	(.0009)			(.0002)	(.0008)	(.0004)	(.0002)
1(Upheld)	.0017			.0001	-.0002	.0001	-.0004
	(.0007)**			(.0004)	(.0010)	(.0010)	(.0003)
Employee-share		.0166	.0248				
		(.007)**	(.0109)**				
1st stage F-test			7.96				
p-value			(.001)				
Implied elasticity	1.292	.6225	.900				
Number of states	48	48	48	48	48	48	48
Number of state-years	2931	2931	2931	2931	2931	2931	2931
R-squared	0.9195	0.9280		0.7081	0.8653	0.8805	0.8414
Method	OLS	OLS	IV	OLS	OLS	OLS	OLS

Outline

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Taxing Firms in Developing Countries

- Pomeranz (AER 2015) *No Taxation Without Information: Deterrence and Self-Enforcement in the Value Added Tax*
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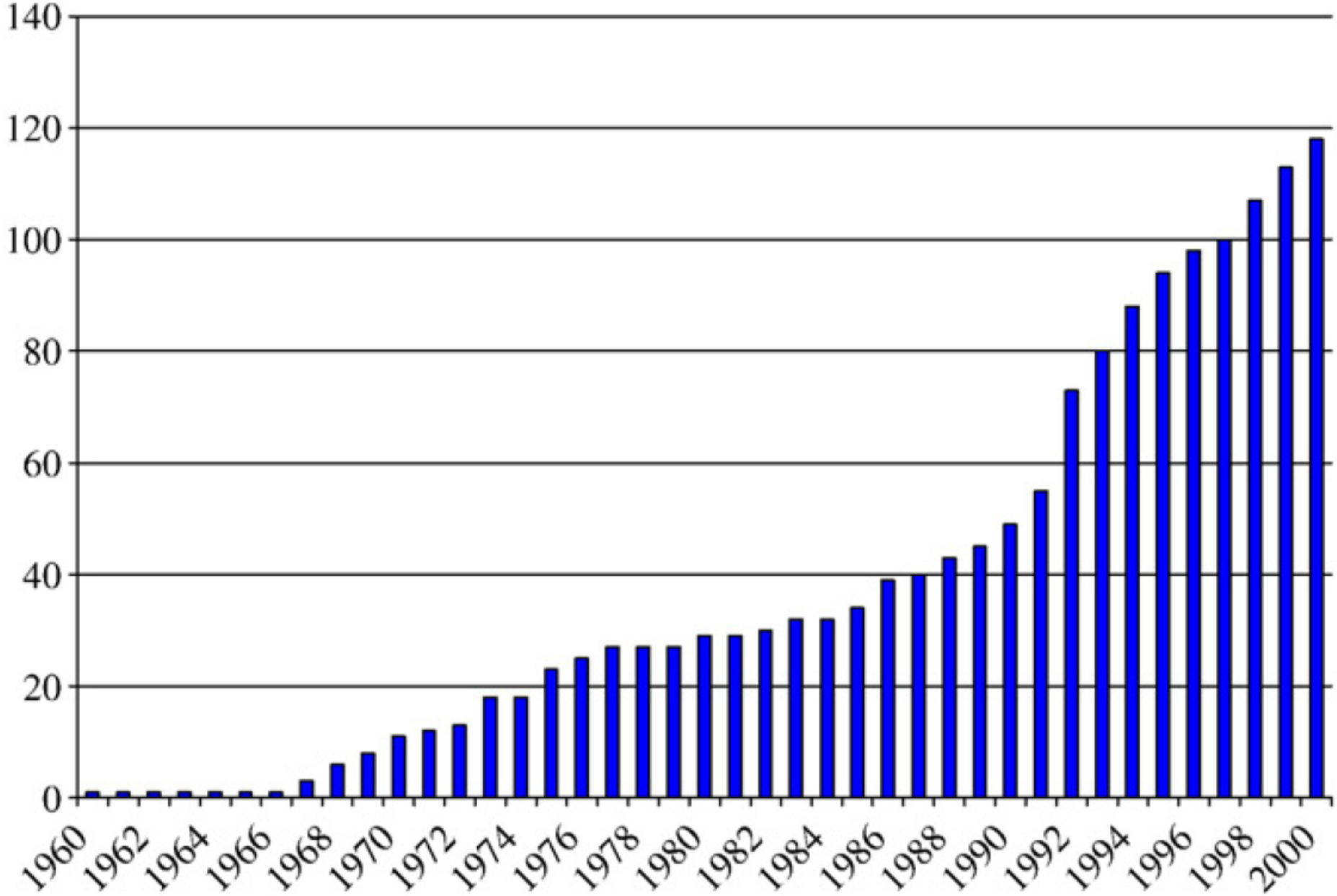
Various Ways to Tax Sales

- **Turnover Taxes** used to tax all sales: business to consumer (B-C) and business to business (B-B): Creates multiple layers of taxes along a production chain
  $\Rightarrow$ Higher total tax when B-B-C than B-C: *cascading*
  production inefficient

- **Retail Sales Tax** imposed on B-C sales only [B-B] exempt: difficult to distinguish B-B and B-C (shifting), strong evasion incentive for B-C [ST doesn't work well with small retailers]
  production efficient, but hard to enforce

- Value-Added-Tax (VAT) taxes only value added [sales minus purchases] in all transactions (B-B and B-C): equivalent to retail sales tax economically, but easier to enforce [automatic upstream enforcement]
  production efficient, but easier to enforce?

Spread of the VAT Around the World



Source: Keen & Lockwood (JPubE 2009)

Pomeranz (2015): Self-Enforcing Properties of the VAT

- Consider a value chain of firms indexed by $i \in 1, 2, \ldots, N$. Tax liability is $\tau_v (s_i - c_i)$
- When i trades with $i+1$, $i+1$ wants a receipt (paper trail) from i to deduct s_i from its costs c_{i+1}
- Mechanism breaks down at firm N. No firm $N+1$, instead, a consumer with no incentive to request receipt.
- Firms don't actually report every sale in most countries. Paperwork could be uncovered in an audit $\Rightarrow$threat of audit should affect evasion.
- 2 types of evasion:

1. Unilateral evasion: $\hat{c}_i > c_i$ or $\hat{s}_i < s_i \Rightarrow \hat{c}_i > \hat{s}_{i-1}$ or $\hat{s}_i < \hat{c}_{i+1}$
2. Collusive evasion: $\hat{c}_i \neq c_i$ but $\hat{c}_i = \hat{s}_{i-1}$ or $\hat{s}_i \neq s_i$ but $\hat{s}_i = \hat{c}_{i+1}$

Pomeranz (2015): Audit Threat Predictions

TABLE 1—RESPONSES TO INCREASE IN AUDIT PROBABILITY: COLLUSIVE AND UNILATERAL EVASION

Position in supply chain	Collusive evasion		Unilateral evasion	
Supplier	Sales ↑	VAT ↑	Sales ↑	VAT ↑
Treated firm	Inputs ↑ Sales ↑	VAT (↑)	Inputs ↓ Sales ↑	VAT ↑
Client	Inputs ↑	VAT ↓	Inputs ↓	VAT ↑

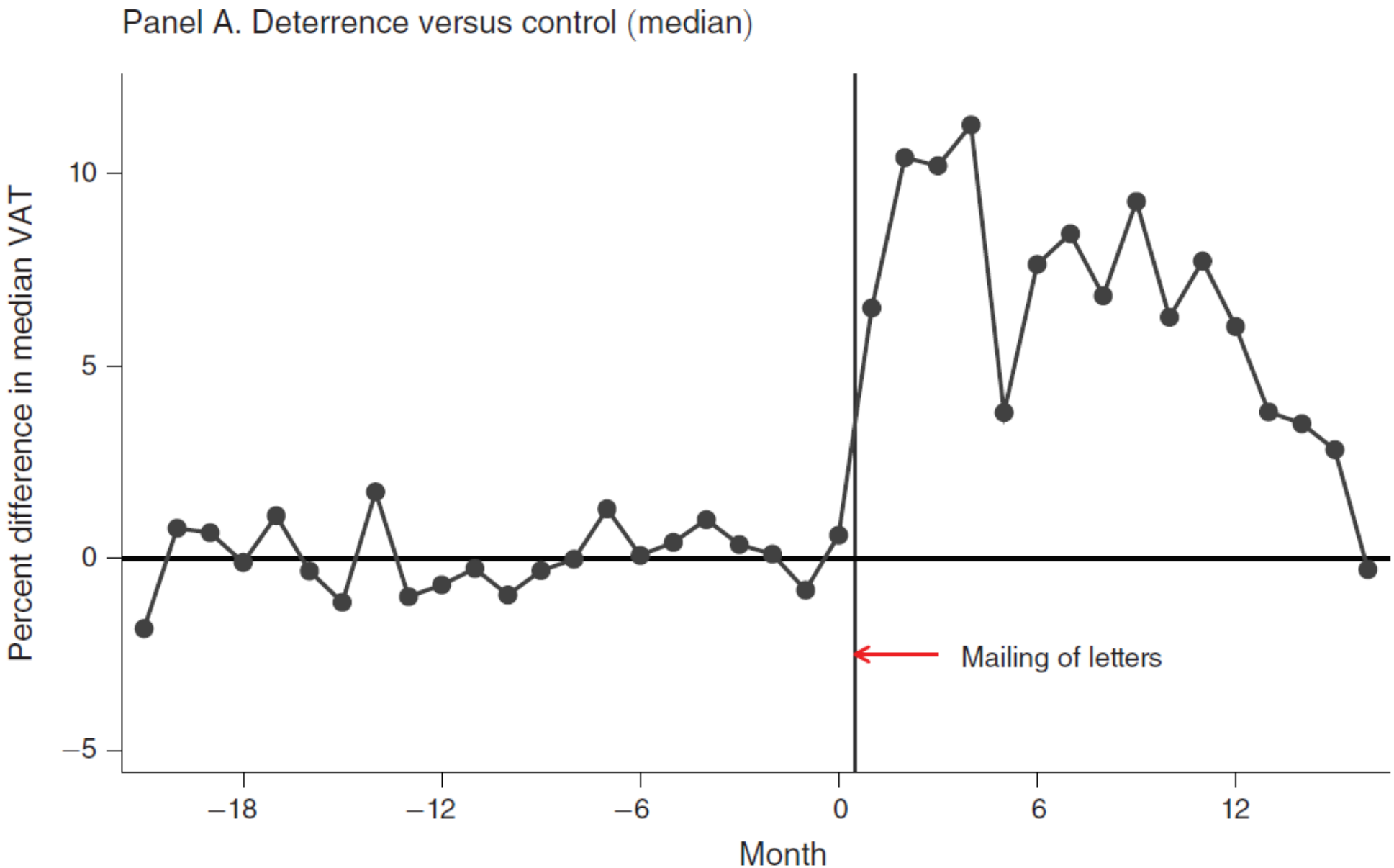
Pomeranz (2015): Experiment 1-Threat of Audit Letters

- Sent letters to VAT-liable firms in Chile from the tax authority
  - Letter 1: Deterrence (N=102,031)
  - Letter 2: Tax Morale (N=18,579)
  - Letter 3: Placebo (N=18,519)
  - Control Group (N=306,605)
- Look for differential effects on transaction types/firm types

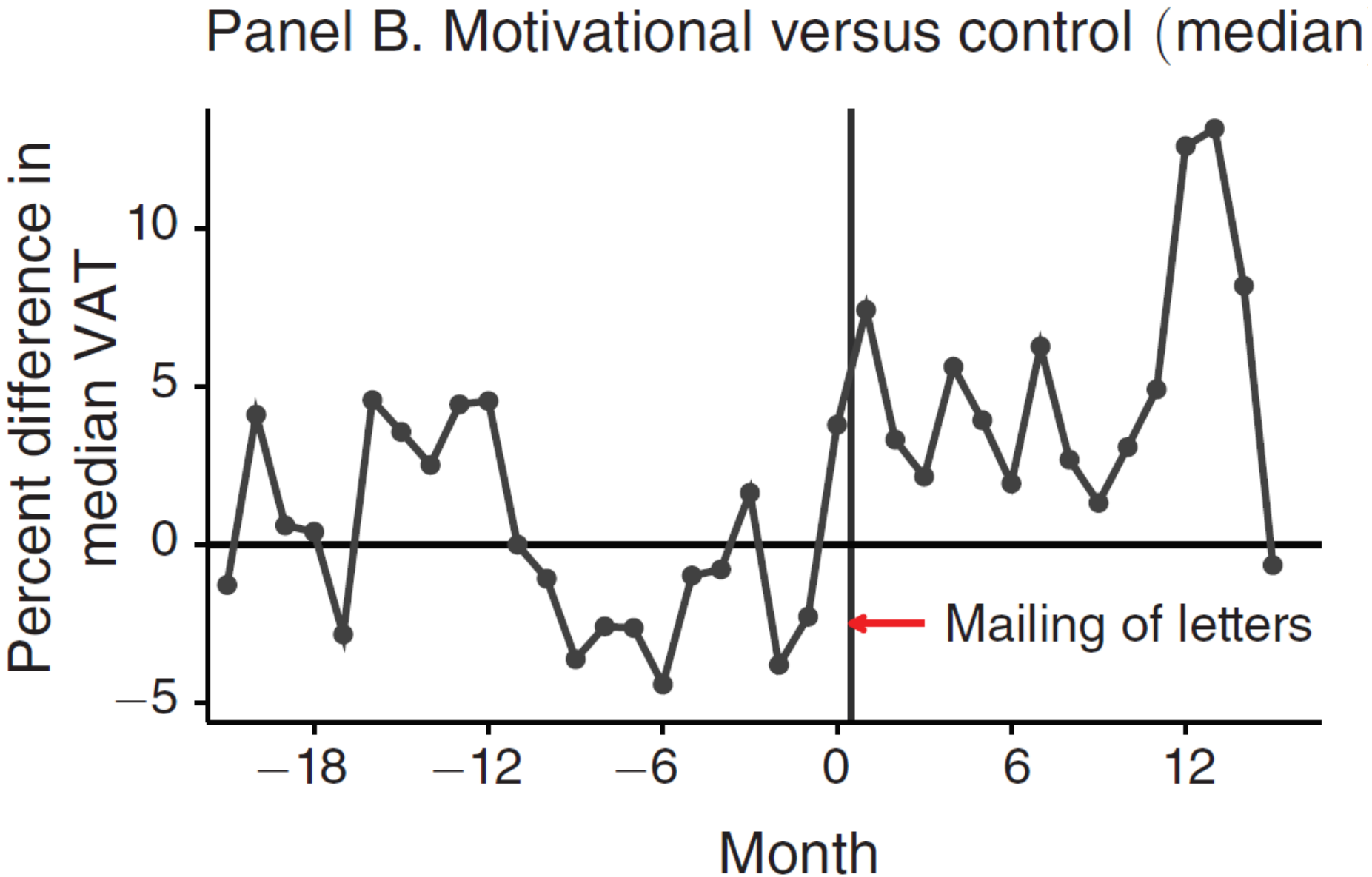
Pomeranz (2015): Experiment 2-Spillovers

- Look directly for spillovers onto trading partners
- Sample of 5,600 suspected evaders already chosen for audit
- Randomly preannounce audit to half of them
- During audit, auditors gather data on trading partners
- Look at VAT declarations before and after announcement of audit of trading partners

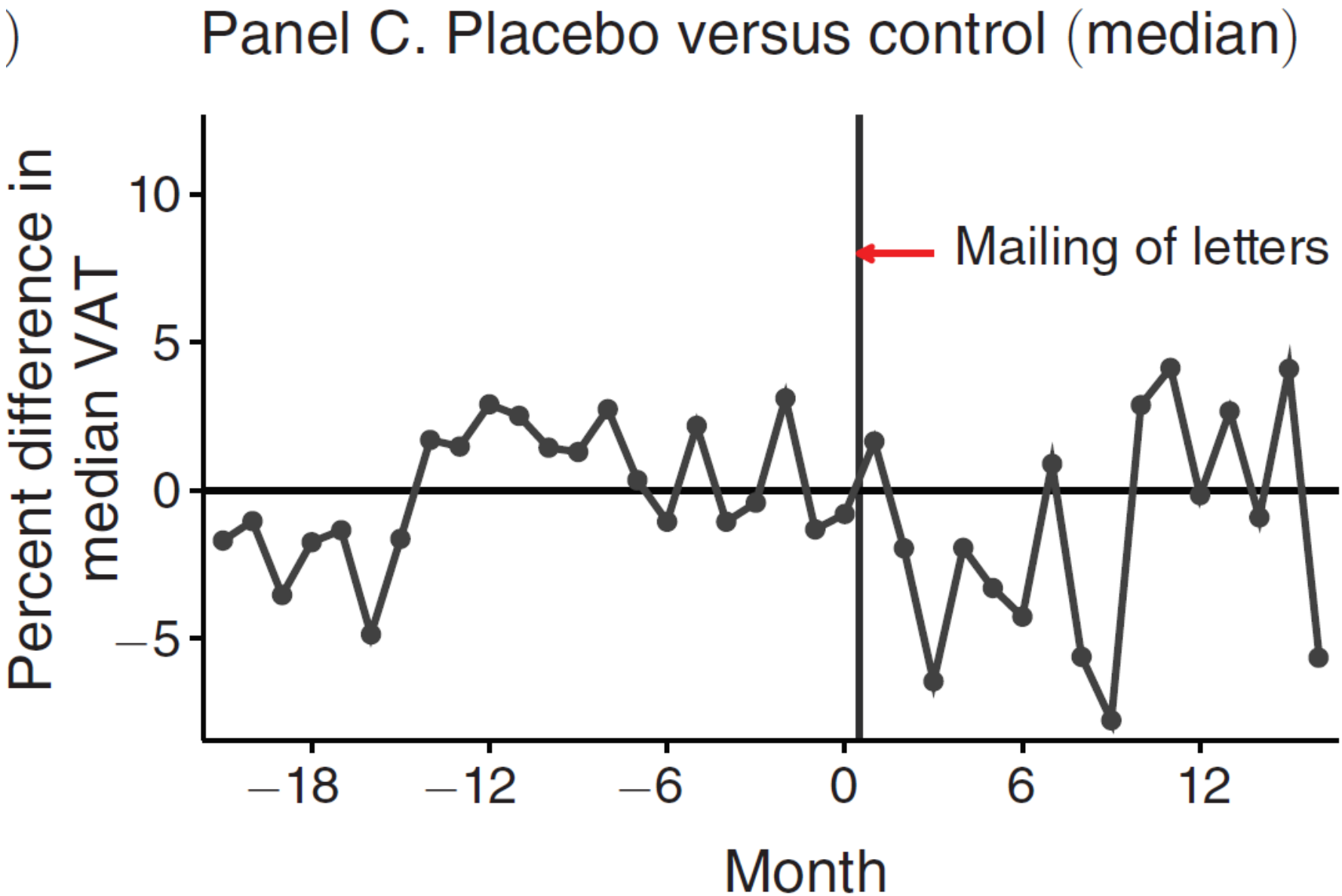
Pomeranz (2015): Experiment 1 Results



Pomeranz (2015): Experiment 1 Results



Pomeranz (2015): Experiment 1 Results



Pomeranz (2015): Experiment 1 Results

	Percent sales > previous year (1)	Percent input costs > previous year (2)	Percent intermediary sales > previous year (3)	Percent final sales > previous year (4)
Deterrence letter × post	1.17***	0.16	0.12	1.33***
	(0.22)	(0.21)	(0.19)	(0.21)
Constant	55.39***	53.25***	38.37***	45.04***
	(0.13)	(0.13)	(0.12)	(0.12)
Month fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	2,392,529	2,392,529	2,392,529	2,392,529
Number of firms	133,156	133,156	133,156	133,156
Adjusted R^2	0.25	0.22	0.30	0.32

