Robust Bounds on Optimal Tax Progressivity

Anmol Bhandari[1] Jaroslav Borovička[2] Yuki Yao[3]

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[1]University of Minnesota

[2]New York University

[3]University of Kent

- Large literature on optimal tax design
  - theory: Ramsey, Mirrlees
  - applications: Diamond–Saez, Golosov–Troshkin–Tsyvinski
- Key predictions depend hard to measure objects
  - distribution of earning potentials (labor productivity)
  - distribution of preferences (labor supply elasticity)
- Optimal tax design acknowledging uncertainty about distribution of individual characteristics
  - combine robust control approach to model statistical uncertainty with Mirrlees
  - key sources of uncertainty: tail behavior and correlation of productivity and labor supply elasticity

Framework

Household type indexed with $s \sim G(s)$

Given a labor income tax function $T(\cdot)$, household of type s solves

$$\max_{c,n} u(c, n; s)$$

subject to

$$c = z(s)n(s) - T(z(s)n)$$

Indirect utility function: $V(s; T)$

Uncertainty about $s \sim G(s)$

- Represent a benchmark distribution $G(s)$ as a mixture

$$G(s) = \sum_k p_k G_k(s)$$

- Parameterize cost of deviating from G to $\widetilde{G}$ using an entropy penalty with $\{\theta_k\}$

$$\sum_k \theta_k \mathbb{E}_k m_k \ln(m_k)$$

where $m_k = d\widetilde{G}_k / dG_k$.

- allows us to express misspecification concerns about specific parts of the distribution

Government

A utilitarian government solves

$$\max_{T(\cdot)} \mathbb{E}V(T)$$

subject to

$$\mathbb{E}T(y) = g.$$

A robust utilitarian government solves

$$\min_{\widetilde{G}_k} \max_{T(\cdot)} \widetilde{\mathbb{E}} V(T) + \sum_k \theta_k \mathbb{E}_k m_k \ln(m_k)$$

subject to

$$\widetilde{\mathbb{E}} T(y) = g.$$

Solution bounds welfare losses coming from specification errors in G in a flexible way.

Analysis

Households only differ in productivity z.

The optimal tax problem can be cast as a mechanism design problem (Mirrlees)

$$\min_{\widetilde{G}_k} \max_{c,y} \widetilde{\mathbb{E}} u\left(c, \frac{y}{z}\right) + \sum_k \theta_k \mathbb{E}_k m_k \ln(m_k)$$

subject to incentive constraints

$$u\left(c(z), \frac{y(z)}{z}\right) \geq u\left(c(z'), \frac{y(z')}{z}\right) \quad \forall z, z'$$

and resource constraint

$$\widetilde{\mathbb{E}}(y - c) = g.$$

Let ξ be the multiplier on the resource constraint. The allocation with full information satisfies

$$c(z;\{\theta_k\}) = C(z,\xi(\{\theta_k\}))$$
$$n(z;\{\theta_k\}) = N(z,\xi(\{\theta_k\}))$$

with

$$u_c(z)z = -u_n(z)$$

- concerns only appear via marginal value of public funds
- marginal labor income tax rates are zero

Marginal tax T' for type $\hat{z}$ satisfies

$$\frac{T'}{1-T'}[\hat{z}] = \left(\frac{1+\varepsilon^u(\hat{z})}{\varepsilon^c(\hat{z})}\right)\left(\frac{\hat{z}d\widetilde{G}(\hat{z})}{\widetilde{G}(\hat{z})}\right)^{-1}\left[\