Pomeranz (2015): Experiment 2 Results

	Percent VAT > previous year (1)	Percent VAT > predicted (2)	Percent VAT > previous year (3)	Percent VAT > predicted (4)	Percent VAT > previous year (5)	Percent VAT > predicted (6)
Audit announcement × post	2.41**	2.03*				
	(1.14)	(1.11)				
Audit announcement × supplier × post			4.28***	3.92***	4.14***	3.83***
			(1.54)	(1.50)	(1.52)	(1.52)
Audit announcement × client × post			−0.26	−0.28	−0.14	−0.28
			(1.64)	(1.51)	(1.67)	(1.55)
Supplier × 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 × post	No	No	No	No	Yes	Yes
Controls × audit announcement × 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
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

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Best *et al.* (2015): Production Efficiency

- **Production Efficiency Theorem** (Diamond & Mirrlees 1971):

  Any second-best optimal tax system maintains production efficiency

- **Key policy implications**:
  - Permits taxes on consumption, wages and profits
  - Precludes taxes on inputs, turnover and trade

- The theorem has been influential in the policy advice given to developing countries

Best *et al.* (2015): Production Efficiency vs Revenue Efficiency

- Production Efficiency Theorem **assumes perfect tax enforcement**

  $\rightarrow$ Violated everywhere, but especially in developing countries

- **Tax evasion** introduces a trade-off between production and revenue efficiency in tax design

- In the context of firm taxation in Pakistan, we provide:
  - **Simple model** on the optimal production-revenue efficiency trade-off
  - **Quasi-experimental evidence** on the evasion elasticity w.r.t taxes
  - **Link model & evidence** to quantify optimal policy

Best *et al.* (2015): Novel Quasi-Experimental Approach

- **Minimum Tax Scheme:** firms taxed either on profits or turnover (lower rate on turnover) depending on which liability is larger
  - This production inefficient policy is motivated by tax compliance
- **Non-standard kink** where both tax rate and tax base jump
  - Kink changes real and evasion incentives differentially
  - Novel method for estimating tax evasion based on a bunching approach
- **Wide applicability** of our approach: such schemes are ubiquitous

Best *et al.* (2015): Firm Behavior: Real vs Evasion Responses

- Real output y, real cost $c(y)$, declared cost $\hat{c}$, penalty $g(\hat{c} - c(y))$
- Tax liability $T = \tau[y - \mu\hat{c}]$
- Maximization of after-tax profits

$$\begin{aligned} c'(y) &= 1 - \tau_E \\ g'(\hat{c} - c(y)) &= \tau\mu \end{aligned}$$

- **Effective Marginal Tax Rate** $\tau_E = \tau\frac{1-\mu}{1-\tau\mu}$:
  - $\tau_E = 0$ for a profit tax $\mu = 1$ [**production efficiency**]
  - $\tau_E = \tau$ for a turnover tax $\mu = 0$ [**production inefficiency**]

Best *et al.* (2015): Proposition [Production Inefficiency]

*With **perfect enforcement**, optimal tax base is pure profits* ($\mu = 1$)

*With **imperfect enforcement**, the optimal tax base is*

- *Between pure profits and turnover* ($0 < \mu < 1$)
- *Depends on the evasion-output elasticity ratio*

$$\underbrace{\frac{\tau}{1-\tau} \times \frac{\partial \tau_E}{\partial \tau}(\mu)}_{\text{effective wedge } (\downarrow \text{ in } \mu)} = \underbrace{G(\mu)}_{\text{tax gap } (\uparrow \text{ in } \mu)} \times \underbrace{\frac{\varepsilon_{\hat{c}-c}}{\varepsilon_y}}_{\text{elasticity ratio}}$$

Best *et al.* (2015): Partial Equilibrium: Intuition

$$\underbrace{\frac{\tau}{1-\tau} \times \frac{\partial \tau_E}{\partial \tau}(\mu)}_{\text{effective wedge } (\downarrow \text{ in } \mu)} = \underbrace{G(\mu)}_{\text{tax gap } (\uparrow \text{ in } \mu)} \times \underbrace{\frac{\varepsilon_{\hat{c}-c}}{\varepsilon_y}}_{\text{elasticity ratio}}$$

- Broader base (smaller μ) when:
  - $G(\mu)$ is higher: Evasion *level* is higher
  - $\varepsilon_{\hat{c}-c}/\varepsilon_y$ is higher: Evasion decisions relatively more responsive than production decisions.
- More generally, with two bases, one easier to evade than the other:
  - shift towards hard to evade base
  - go further from efficiency the bigger the problem is, and the more responsive evasion is to tax policy.
- $\Rightarrow$ have expressed optimal policy in terms of sufficient statistics $G(\mu)$ and $\varepsilon_{\hat{c}-c}/\varepsilon_y$ which we can, in principle, take to the data.

Best *et al.* (2015): Tax Policy in General Equilibrium

General equilibrium extension raises two additional considerations

1. **Cascading effect**: Distortions travel through production chain
2. **Incidence effect**: Price changes shift income between final and intermediate sectors

Simple 2-sector model:

- Intermediate sector A

$$y_A = l_A$$

- Final goods sector B

$$y_B = F(l_B, y_A)$$

Best *et al.* (2015): Firm Behavior

- Intermediates

$$p_A = w/\left(1-\tau_E\right)$$

***Incidence* effect**: τ_E distorts scale and income of sector A

- Final goods

$$\begin{aligned} w &= F'_{l_B} \times \left(1-\tau_E\right) = F'_{y_A} \times \left(1-\tau_E\right)^2 \\ \text{MRTS}_{l_B,y_A} &= F'_{l_B}/F'_{y_A} = 1-\tau_E \end{aligned}$$

***Cascading* effect**: y_A taxed twice $\Rightarrow$ τ_E distorts input mix in sector B

Best *et al.* (2015): Optimal Policy

*With **perfect enforcement**, optimal tax base is pure profits* ($\mu = 1$)

*With **imperfect enforcement**, the optimal tax base is interior* ($0 < \mu < 1$) and satisfies

$$\frac{\tau}{1-\tau} \times \frac{\partial \tau_E}{\partial \tau}(\mu) \times \left\{ \frac{\beta\left[1+\alpha(\mu)\right]}{1+(1-\beta)\,\varepsilon_{p_A}} \right\} = G(\mu) \times \frac{\varepsilon_{\hat{c}-c}}{\varepsilon_y}$$

$$\alpha = \frac{\text{MRTS}}{1+\text{MRTS} \times \left(\frac{\partial l_B}{\partial \tau_E} \Big/ \frac{\partial y_A}{\partial \tau_E} \right)} \qquad \beta = \frac{y_B}{p_A y_A + y_B} \qquad \varepsilon_{p_A} = \frac{\partial \log p_A}{\partial \log \tau_E}$$

Best *et al.* (2015): Optimal Policy

*With **imperfect enforcement**, the optimal tax base is interior* $(0 < \mu < 1)$ and satisfies

$$\frac{\tau}{1-\tau} \times \frac{\partial \tau_E}{\partial \tau}(\mu) \times \left\{ \frac{\beta\left[1+\alpha(\mu)\right]}{1+(1-\beta)\,\varepsilon_{p_A}} \right\} = G(\mu) \times \frac{\varepsilon_{\hat{c}-c}}{\varepsilon_y}$$

$$\alpha = \frac{\text{MRTS}}{1+\text{MRTS} \times \left(\frac{\partial l_B}{\partial \tau_E} \Big/ \frac{\partial y_A}{\partial \tau_E} \right)} \qquad \beta = \frac{y_B}{p_A y_A + y_B} \qquad \varepsilon_{p_A} = \frac{\partial \log p_A}{\partial \log \tau_E}$$

- partial equilibrium analysis $\Rightarrow$ smaller μ (broader base) if
  - α large: l_B & y_A highly substitutable
  - β large: final goods large part of economy

Best *et al.* (2015): Minimum Tax Scheme

- Combination of profit tax ($\mu = 1$) and turnover tax ($\mu = 0$):

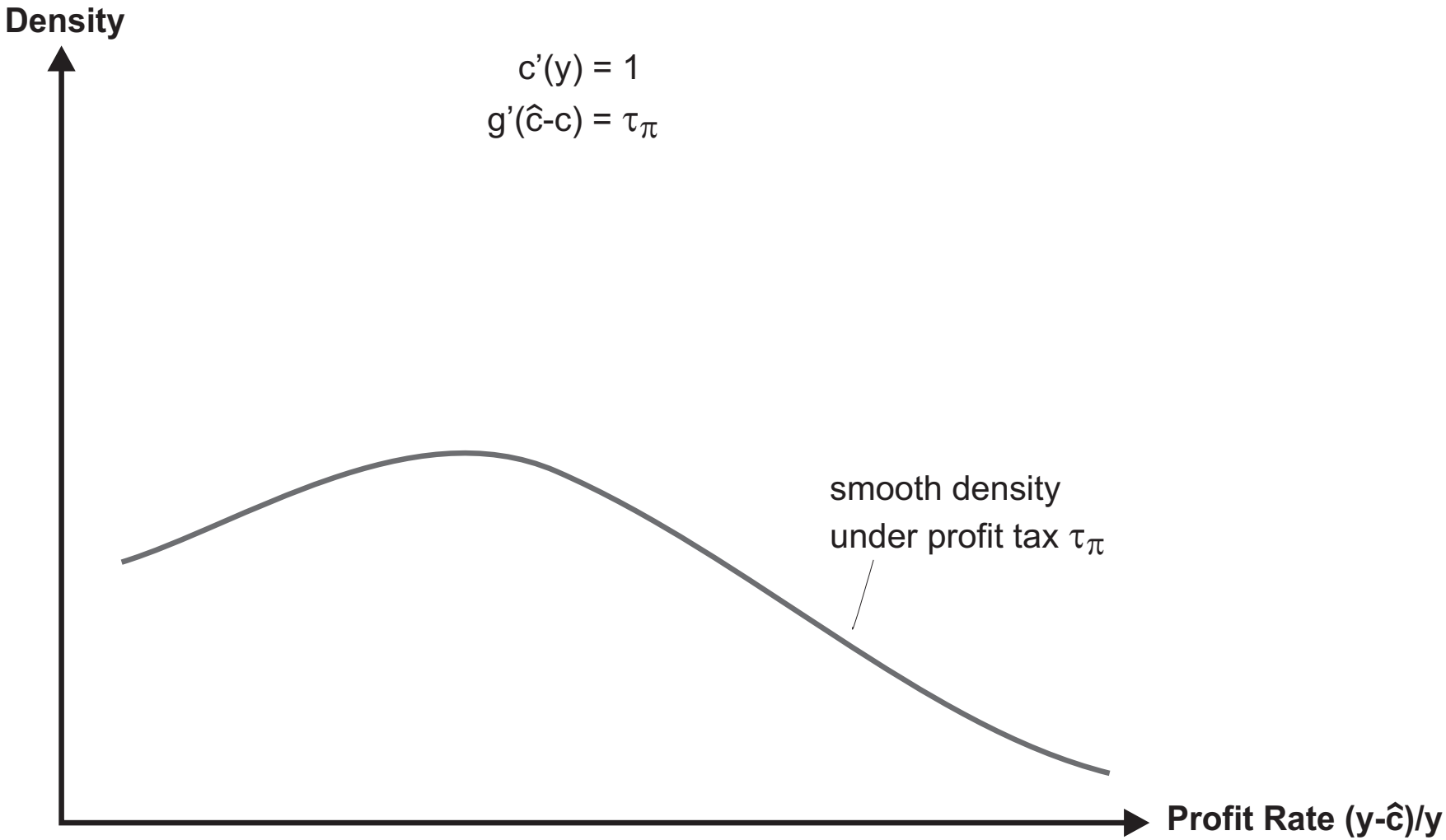
$$T = \max\left\{\tau_\pi\left(y - c\right); \tau_y y\right\}.$$

- Firms switch between the two taxes depending on profit rate $\hat{\pi}$:

$$\tau_\pi\left(y - c\right) = \tau_y y \quad \Leftrightarrow \quad \hat{\pi} \equiv \frac{y - c}{y} = \frac{\tau_y}{\tau_\pi}.$$

- **Kink: tax base and marginal tax rate change discontinuously, but tax liability is continuous**

Best *et al.* (2015): Bunching at the Minimum Tax Kink



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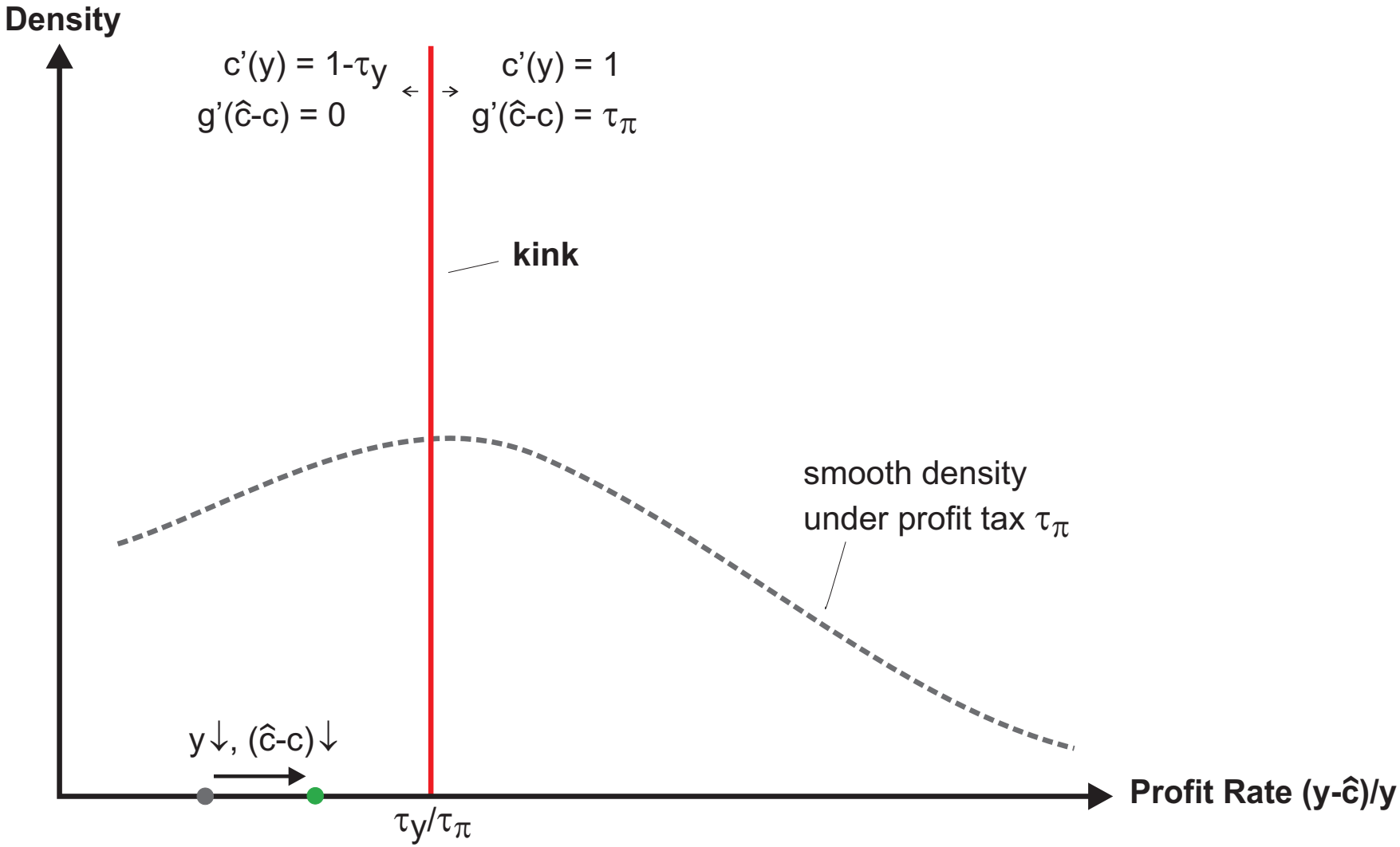

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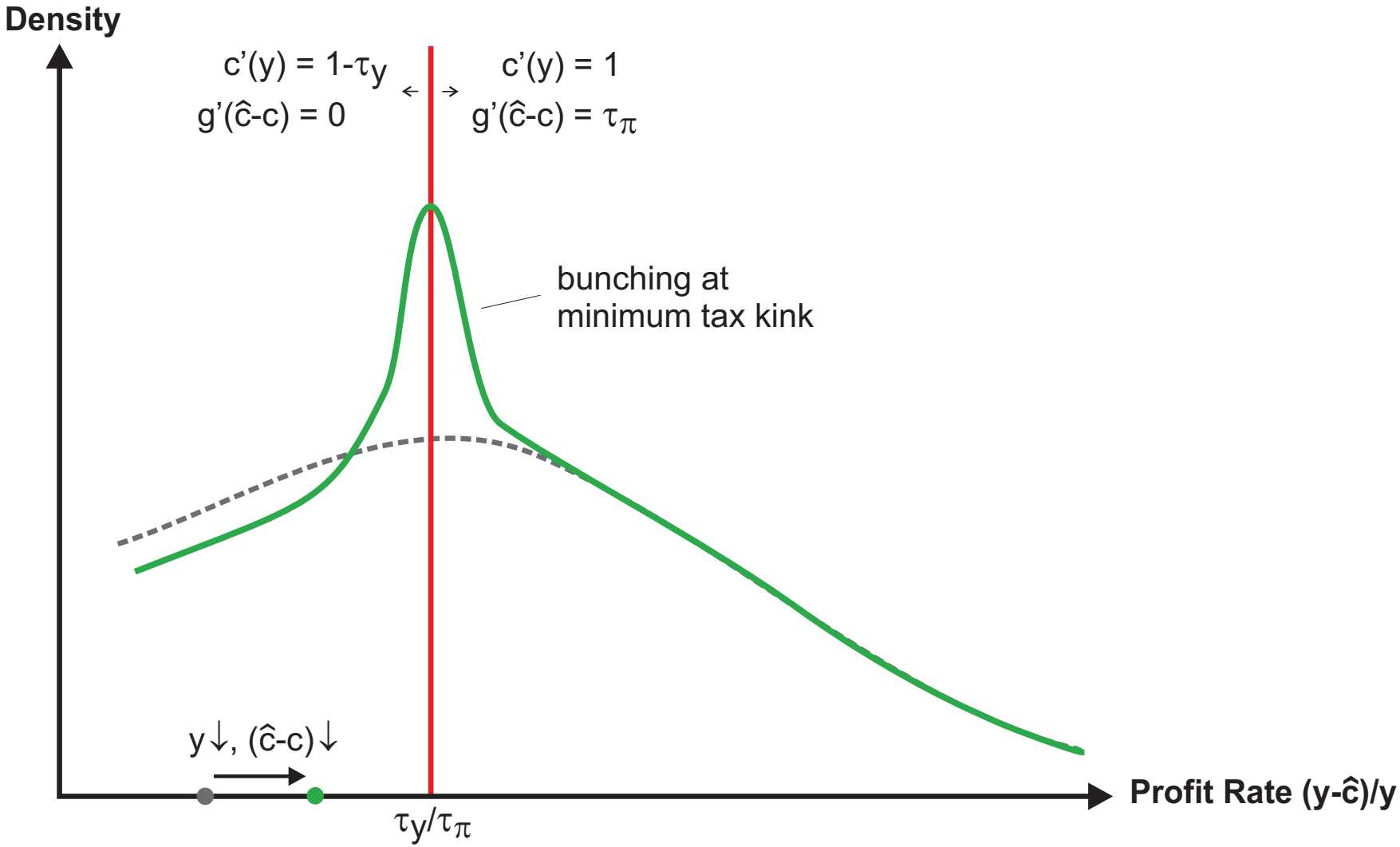


Best *et al.* (2015): Minimum Tax Kink Ideal for Eliciting Evasion

- **Real output response:**
  - Firms choose real output based on $1 - \tau_E$
  - At the kink, production wedge τ_E changes from 0 to τ_y (≈ 0)
    $\Rightarrow$ almost no variation and therefore small real response
- **Evasion response:**
  - Firms choose evasion based on $\tau\mu$
  - At the kink, $\tau\mu$ changes from τ_π $(\gg 0)$ to 0
    $\Rightarrow$ large variation and therefore large evasion response
- **Bunching B identifies (mostly) evasion:**

$$B \propto \frac{\tau_y^2}{\tau_\pi}\varepsilon_y - \frac{\Delta(\hat{c} - c)}{y}$$

Best *et al.* (2015): Data

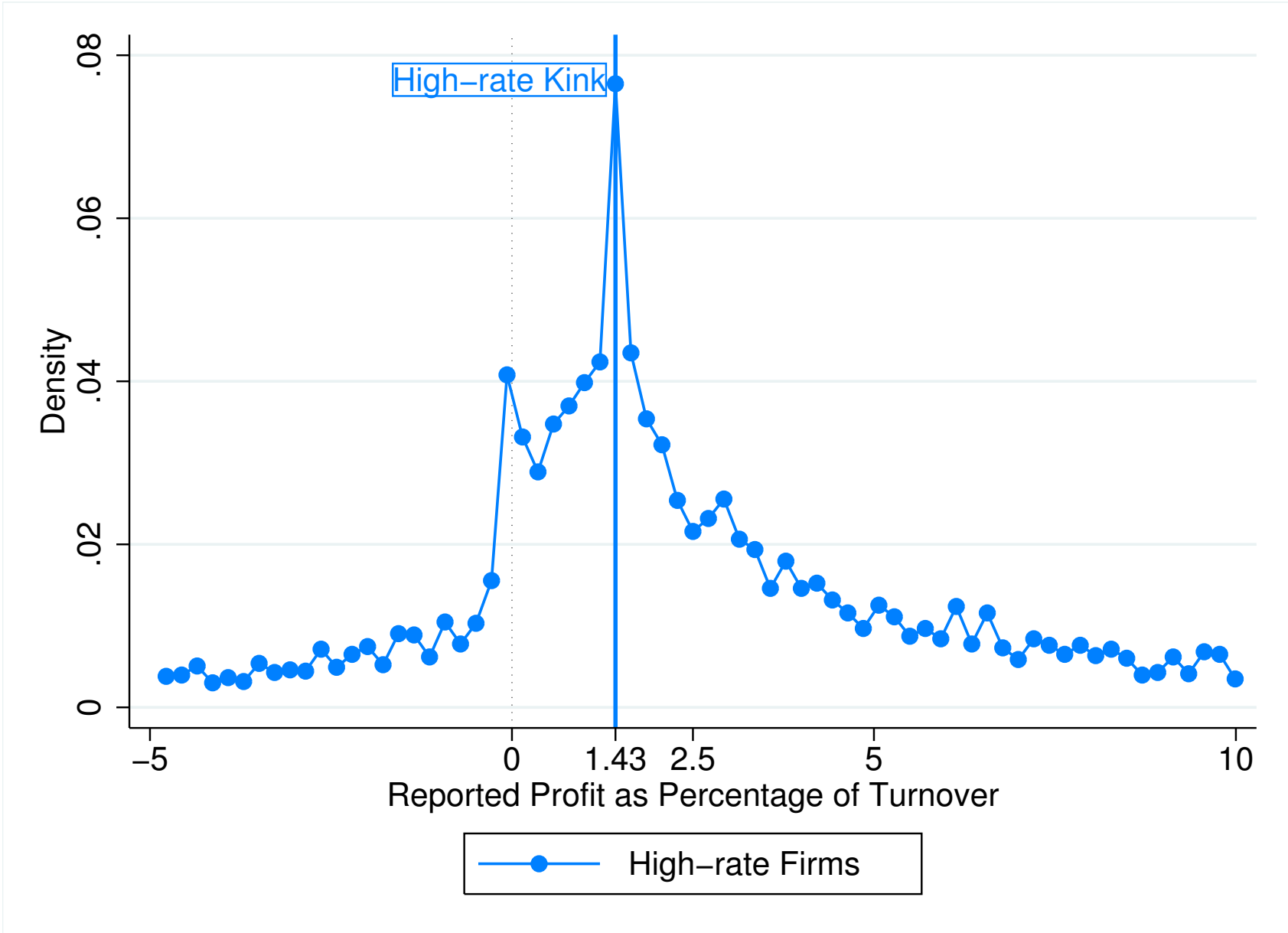
- Administrative data from FBR Pakistan
- All corporate tax returns from 2006-2010 ($\sim$15,000 returns/year)
- New electronic data collection system in place for this time period
- In each year, about half of the firms are turnover tax payers and half of them are profit tax payers

Best *et al.* (2015): Variation in Minimum Tax Kink

- **Variation in profit tax rate τ_π across firms:**
  - High rate of 35%, low rate of 20%
    [depends on incorporation date, turnover, assets, #employees]

- **Variation in turnover tax rate τ_y over time:**
  - 2006-07: tax rate of 0.5%
  - 2008: turnover tax scheme withdrawn
  - 2009: tax rate of 0.5%
  - 2010: tax rate of 1%

Best *et al.* (2015): Bunching Evidence



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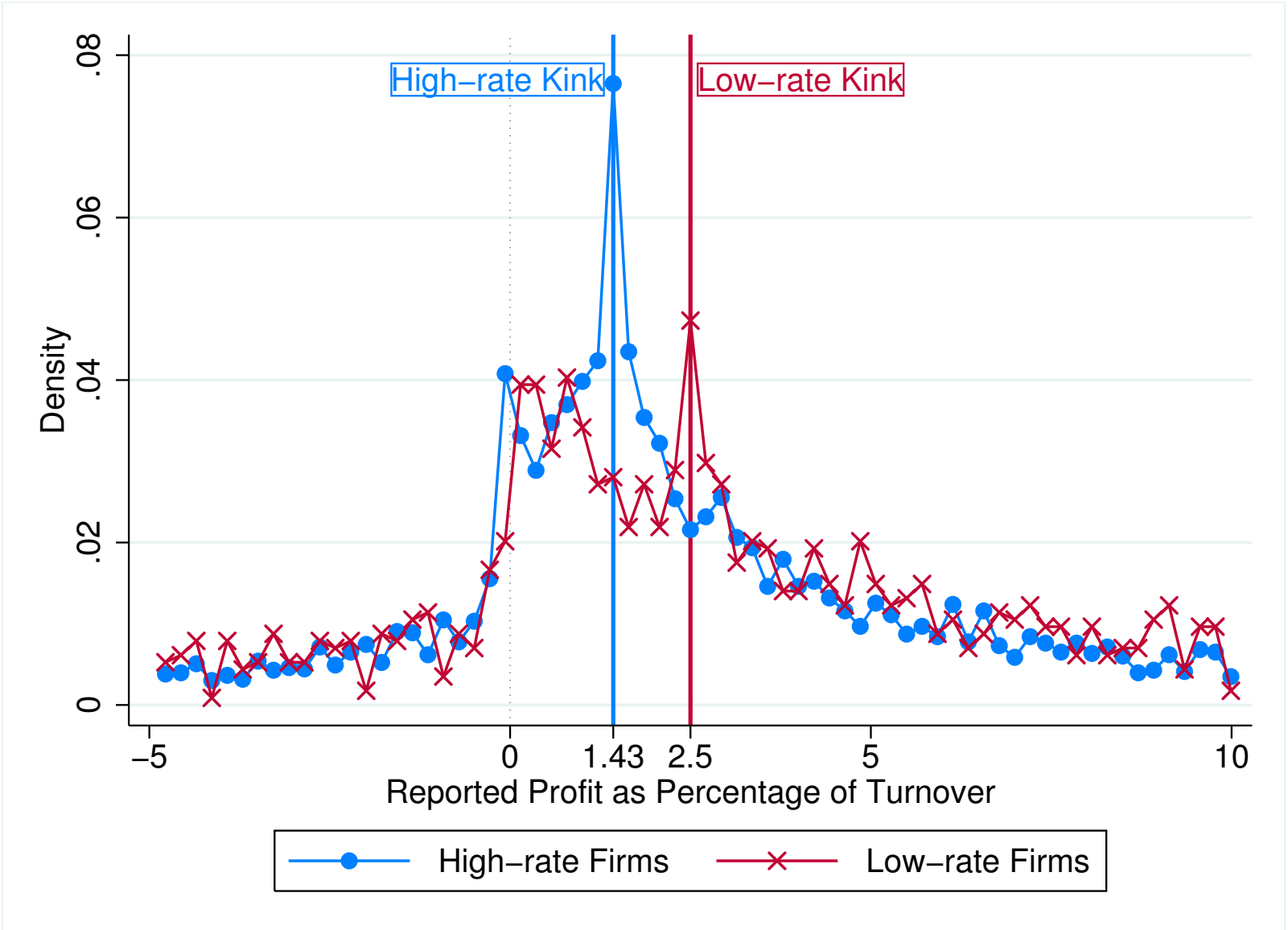

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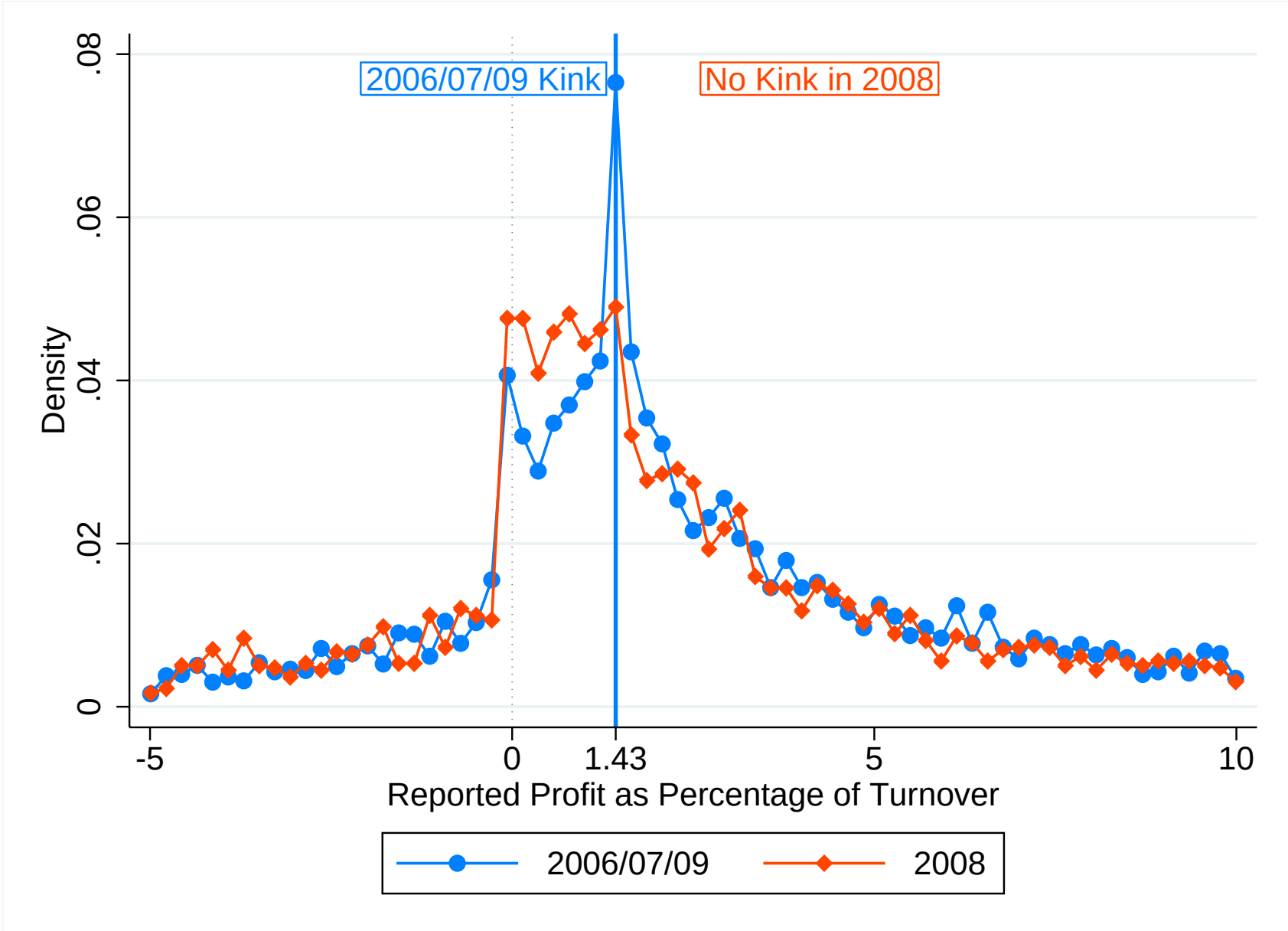

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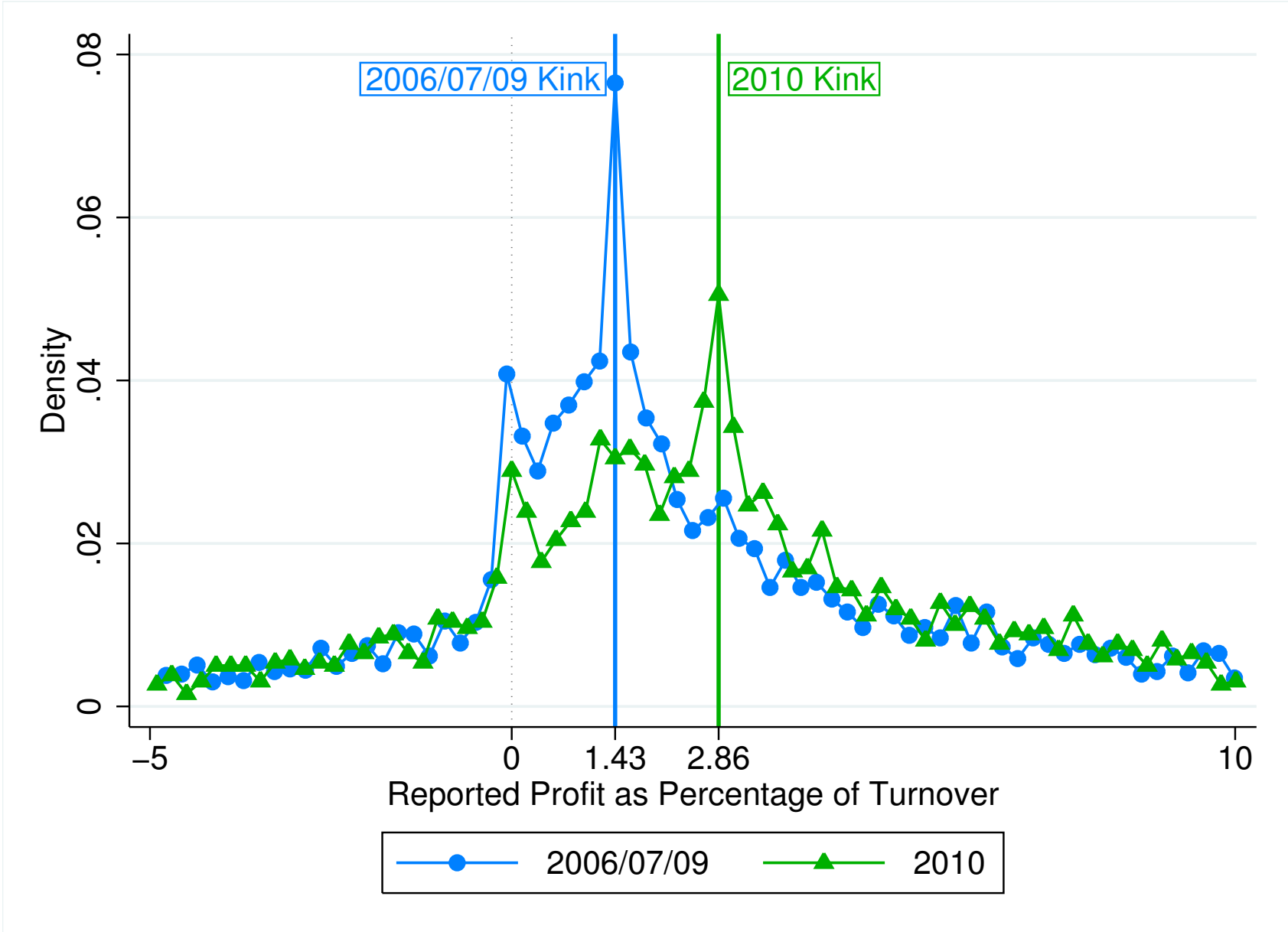
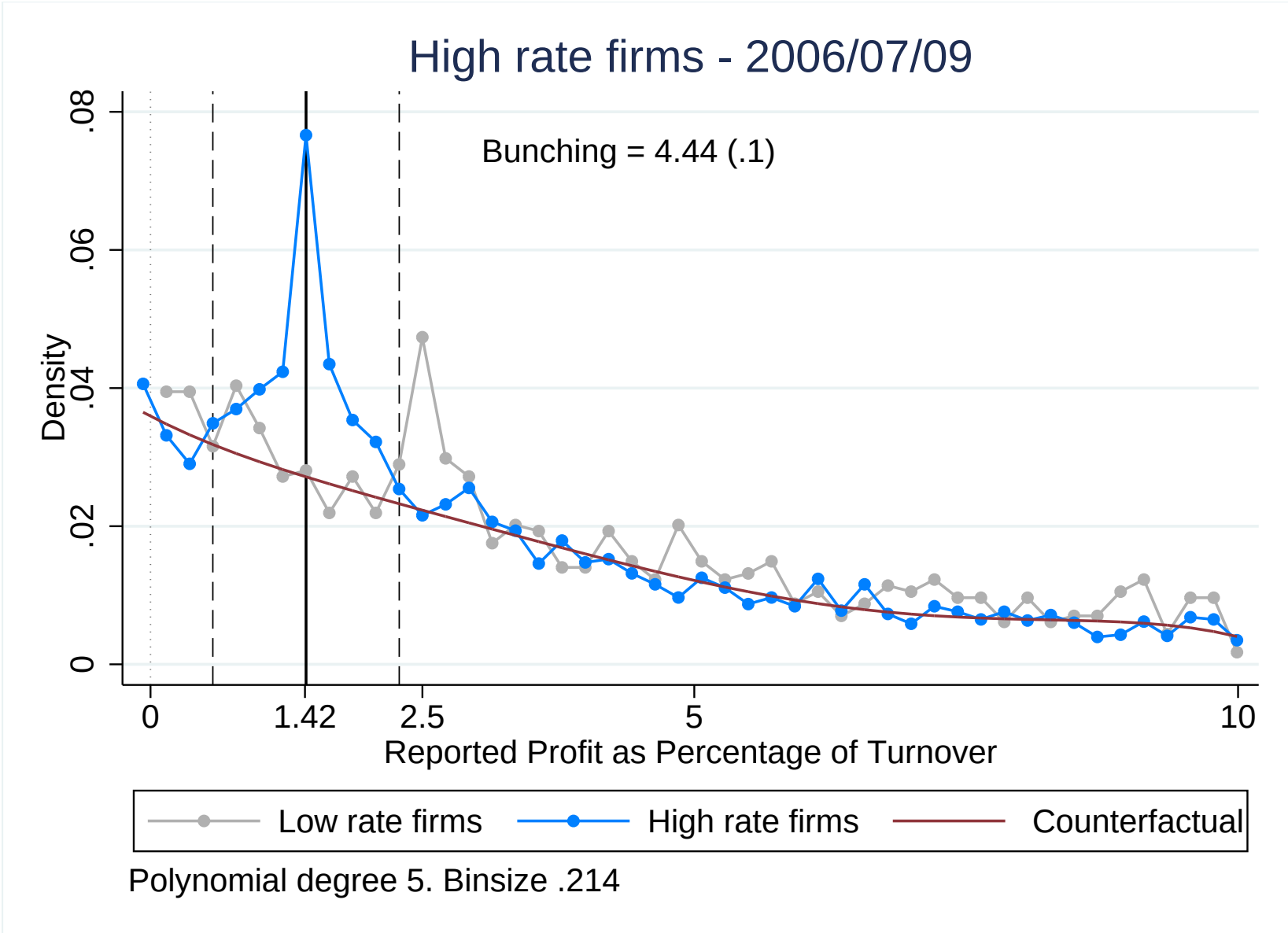
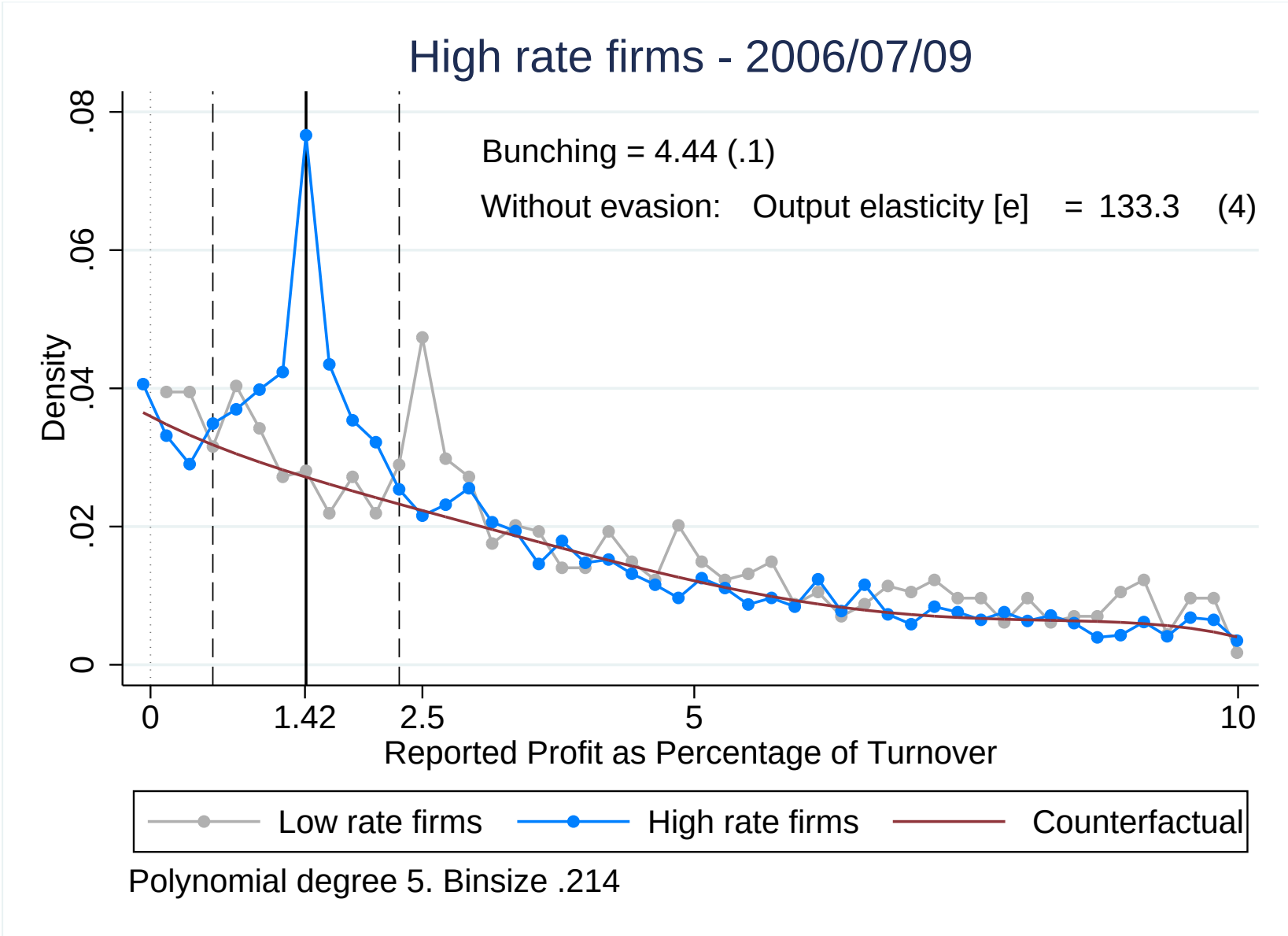


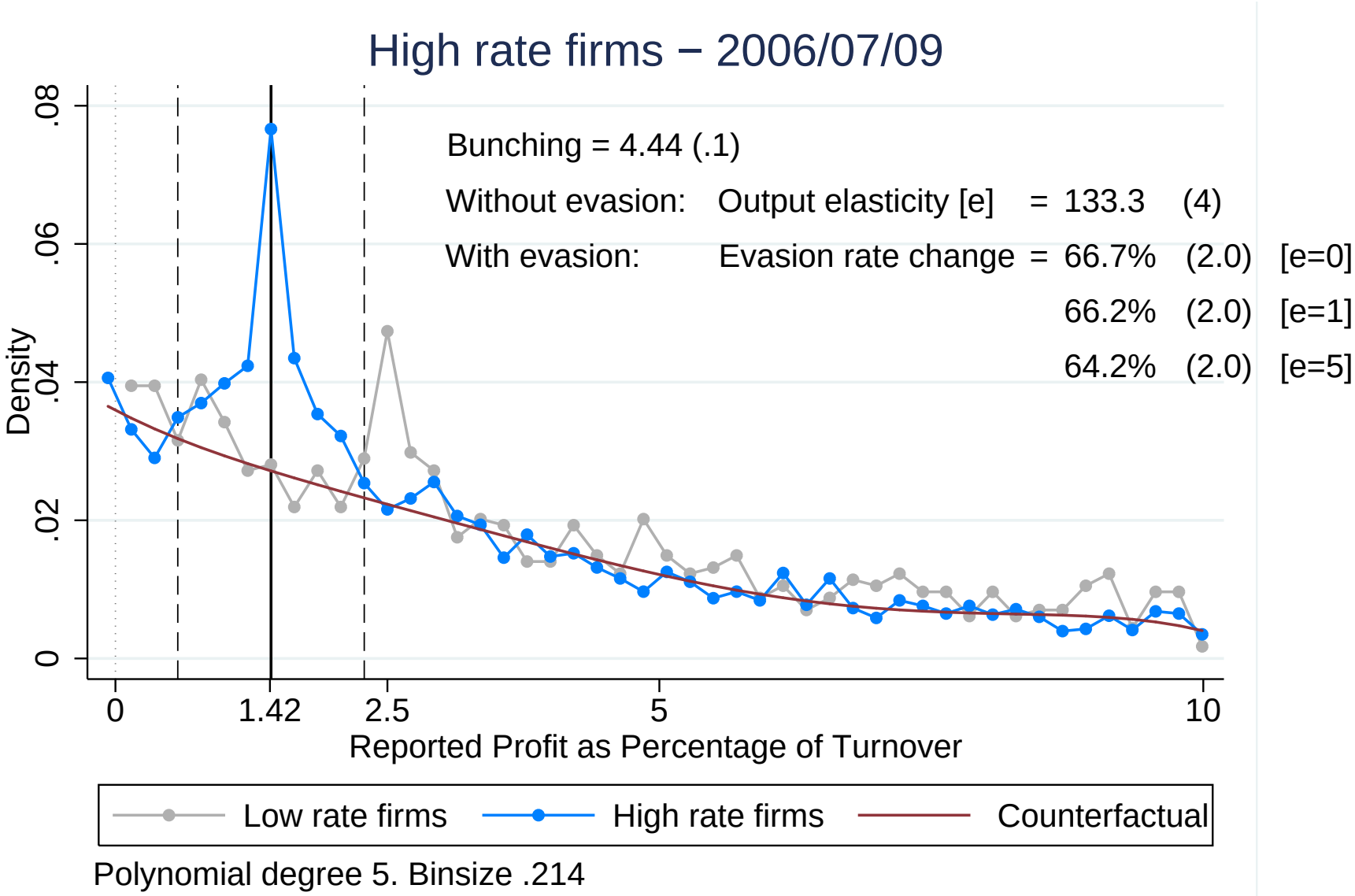
Best *et al.* (2015): Estimating Evasion



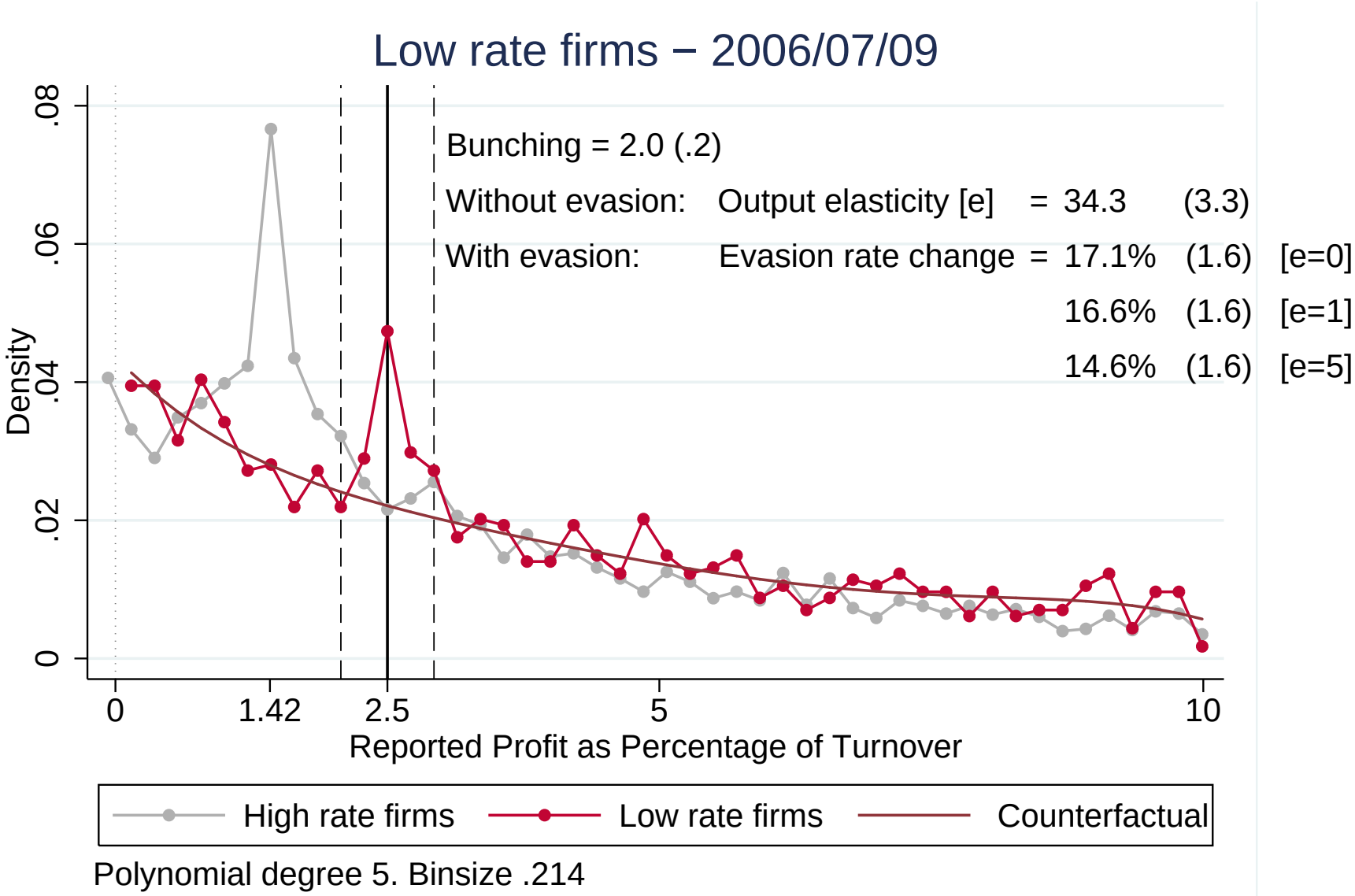
Best *et al.* (2015): Estimating Evasion



Best *et al.* (2015): Estimating Evasion



Best *et al.* (2015): Estimating Evasion



Best *et al.* (2015): Robustness

- **Distortionary profit tax**
  - If $\tau_E > 0$ under profit tax, then turnover tax may improve real incentives

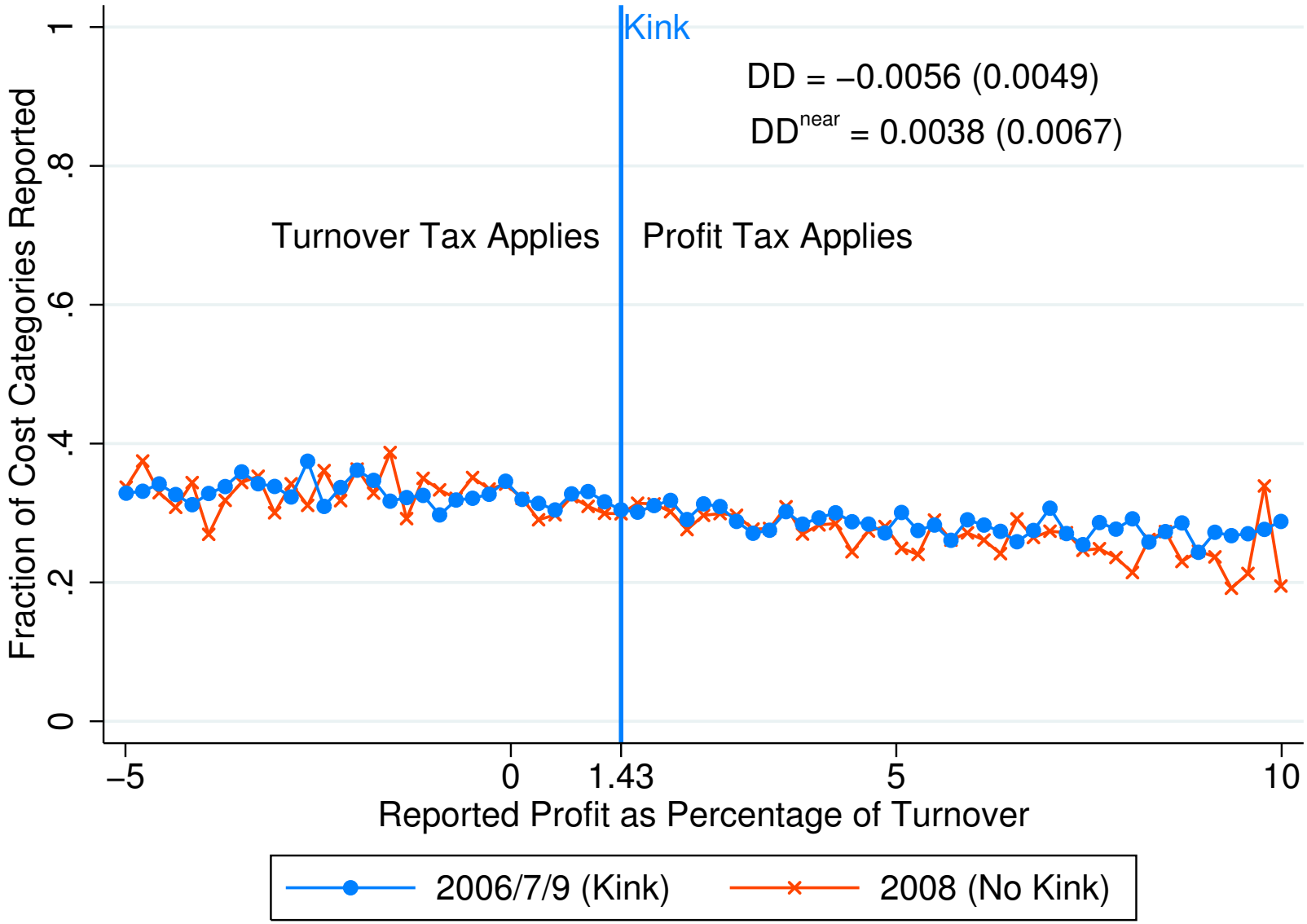
    $\Rightarrow$ firms move away from the kink and **create a hole**
- **Output evasion**
  - If firms can underreport output, the turnover tax reduces output evasion (due to $\tau_y < \tau_\pi$) in addition to cost evasion

    $\Rightarrow$ bunching identifies **combined output and cost evasion**
- **Filing Costs (Lazy Reporting)**
  - If adding line items to return involves a fixed cost, then underreport costs under turnover tax

    $\Rightarrow$ bunching **conflates evasion and filing responses**

    $\Rightarrow$ kink should affect **number of items reported**

Best *et al.* (2015): Testing for Lazy Reporting



Best *et al.* (2015): Numerical Analysis: Methodology

- Welfare increased by broader base and lower rate $(\mu \downarrow, \tau \downarrow)$ if

$$\frac{\tau}{1-\tau} \cdot \frac{\partial \tau_E}{\partial \tau}(\mu) < G(\mu) \cdot \frac{\varepsilon_{\hat{c}-c}}{\varepsilon_y} \simeq -\frac{d(\hat{c}-c)}{\Pi} / \varepsilon_y$$

- lhs $\in [0, 0.54]$. Estimate rhs $\simeq 1.22$
  $\Rightarrow$ welfare gains from broadening base

- Evaluate welfare gains of moving from pure profit tax to pure turnover tax holding aggregate profits fixed
  - Assume iso-elastic production function and evasion cost function
  - Calibrate to match empirical distributions of turnover, costs and evasion rate responses

Best *et al.* (2015): Simulation Results

	Panel A: Pure Turnover Tax			Panel B: Optimal Tax		
Output Elasticity (ε_y)	**Revenue Gain** (%)	**Tax Base** (μ)	**Tax Rate** (τ)	**Revenue Gain** (%)	**Tax Base** (μ)	**Tax Rate** (τ)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0.5	74	0	0.005	76	0.522	0.009
1	73	0	0.005	76	0.706	0.015
5	70	0	0.005	75	0.889	0.037
10	66	0	0.005	75	0.944	0.067
30	62	0	0.005	77	0.986	0.170

Outline

Taxing Firms in Developing Countries

- Pomeranz (AER 2015) *No Taxation Without Information: Deterrence and Self-Enforcement in the Value Added Tax*
- Best, Brockmeyer, Kleven, Spinnewijn & Waseem (JPE 2015) *Production vs Revenue Efficiency With Limited Tax Capacity: Theory and Evidence From Pakistan*
- Benhassine, McKenzie, Pouliquen & Santini (JPubE 2018) *Does Inducing Informal Firms to Formalize Make Sense? Experimental Evidence From Benin*

Benhassine et al (2018): Overview

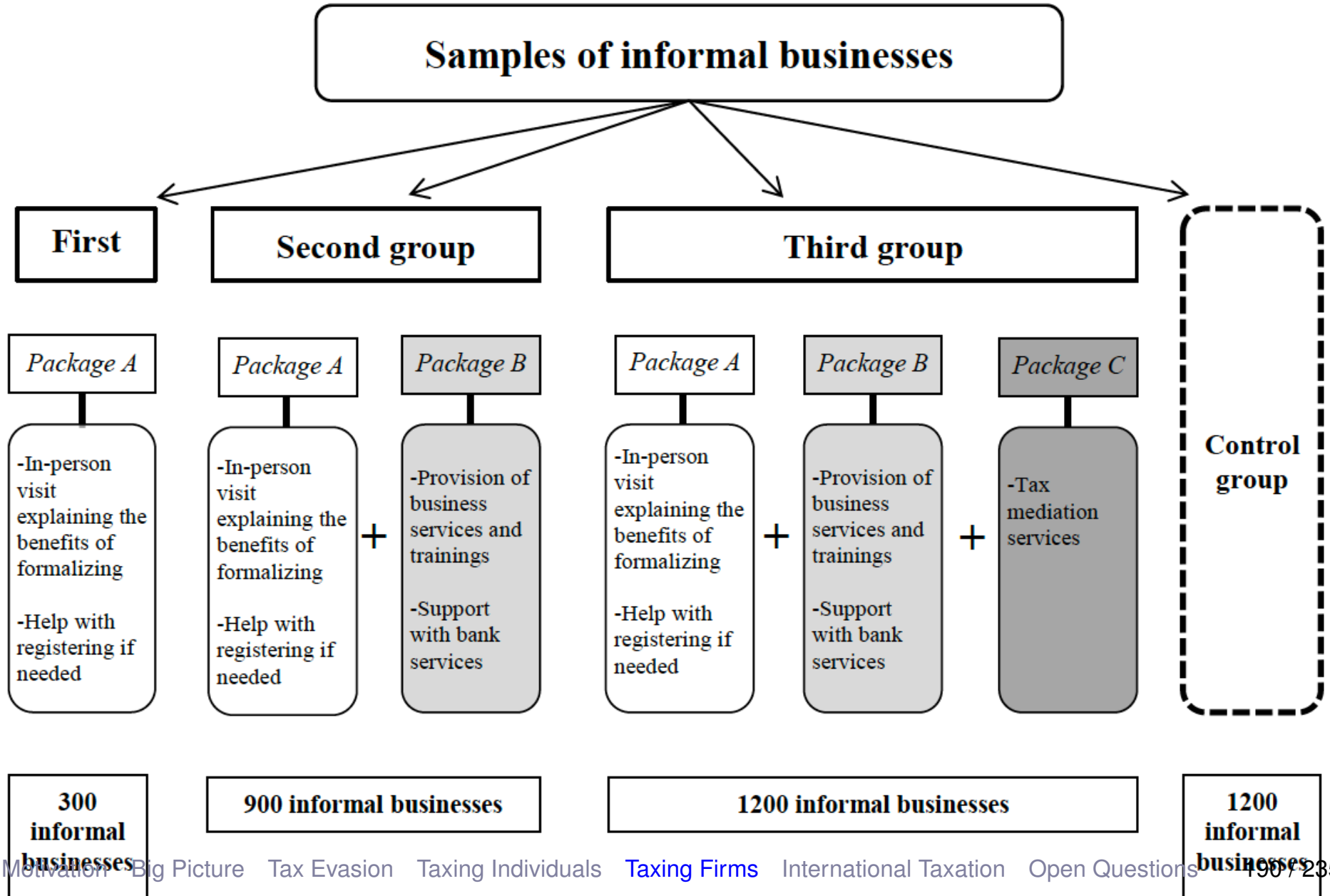
- Informality is widespread in the developing world (LaPorta & Shleifer 2014)
  - Costly for firms: Can't access finance, public contracts etc. (de Soto, 1989)
  - Costly for governments: Lose tax revenues.
- Governments have tried many things to get firms to formalize, but with little success. Should they try harder?
- Conduct experiment in Benin around introduction of simplified legal status *"entreprenant"*
- Conclude:
  - Costs of inducing formalization outweigh benefits to govt and firm
  - Better targeting can tip the balance a bit.

Benhassine et al (2018): Context

- Experiment in Benin: $\sim$70% of GDP and 95% of employment is informal
- In 2011 introduced *entreprenant* legal status. Simplified legal regime for small businesses.
  - one-stop shop for registration
  - Free to register
  - Only require legal ID, a short form, 2 photos
- 4 treatment arms:

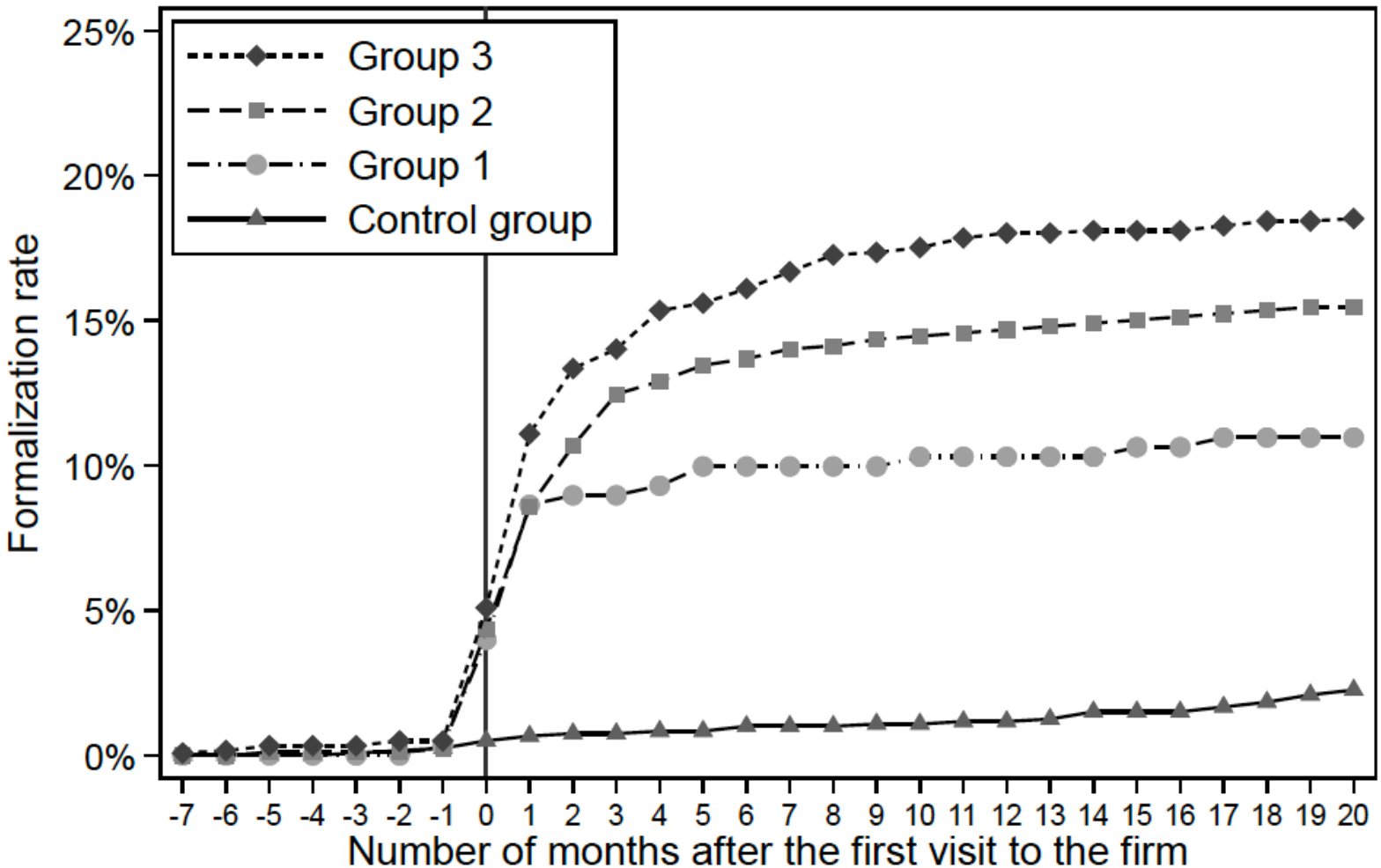
1. Information and assistance to register.
   - 1.1 Send advisors (MA & experience) to explain benefits, leave leaflets.
   - 1.2 Help at the office when registering
2. Treatment 1 + business training workshops, help opening a bank account.
3. Treatment 2 + mediation and tax counseling.
4. Control

Benhassine et al (2018): Experimental Design



Benhassine et al (2018): Formalization

Figure 1: Formalization Rates over Time



Notes: N=3,596
For the control group, date of visit 1 is set at the mode of the visit 1 date for other firms (3 months after program start)

Benhassine et al (2018): Formalization

Table 3: Impact on Formalization

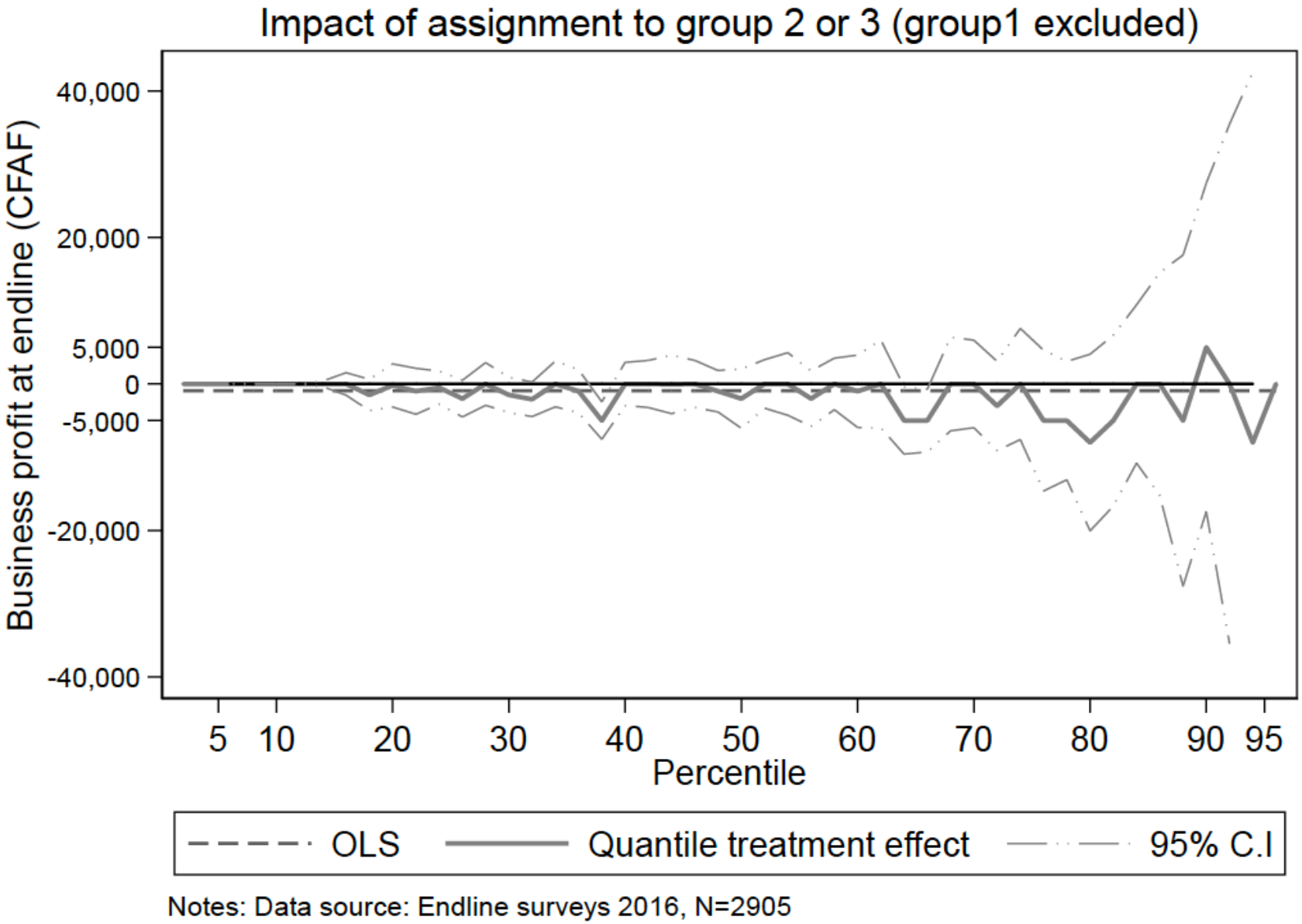
Dependent variables:	(1) Admin. Data (GUFE)	(2) Declared that the business is formal	(3) Showed a document	(4) Declared formality or found in admin. data	(5) Showed a document or found in admin. data
Group 1	0.096***	0.066**	0.069***	0.107***	0.130***
	(0.023)	(0.026)	(0.024)	(0.029)	(0.029)
Group 2	0.130***	0.108***	0.093***	0.143***	0.146***
	(0.014)	(0.017)	(0.015)	(0.018)	(0.018)
Group 3	0.163***	0.128***	0.120***	0.176***	0.181***
	(0.013)	(0.015)	(0.013)	(0.016)	(0.016)
Observations	3,596	3,061	2,929	3,061	2,929
R-squared	0.392	0.436	0.453	0.446	0.464
Adjusted R-squared	0.086	0.072	0.075	0.090	0.094
Mean dependent variable in Control	0.023	0.052	0.026	0.059	0.040
Pvalue Test Group1=Group2	0.175	0.153	0.353	0.257	0.602
Pvalue Test Group1=Group3	0.003	0.017	0.028	0.015	0.075
Pvalue Test Group2=Group3	0.022	0.211	0.066	0.068	0.057
Pvalue Test Group1=Group2=Group3	0.002	0.037	0.026	0.016	0.049
Pvalue Test Group1=Group2=Group3=0	0.000	0.000	0.000	0.000	0.000

Benhassine et al (2018): Firm Performance

Table 5 : Impact on Firm Performances

	(1) Total sales in the last day$^{\alpha\beta}$ (CFAF)	(2) Total sales in the last week$^{\alpha\beta}$ (CFAF)	(3) Last month profit$^{\alpha\beta}$ (CFAF)	(4) Summary index of sales and profit$^{\alpha\beta}$	(5) Total number of employees$^{\alpha}$	(6) Any tax paid for business activity in 2015^{B}	(7) Sum of all taxes paid in 2015^{B} (CFAF)
1st stage: impact of treatment allocation:							
Group1 X year1 (b1)	2,228	12,496	-8,053*	0.008	-0.22**	0.013	-19
	(2,754)	(14,029)	(4,798)	(0.057)	(0.10)	(0.030)	(1,747)
Group2 X year1 (b2)	540	-7,376	-3,016	-0.052*	-0.06	0.048***	-51
	(1,451)	(7,312)	(3,021)	(0.031)	(0.09)	(0.018)	(1,091)
Group3 X year1 (b3)	-114	-1,224	-3,106	-0.010	-0.11	0.005	-2,041**
	(1,384)	(6,399)	(2,858)	(0.030)	(0.08)	(0.016)	(949)
Group1 X year2 (c1)	602	12,192	470	0.041	-0.09	-0.066**	-3,308**
	(2,930)	(14,243)	(5,742)	(0.060)	(0.10)	(0.030)	(1,678)
Group2 X year2 (c2)	1,246	-5,235	-874	-0.007	0.05	-0.055***	-3,413***
	(1,832)	(8,010)	(3,377)	(0.036)	(0.07)	(0.018)	(1,047)
Group3 X year2 (c3)	1,847	3,998	242	0.026	0.08	-0.067***	-5,967***
	(1,669)	(7,911)	(3,233)	(0.035)	(0.07)	(0.017)	(869)

Benhassine et al (2018): Firm Performance



Notes: Data source: Endline surveys 2016, N=2905

Benhassine et al (2018): Total Costs

Table 6: Cost Effectiveness Analysis

	In CFAF			In USD		
	Group 1	**Group 2**	**Group 3**	**Group 1**	**Group 2**	**Group 3**
Program costs:						
Total Program costs	**21,304,850**	**154,397,653**	**195,493,401**	**35,746**	**259,056**	**328,009**
Costs by intervention:						
One-stop-shop for formalization	6,325,293	18,975,879	25,301,172	10,613	31,839	42,452
Interventions to increase take up	14,979,557	135,421,774	170,192,229	25,133	227,218	285,557
Costs by types:						
Total set up costs	5,728,222	36,001,489	45,733,290	9,611	60,405	76,734
Total variable costs	15,576,628	118,396,164	149,760,111	26,135	198,651	251,275

Benhassine et al (2018): Cost-Effectiveness

Cost per formalization						
Number of businesses	301	899	1199	301	899	1199
Program impact:						
Impact on formalization (in pp)	9.6%	13.0%	16.3%	9.6%	13.0%	16.3%
Number of firms which formalized because of the program	29	117	195	29	117	195
Total costs…						
… per business included in treatment	70,780	171,744	163,047	119	288	274
… per formalization	737,294	1,321,106	1,000,289	1,237	2,217	1,678
Variable costs…						
… per business included in treatment	51,750	131,698	124,904	87	221	210
… per formalization	539,058	1,013,059	766,283	904	1,700	1,286
Cost effectiveness						
Expected increase in tax revenue (see appendix 5 for more details)	27,185	27,185	27,185	46	46	46
Number of years before tax revenue are greater than cost per formalization[α]	19	35	29	19	35	29

Benhassine et al (2018): Heterogeneous Treatment Effects

Table 7: Heterogeneous Impact on Formalization by Baseline Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variables:	**Formalized: GUFE data**							
Variable for heterogeneous analysis:	Female owner	Operates in Dantokpa market	Trader	Doesn't look like formal species	Index of business size below median	Does not have secondary education	One visit or fewer from tax inspectors	Female owner (sample restricted[α])
Impact in group [...] for heterogeneous variable=0								
Group1	0.134***	0.105***	0.144***	0.125**	0.085***	0.140***	0.124**	0.168***
	(0.035)	(0.026)	(0.032)	(0.055)	(0.032)	(0.036)	(0.054)	(0.045)
Group2	0.192***	0.151***	0.178***	0.224***	0.139***	0.175***	0.176***	0.232***
	(0.024)	(0.016)	(0.021)	(0.035)	(0.020)	(0.024)	(0.036)	(0.031)
Group3	0.206***	0.179***	0.195***	0.231***	0.151***	0.218***	0.214***	0.216***
	(0.021)	(0.014)	(0.019)	(0.032)	(0.018)	(0.022)	(0.033)	(0.027)
Additional impact in group [...] for heterogeneous variable=1								
Group1 x Heterogenous variable (int1)	-0.063	-0.048	-0.089**	-0.036	0.022	-0.074	-0.035	-0.068
	(0.046)	(0.054)	(0.045)	(0.061)	(0.046)	(0.049)	(0.061)	(0.072)
Group2 x Heterogenous variable (int2)	-0.096***	-0.100***	-0.086***	-0.115***	-0.017	-0.073**	-0.056	-0.125***
	(0.029)	(0.034)	(0.028)	(0.039)	(0.029)	(0.033)	(0.041)	(0.047)
Group3 x Heterogenous variable (int3)	-0.070***	-0.080***	-0.058**	-0.083**	0.022	-0.096***	-0.064*	-0.052
	(0.026)	(0.031)	(0.025)	(0.036)	(0.026)	(0.031)	(0.038)	(0.042)
Observations	3,596	3,596	3,596	3,596	3,596	3,596	3,596	1,619

Outline

Outline

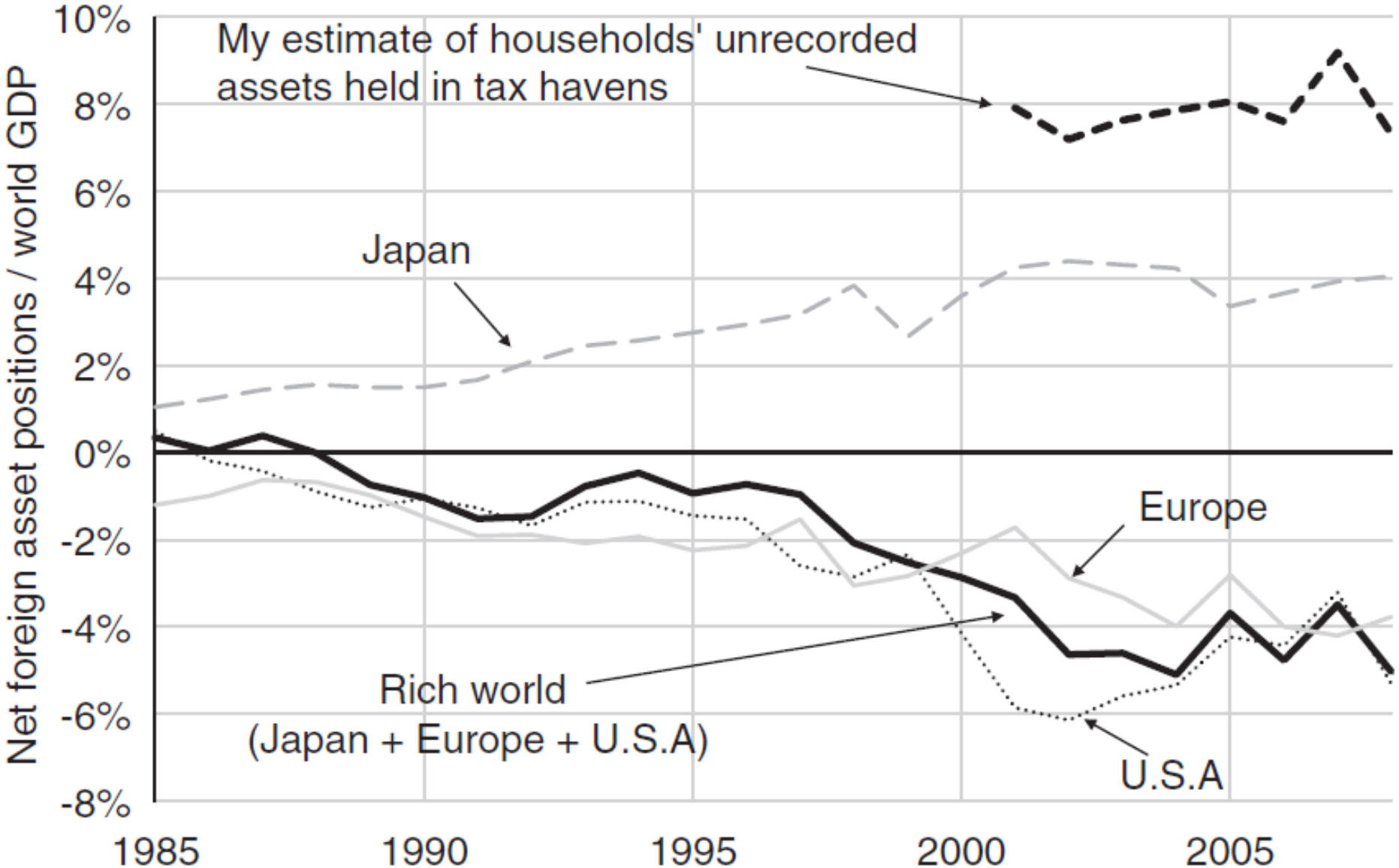
International Taxation and Developing Countries

- Zucman (QJE 2013) *The Missing Wealth of Nations: Are Europe and the US Net Debtors or Net Creditors?*
- Fisman & Wei (JPE 2004) *Tax Rates and Tax Evasion: Evidence from "Missing Imports" in China*
- Sequeira (AER 2016) *Corruption, Trade Costs, and Gains from Tariff Liberalization: Evidence from Southern Africa*

Zucman (2013): Overview

- At the global level, liabilities > assets. The world is a net debtor!
- Capital seems to be moving away from the rich world, EU and US net debtors. “China owns the world”
- Zucman: This is a statistical illusion. Accounting for offshore wealth properly $\rightarrow$ EU and US are net creditors.

Zucman (2013): Overview



Zucman (2013): Definitions

- Each country's International Investment Position (IIP) shows its foreign assets and liabilities.

TABLE I

SECURITIES FORM THE BULK OF CROSS-BORDER WEALTH

	Trillions of current US$	% of world GDP
Securities	40.1	65
Bonds	26.4	43
Equities (including mutual fund shares)	13.7	22
Foreign direct investment	17.7	29
Other (loans, deposits, etc.)	32.0	52
Total cross-border wealth	89.9	146

Notes. World GDP (2008) = US$61.4 trillion. Values are as of end of 2008. Securities include all "portfolio investments" and the fraction of "reserve assets" invested in equities and bonds. In international investment statistics, all mutual fund shares are classified as equities (irrespective of whether the funds invest in equities or bonds). Derivatives are excluded because they are not measured yet in all leading economies. *Source*. IMF Balance of Payments Statistics and the updated and extended version of the External Wealth of Nations database constructed by Lane and Milesi-Ferretti (2007).

Zucman (2013): Definitions

- Denote by A_{ij} the amount of securities issued by country j and owned by residents of country i
- Covered agents: Large banks etc, report directly a_{ij}. Others (households) indirectly $\tilde{a}_{ij}$
- Securities are entrusted to a bank somewhere for custody, in country k

$$A_{ij} = \sum_k A_{ij}^k = \sum_k \left(a_{ij}^k + \tilde{a}_{ij}^k \right) =$$

$$\underbrace{\left[a_{ij}^i + \tilde{a}_{ij}^i \right]}_{\text{onshore}} + \underbrace{\sum_{k \neq i} \left(a_{ij}^k + \tilde{a}_{ij}^k \right)}_{\text{offshore}}$$

- The problem: The $\tilde{a}_{ij}^k$ aren't recorded in i or k
- The trick: The $\tilde{a}_{ij}^k$ are liabilities in j

Zucman (2013): Swiss Case Study

TABLE II

LARGE PORTFOLIOS OF SECURITIES ARE HELD IN SWISS BANKS BY FOREIGNERS

	Belonging to foreigners	Belonging to Swiss residents
Foreign securities	1,545	810
Bonds	540	484
Equities	1,005	326
(of which: mutual fund shares)	767	196
Fiduciary bank deposits	478	45
Total	2,022	855

Notes. Values are in billions of current U.S. dollars, as of end 2008. *Source*. Securities: Swiss National Bank's *Monthly Statistical Bulletin* (http://www.snb.ch/en/iabout/stat/statpub/statmon/stats/statmon), series $D5_1$, $D5_{1a}$, $D5_1$, $D5_{1b}$, $D5_2$, and $D5_{2b}$ and *Banks in Switzerland* (http://www.snb.ch/en/iabout/stat/statpub/bchpub/stats/bankench), series 38a, 38b, 38c. Fiduciary deposits: *Monthly Statistical Bulletin*, series $D4$, $D4_{1a}$, $D4_{2a}$, and *Banks in Switzerland* series 36, 37, 38.

Zucman (2013): Swiss Case Study

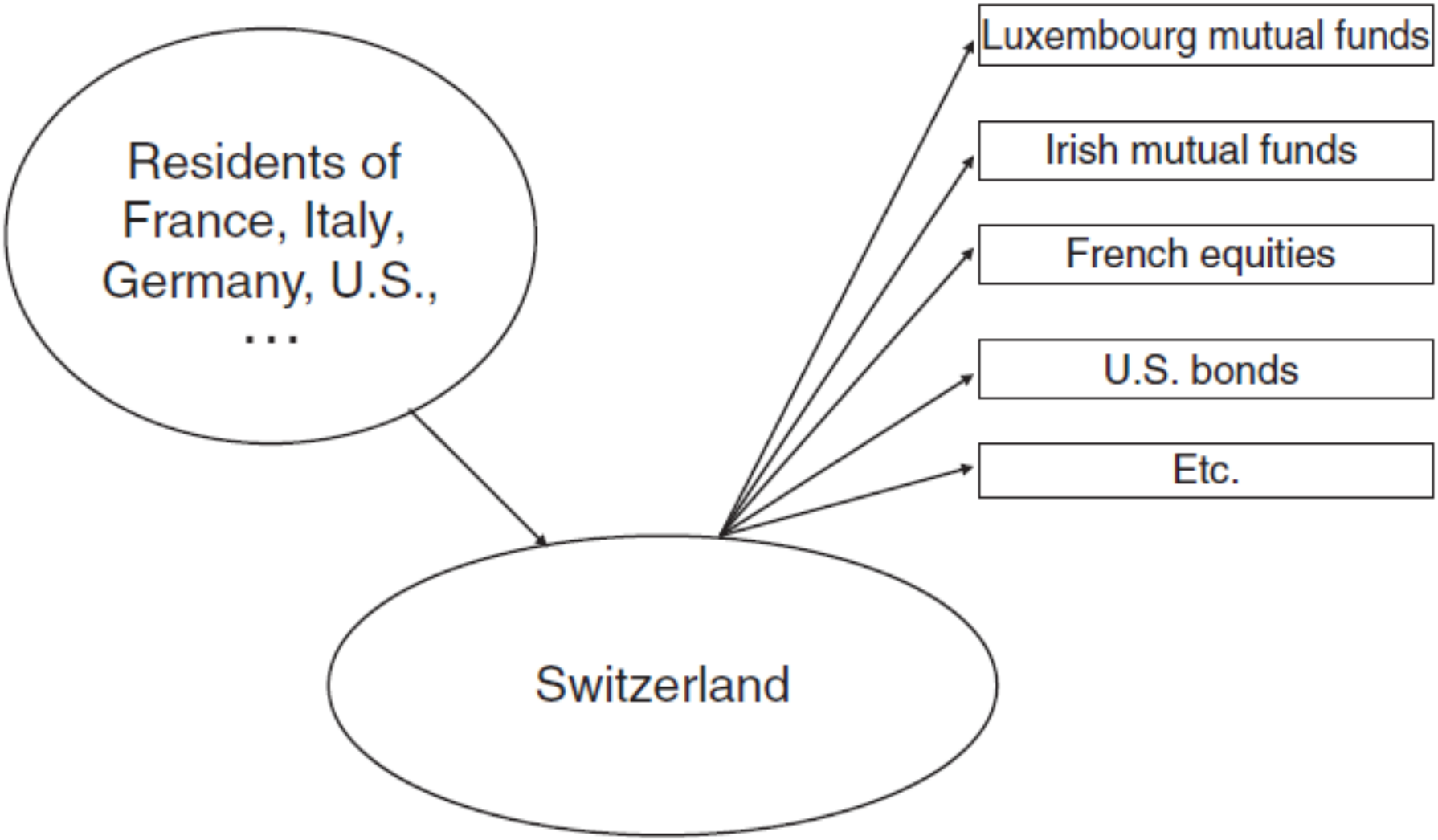


FIGURE II

Through Their Swiss Accounts, Foreigners Mostly Invest in Mutual Funds

Zucman (2013): Swiss Case Study

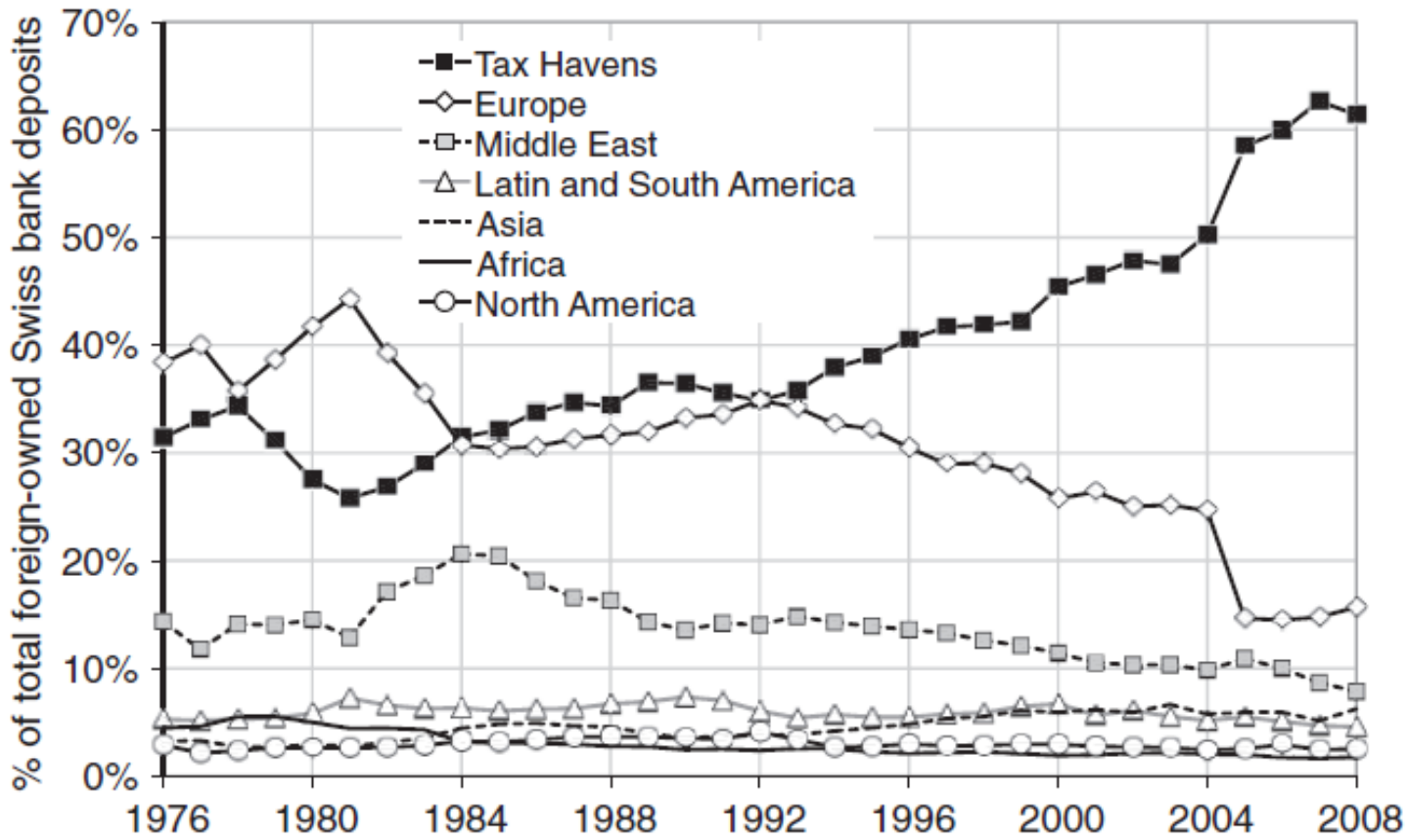


FIGURE III

Most Swiss Accounts Probably Belong to Europeans

This figure shows which countries' residents own Swiss fiduciary bank deposits, as reported by the Swiss National Bank (SNB). The SNB does not see through the sham corporations with addresses in such places as Panama or the British Virgin Islands used by European, U.S., and other rich countries' households as nominal owners of their accounts. This explains the high share of deposits assigned to tax havens. *Source*: Online Appendix Table A25.

Zucman (2013): Estimating Total Offshore Wealth

- e.g. French hh holds Luxembourg asset through Swiss bank.
  - no French record
  - Switzerland records nothing
  - Luxembourg records liability
- Generalize: L_j= liabilities of country j A_{ij} true assets i holds on j. $\hat{A}_{ij}$ statistical estimate of A_{ij}

$$\sum_j L_j > \sum_j \sum_i A_{ij}$$

- As a result, more dividends and interest will be paid than received too.

Zucman (2013): Estimating Total Offshore Wealth

- This applies in flows too: e.g. a US individual uses Bahamian account to buy a UK equity.
- $\Rightarrow$ if offshore account holders are net buyers of securities, more securities sold than purchased globally.
- To measure assets assume:
  1. direct reporters and onshore household assets measured correctly
  2. global portfolio liabilities accurately recorded
- Then difference between liabilities and assets captures tax haven wealth.

$$\Omega = \sum_i L_i - \sum_i \hat{A}_i$$

Zucman (2013): Results

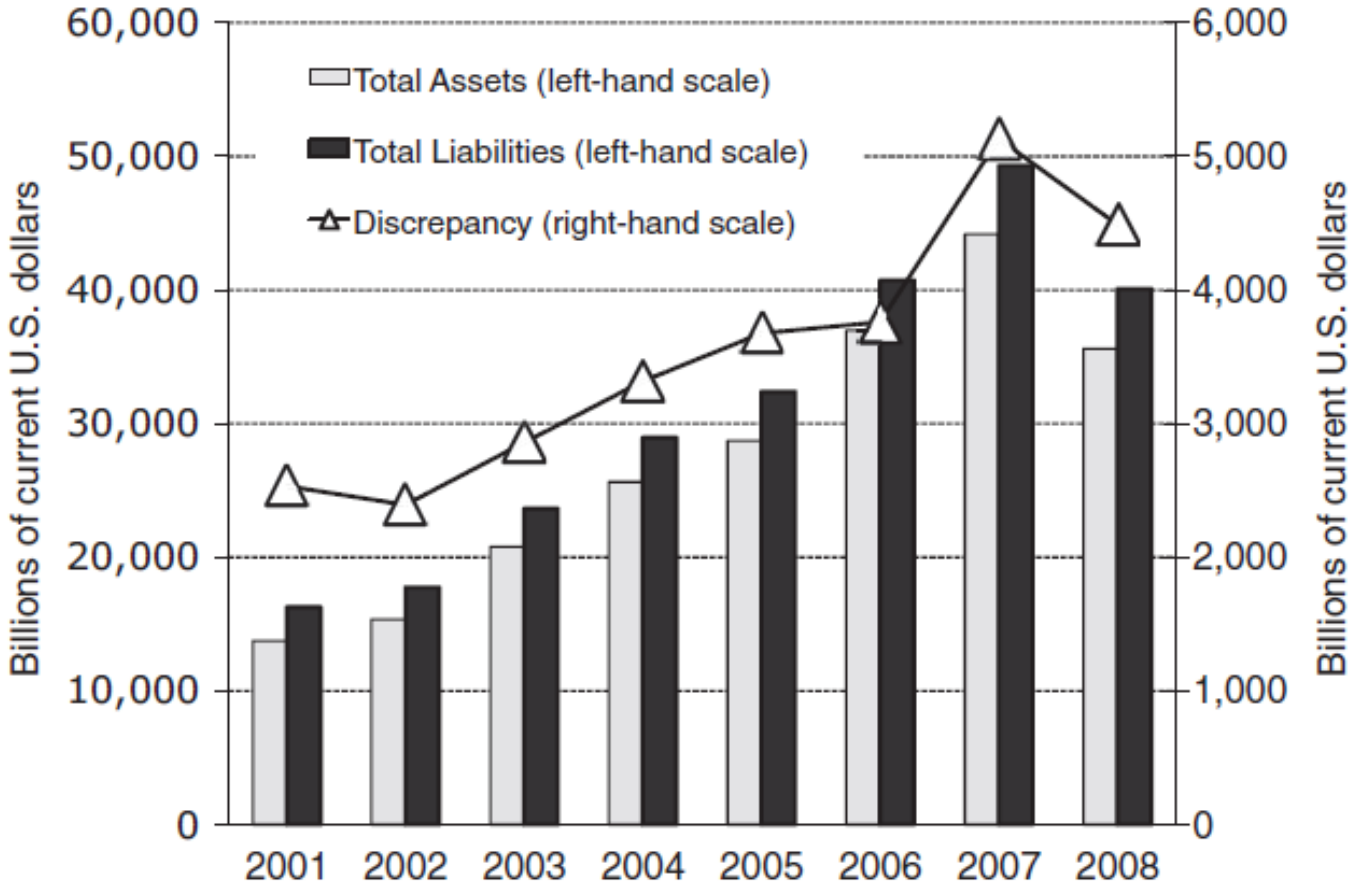


FIGURE IV

Each Year, Less Securities Assets Are Recorded Than Liabilities

This figure charts the securities assets and liabilities identifiable worldwide. Securities include all equities and bonds classified as portfolio investments or reserves. The totals cover 237 countries and territories along with international organizations. *Source*: Online Appendix Table A3.

Zucman (2013): Results

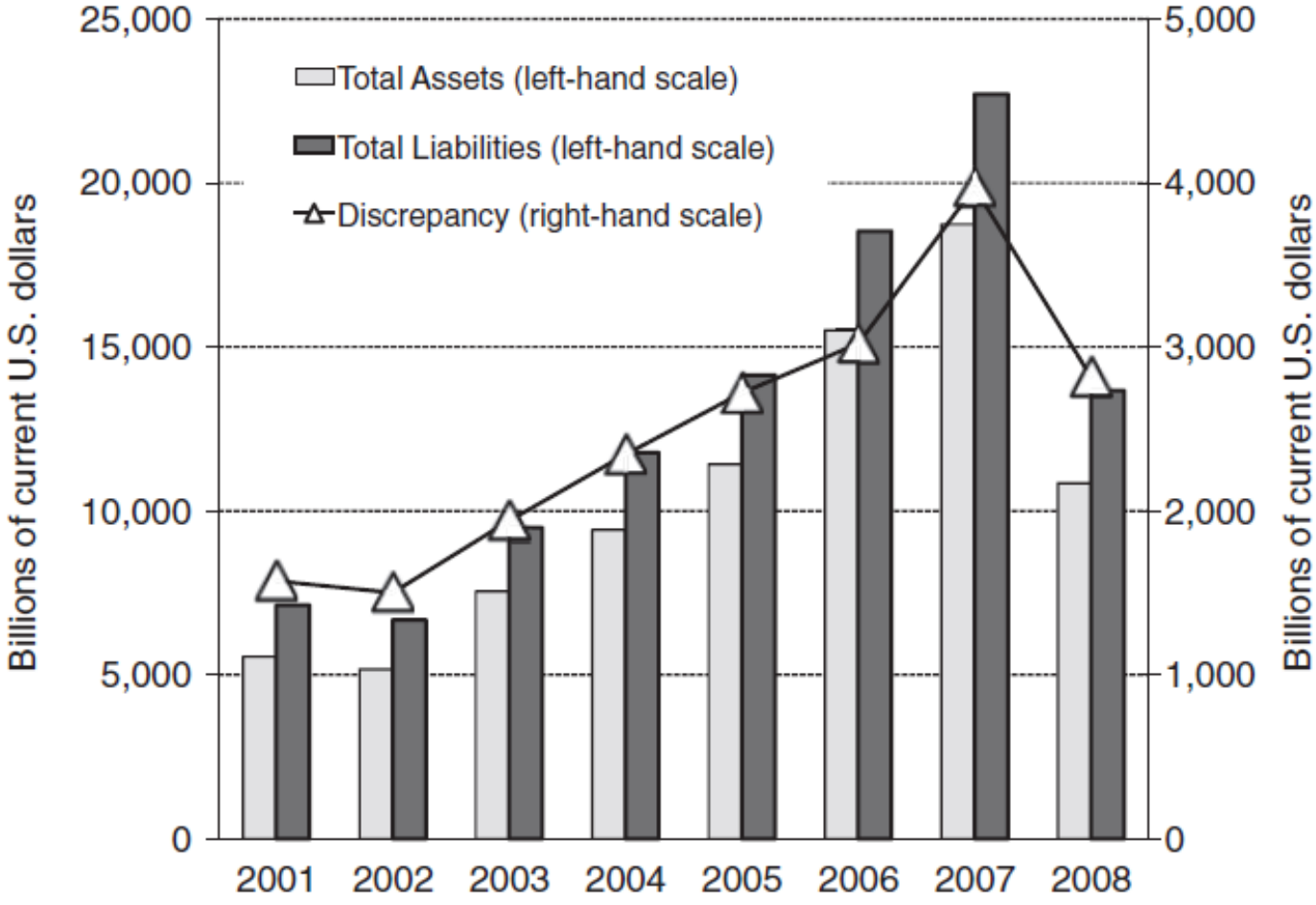


FIGURE V

Each Year, Less Equity Assets Are Recorded Than Liabilities

This figure charts the equity assets and liabilities identifiable worldwide. Equities include all equities classified as portfolio investments or reserves. The totals cover 237 countries and territories along with international organizations. *Source*: Online Appendix Table A3.

Zucman (2013): Results

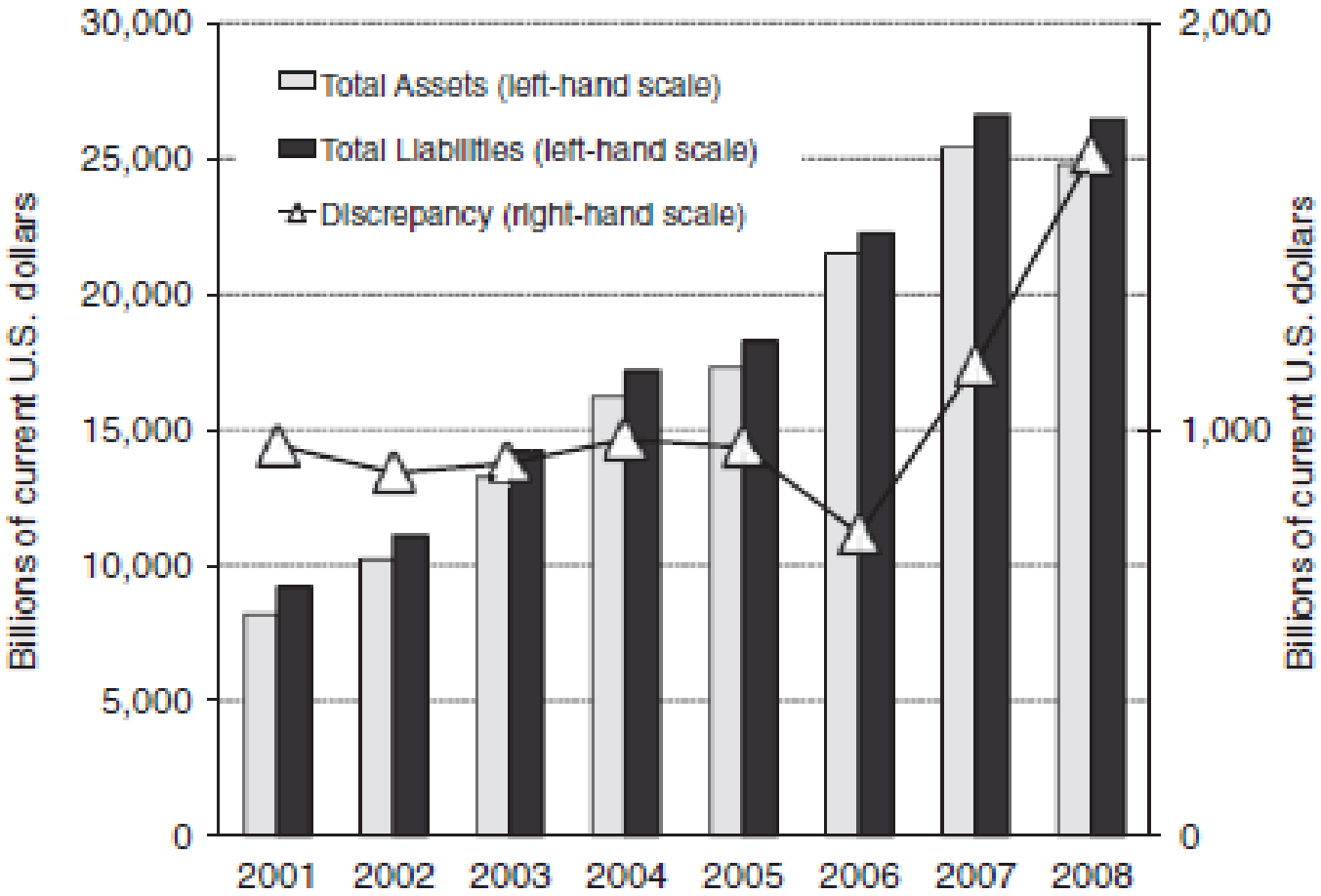


FIGURE VI

Each Year, Less Bond Assets Are Recorded Than Liabilities

This figure charts the bond assets and liabilities identifiable worldwide. Bonds include all debt securities classified as portfolio investments or reserves. The totals cover 237 countries and territories along with international organizations. *Source*: Online Appendix Table A3.

Zucman (2013): Results

TABLE III

ESTIMATED OFFSHORE WEALTH, WORLD AND SWITZERLAND

	World	Switzerland
Offshore securities	4,490	1,545
Bonds	37%	35%
Equities	63%	65%
(Of which: mutual fund shares)	48%	50%
Offshore bank deposits	1,388	478
Total offshore financial wealth	5,878	2,022

Zucman (2013): Results

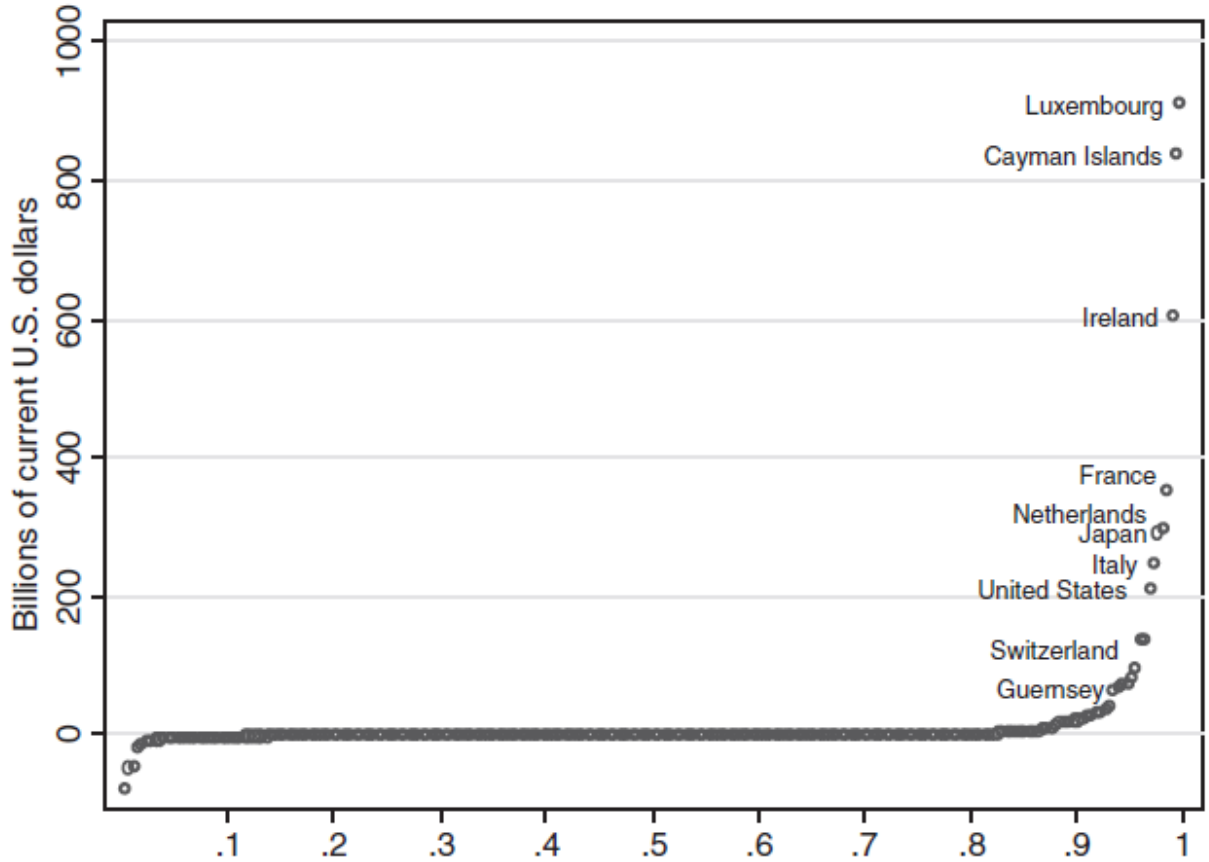


FIGURE VII

Many Mutual Fund Shares Have no Readily Identifiable Owners in the Official Statistics

Each dot represents a country j and is equal to the difference between the securities liabilities reported in 2008 by j (L_j) and the sum of the securities assets on j held by 236 countries i and international organizations ($\sum_i \hat{A}_{ij}$). The securities issued by Luxembourg, the Cayman Islands, and Ireland are mostly mutual fund shares. *Source*: Online Appendix Tables A13 and A14.

Zucman (2013): Results

TABLE V

ACCOUNTING FOR THE WEALTH IN TAX HAVENS CAN TURN THE EUROZONE INTO A NET CREDITOR

Share (%) of offshore portfolios in Switzerland belonging to eurozone residents	Share (%) of offshore portfolios in havens other than Switzerland belonging to eurozone residents			
	0	25	50	75
0	−11	−6	0	6
40	−6	0	5	11
50	−5	1	7	12
60	−3	2	8	13

Notes. The official eurozone's net foreign asset position/GDP ratio averaged −11% over the 2001–2008 period. If eurozone residents owned 40% of the unrecorded assets held through Switzerland and 50% of those held through the other tax havens, the true net foreign asset position/GDP ratio of the eurozone averaged +5%. *Source*. Online Appendix Table A28.

Zucman (2013): Results

TABLE VI

ACCOUNTING FOR THE WEALTH IN TAX HAVENS IMPROVES THE U.S. NET FOREIGN ASSET POSITION

Share (%) of offshore portfolios in Switzerland belonging to U.S. residents	Share (%) of offshore portfolios in havens other than Switzerland belonging to U.S. residents			
	0	25	50	75
0	−18	−13	−9	−5
5	−17	−13	−8	−4
15	−16	−12	−7	−3

Notes. The official U.S. net foreign asset position/GDP ratio averaged −18% over the 2001–2008 period. If U.S. residents owned 15% of the unrecorded assets held through Switzerland and 25% of those held through the other tax havens, the true net foreign asset position/GDP ratio of the U.S. averaged −12%. *Source*. Online Appendix Table A29.

Outline

International Taxation and Developing Countries

- Zucman (QJE 2013) *The Missing Wealth of Nations: Are Europe and the US Net Debtors or Net Creditors?*
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- Sequeira (AER 2016) *Corruption, Trade Costs, and Gains from Tariff Liberalization: Evidence from Southern Africa*

Fisman & Wei (2004): Overview

- How does tax evasion respond to tax rates?
  - Theoretically ambiguous (e.g. Allingham-Sandmo dependence on risk preferences)
  - Hard to measure evasion directly
- Here: Direct (noisy) measure of evasion: Difference between amount exported to China from Hong Kong (reported by HK) and the amount imported to China from Hong Kong (reported by China).
  - Correlate evasion gap with tax rates in China
  - Diff in Diff around reforms to tariffs in China in 1997
- Conclusion: Evasion very sensitive to tax rates.

Fisman & Wei (2004): Data

- Data on trade flows from WB World Integrated Trade Solution (WITS) database.
- Trade flows (Value and quantity) at 6-digit-product-origin-destination-year level.
- gap_value=$\log$ (export_value)-$\log$ (import_value)
- Focus on variation *within* 4-digit HS-codes in tariff rates.
- Add in Chinese VAT rates

Fisman & Wei (2004): Basic Results

$$\log(\text{export\_value}_k) - \log(\text{import\_value}_k) = \alpha + \beta \text{tax}_k + e_k$$

TABLE 5
EFFECT OF TAX RATES ON EVASION (Measured in Value)

	REGRESSION						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax rate	2.93	2.46	3.21	3.57	2.98	2.61	3.4
	(.74)	(.67)	(.87)	(.89)	(.81)	(.79)	(.96)
Constant	−1.31	−1.04	−1.31	−1.48	−1.29	−1.12	−1.46
	(.29)	(.23)	(.30)	(.31)	(.29)	(.27)	(.34)
Excluding outliers?	no	yes	no	no	yes	yes	yes
Excluding products lacking tax on similar products?	no	no	yes	no	no	yes	yes
Excluding products lacking observations on quantities?	no	no	no	yes	yes	no	yes
Observations	1,663	1,639	1,470	1,102	1,087	1,450	968
R^2	.020	.017	.022	.031	.025	.017	.029

NOTE.—The dependent variable is log(value of exports from Hong Kong to China) − log(value of imports to China from Hong Kong). Robust standard errors are in parentheses, accounting for clustering of standard errors by four-digit HS.

Fisman & Wei (2004): Substitution

- Stronger incentives to misclassify items if similar products face higher rates. $\rightarrow$ Include avg (tax_o), average of other products in same 4-dig group.

INCORPORATING THE AVERAGE TAX ON SIMILAR PRODUCTS
Dependent Variable: Log(Value of Exports from Hong Kong to China) − Log(Value of Imports to China from Hong Kong)

	REGRESSION				
	(1)	(2)	(3)	(4)	(5)
Tax rate		6.07	5.31	8.32	7.46
		(1.37)	(1.25)	(1.56)	(1.42)
Tax on similar products	2.62	−3.16	−2.98	−4.65	−4.45
	(.90)	(1.39)	(1.33)	(1.58)	(1.53)
Constant	−1.09	−1.20	−1.02	−1.56	−1.33
	(.034)	(.31)	(.28)	(.38)	(.35)
Excluding outliers?	no	no	yes	no	yes
Excluding products lacking observations on quantities?	no	no	no	yes	yes
Observations	1,470	1,470	1,450	981	968
R^2	.014	.025	.020	.041	.035

NOTE.—Robust standard errors are in parentheses, accounting for clustering of standard errors by four-digit HS.

Fisman & Wei (2004): Quantities v Values

- Replace LHS with quantities

EVASION IN PHYSICAL QUANTITIES
Dependent Variable: Log(Quantity of Exports from Hong Kong to China) − Log(Quantity of Imports to China from Hong Kong)

	REGRESSION					
	(1)	(2)	(3)	(4)	(5)	(6)
Tax rate	1.13	1.14	.69		8.37	8.12
	(.93)	(1.11)	(.83)		(2.20)	(1.77)
Tax on similar products				.08	−7.93	−8.31
				(1.13)	(2.23)	(1.84)
Constant	−1.05	−1.08	−.92	−.68	−.85	−.65
	(.33)	(.40)	(.30)	(.40)	(.40)	(.36)
Excluding products lacking observations on avg(tax_*o*)?	no	yes	no	yes	yes	yes
Excluding outliers?	no	no	yes	no	no	yes
Observations	1,102	981	1,082	981	981	962
R^2	.003	.002	.001	.000	.015	.019

NOTE.—Robust standard errors are in parentheses, accounting for clustering of standard errors by four-digit HS.

Fisman & Wei (2004): Diff in Diff

- Use changes in Chinese tariff rates in 1997

TABLE 10

TAX AND EVASION IN FIRST DIFFERENCES, 1997–98

	DEPENDENT VARIABLE: Change in Gap_Value between 1997 and 1998		DEPENDENT VARIABLE: Change in Gap_Qty between 1997 and 1998	
	(1)	(2)	(3)	(4)
Change in tax rate	1.71	5.60	1.88	5.78
	(.85)	(1.92)	(1.48)	(2.91)
Change in tax on similar products		−3.97		−4.72
		(2.30)		(3.55)
Constant	.036	.01	.11	.05
	(.060)	(.063)	(.08)	(.091)
Observations	1,617	1,430	1,042	938
R^2	.004	.008	.002	.005

NOTE.—Robust standard errors are in parentheses, accounting for clustering of standard errors by four-digit HS.

Outline

International Taxation and Developing Countries

- Zucman (QJE 2013) *The Missing Wealth of Nations: Are Europe and the US Net Debtors or Net Creditors?*
- Fisman & Wei (JPE 2004) *Tax Rates and Tax Evasion: Evidence from "Missing Imports" in China*
- Sequeira (AER 2016) *Corruption, Trade Costs, and Gains from Tariff Liberalization: Evidence from Southern Africa*

Sequeira (2016): Overview

- How does behavior (trade volumes) respond to taxes (tariffs)?
- Existing literature finds small effects. Puzzling.
- This paper:
  - When people are evading the tariffs, changing their levels doesn't matter that much.
  - However, tariff liberalization increases honest reporting and transfers (bribes) to public officials.

1. Trade-flow data yields elasticity of trade to tariffs of 0.1
2. Firm-level data confirms no impact on intensive or extensive margins
3. Bribe data shows bribes change when tariffs change.

Sequeira (2016): Aggregate Trade Flows

- Context: Trade between Mozambique and South Africa.
- Mozambique joined Southern African Development Community (SADC) in 1992. Implies big changes in tariffs up to 2015 to harmonize with trade bloc.
- Affects some products but not others.

TABLE 1—COMPARABILITY OF TRADE PATTERNS AND PRODUCT CHARACTERISTICS ACROSS TREATMENT AND CONTROL PRODUCTS, PRIOR TO THE 2008 TARIFF CHANGE

	Treatment products		Comparison products		Difference t-test/χ^2 p-value
	Mean	SD	Mean	SD	
Panel A. Patterns of trade ($N = 4{,}660$)					
Share of imports (quantities)	38.1	492.5	241.2	5244.4	0.20
Share of imports (value)	22.2	237.2	33.84	341.2	0.19
Unit value	4.82	53.7	6.21	83.3	0.51
Panel B. Product characteristics ($N = 265$)					
Shipment value per ton (USD)	44,027	179,869	410,508	2,959,621	0.25
Number of containers per shipment	7.99	2.606	7.4	3.173	0.10
Bulk cargo (non-containerized)					0.94
Rauch product classification					0.01

Sequeira (2016): Aggregate Trade Flows

- Diff in Diff across products/time to estimate trade elasticity.

$$\text{logImportShare}_{it} = \alpha_0 + \alpha_1 \text{logTariffRate}_{it} + \mu_t + \gamma_i + \epsilon_{it}$$

TABLE 2—TARIFF LIBERALIZATION AND IMPORT VOLUMES, 2006–2014: AGGREGATE IMPORT FLOWS

	log share import volumes			
	Fixed effects (1)	First differences (2)	Long differences (3)	Instrumental variable (4)
Panel A. 2 SLS Estimate				
log tariff rate	−0.016			−0.097
	(0.027)			(0.050)
Δ log tariff rate		−0.010	−0.076	
		(0.019)	(0.018)	
Panel B. First stage dep. var. log tariff rate				
Lagged log tariff rate (one period)				0.841
				(0.042)
Lagged log tariff rate (two periods)				−0.085
				(0.011)
Baseline tariff rate 2006				−0.040
				(0.002)
Kleibergen-Paap Wald *F*-statistic				207.09
Observations	21,520	16,353	13,022	15,326
Mean of dependent variable	1.094	1.051	1.055	1.130

Sequeira (2016): Firm-Level Responses

- Use panel of 190 firms in 2006 & 2010 (before after big reform in 2008)
- Extensive margin:

$$\text{D.ImportStatus}_k = \alpha_0 + \alpha_1 \text{D.Tariff}_k + \alpha_3 \mathbf{X}_k + \omega_i + \epsilon_k$$

  where $\text{D.ImportStatus}_k \in$
  $\{\text{Stop importing}, \text{continue domestic sourcing}, \text{begin importing}\}$,
  ω_i are industry FEs
- Intensive margin:

$$\text{D.PctgImportedInput}_k = \alpha_0 + \alpha_1 \text{D.Tariff}_k + \alpha_3 \mathbf{X}_k + \omega_i + \epsilon_k$$

TABLE 4—TARIFF LIBERALIZATION AND IMPORT VOLUMES, 2006–2010: FIRM-LEVEL DATA

	Extensive margin change in import status			Intensive margin change in pctg of imp. input		
	Ordered probit			Ordinary least squares		
	(1)	(2)	(3)	(4)	(5)	(6)
Δ log tariff rate	−0.113	−0.106	−0.091	−0.738	0.689	1.681
	(0.079)	(0.136)	(0.160)	(2.306)	(3.927)	(4.936)
Firm size		0.539	0.534		10.127	9.355
		(0.229)	(0.238)		(7.212)	(7.154)
Ethnicity of owner		0.188	0.187		7.388	5.681
		(0.187)	(0.178)		(7.430)	(6.839)
Foreign firm		0.456	0.436		15.155	14.250
		(0.329)	(0.269)		(14.330)	(12.665)
Age of establishment		−0.016	−0.018		−0.400	−0.431
		(0.009)	(0.009)		(0.251)	(0.242)
log baseline tariff 2006		0.046	0.036		7.059	5.170
		(0.170)	(0.174)		(4.933)	(5.223)
Controls						
Industry fixed effects	No	No	Yes	No	No	Yes
Observations	160	117	117	160	117	117
p-value of joint significance of FE		0.000			0.000	

Sequeira (2016): Corruption-Trade Gaps

- Use similar strategy to Fisman & Wei (2004)

$$\text{logTradeGap}_{it} = \gamma_1 \text{TariffChangeCategory}_i \times \text{POST}_t + \mu_1 \text{POST}_t + \gamma_2 \text{TariffChangeCategory}_i + \beta_2 \text{BaselineTariff}_i + \epsilon_{it}$$

TABLE 5—TRADE GAPS AND TARIFF LEVELS, 2006–2014

	log trade gap					
	Quantity (1)	Value (2)	Unit value (3)	Quantity (4)	Value (5)	Unit value (6)
log tariff	0.201	0.055	−0.013			
	(0.042)	(0.035)	(0.010)			
Treated products × POST				−0.493	−0.083	0.022
				(0.097)	(0.077)	(0.031)
Treated products				0.308	−0.092	0.104
				(0.243)	(0.219)	(0.087)
POST				0.385	0.118	0.394
				(0.086)	(0.068)	(0.028)
log baseline tariff				0.245	0.271	−0.051
				(0.114)	(0.098)	(0.043)
Observations	21,884	21,884	21,861	21,884	21,884	21,861
Mean of dependent variable	0.273	0.213	2.176	0.273	0.213	2.178
R^2	0.187	0.165	0.675	0.170	0.155	0.422

Sequeira (2016): Corruption-Bribe Payments

- Random sample of >1,000 shipments at port of Maputo

	Pre-tariff change	Post-tariff change	
	2007	2008	2011–2012
Probability of paying a bribe (percent)	80	26	16
Avg bribe amount per ton (Metical 2007, CPI adjusted)	2,164 (7,800)	280 (963)	494 (2,746)
Primary bribe recipient	Customs (97%)	Customs (84%)	Customs (72%)
Primary reason for bribe payment	Tariff evasion (61%)	Congestion (59%)	Congestion (38%)
Ratio of bribe amount to tariff duties saved [0–1]*	0.07 (0.13)	0.028 (0.09)	0.008 (0.02)
Average clearing time for all shipments (days)	2.6 (2.2)	2.6 (1.3)	2.6 (3.6)
Average clearing time with the payment of a bribe (days)	2.6 (2.3)	2.2 (1.0)	2.4 (3.1)
Average clearing time without the payment of a bribe (days)	1.9 (1.2)	2.7 (1.4)	2.6 (3.7)
Average clearing time with bribe payment for tariff evasion (days)	2.7 (2.4)	2.4 (1.0)	2.4 (1.8)

Sequeira (2016): Corruption-Bribe Payments

TABLE 7—BRIBES BEFORE AND AFTER THE TARIFF CHANGE: BY SHIPPER AND PRODUCT CHARACTERISTICS

	Pre-tariff change	Post-tariff change	Difference *p*-value
Panel A. Probability of paying a bribe (percent)			
Large firm	96	16	0.000
Medium to small firm	67	18	0.000
Agricultural product	13	12	0.739
Differentiated product	77	18	0.000
Pre-inspected shipment	68	10	0.000
Panel B. Amount of bribe paid per ton (Mtn, CPI adjusted)			
Large firm	3,373	150	0.004
	(1,419)	(75)	
Medium to small firm	3,882	503	0.000
	(1,711)	(85)	
Agricultural product	1,404	615	0.144
	(922)	(143)	
Differentiated product	2,062	537	0.000
	(623)	(90)	
Pre-inspected shipment	2,597	661	0.000
	1,136	130	

TABLE 8—DIFFERENCE-IN-DIFFERENCES: DETERMINANTS OF THE PROBABILITY OF PAYING A BRIBE

	Probability of paying a bribe [0–1] linear probability model			
	(1)	(2)	(3)	(4)
Tariff change category × POST	−0.429	−0.296		
	(0.131)	(0.120)		
Tariff change category	0.448	0.357		
	(0.111)	(0.099)		
Tariff reduction × POST			−0.025	−0.021
			(0.008)	(0.007)
Tariff reduction			0.024	0.022
			(0.005)	(0.009)
POST	−0.089	−0.555	−0.111	−0.686
	(0.106)	(0.203)	(0.116)	(0.241)
Differentiated product	0.065	0.018	0.032	−0.076
	(0.078)	(0.102)	(0.071)	(0.109)
Agricultural product	0.026	−0.221	0.046	0.041
	(0.030)	(0.096)	(0.029)	(0.030)
Pre-shipment inspection	−0.010	0.061	0.003	0.087
	(0.010)	(0.061)	(0.020)	(0.07)
Perishable product	−0.047	0.260	−0.052	0.137
	(0.067)	(0.109)	(0.064)	(0.124)
Large firm	0.058	0.161	0.066	0.172
	(0.047)	(0.055)	(0.051)	(0.066)
log shipment value per ton	0.014	−0.035	0.017	−0.034
	(0.008)	(0.011)	(0.008)	(0.013)

	log bribe amount paid							
	Ordinary least squares				Hurdle model			
					logit	Negative binomial	logit	Negative binomial
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tariff change category × POST	−3.748	−2.928			−30.735	−0.079		
	(1.075)	(0.944)			(1.995)	(0.459)		
Tariff change category	3.632	3.156			30.704	−0.916		
	(0.953)	(0.803)			(1.898)	(0.436)		
Tariff reduction × POST			−0.225	−0.191			−2.996	−0.089
			(0.058)	(0.064)			(0.174)	(0.031)
Tariff reduction			0.200	0.191			2.969	−0.042
			(0.042)	(0.0478)			(0.171)	(0.0260)
POST	−0.678	−3.449	−0.864	−4.652	−0.392	−0.633	−0.371	−0.426
	(0.867)	(1.818)	(0.944)	(2.152)	(0.639)	(0.179)	(0.634)	(0.200)
Differentiated product	0.545	−0.121	0.303	−0.925	−0.0450	0.188	−0.104	0.304
	(0.648)	(0.849)	(0.603)	(0.876)	(0.660)	(0.423)	(0.643)	(0.427)
Agricultural product	0.161	−1.968	0.343	0.337	0.356	0.583	0.327	0.229
	(0.285)	(0.931)	(0.265)	(0.243)	(0.365)	(0.563)	(0.355)	(0.494)
Pre-shipment inspection	−0.227	0.376	−0.137	0.641	−0.122	−0.550	−0.102	−0.595
	(0.208)	(0.628)	(0.197)	(0.712)	(0.215)	(0.182)	(0.207)	(0.189)
Perishable product	−0.084	3.400	−0.119	2.299	−0.551	0.311	−0.711	0.768
	(0.616)	(0.845)	(0.586)	(0.949)	(1.147)	(0.787)	(1.167)	(0.748)
Large firm	0.600	1.593	0.662	1.708	1.137	0.270	1.198	0.277
	(0.389)	(0.486)	(0.431)	(0.585)	(0.610)	(0.391)	(0.618)	(0.393)
log shipment value per ton	0.130	−0.221	0.152	−0.217	0.160	−0.037	0.158	−0.035
	(0.074)	(0.079)	(0.073)	(0.095)	(0.088)	(0.079)	(0.088)	(0.077)

Outline

Open Questions

- How do taxes interact with labor market informality?
- How regressive are taxes that are commonly evaded?
- Does technology allow developing-country tax administrations to leapfrog rich countries and improve enforcement?
- How do policy and administration interact?
- How does politics affect tax systems' design and administration?
- How do taxes affect market structure when there's lots of informality?
- How should tax administrations be organized? Hierarchically? By function? By geography? Independent of government?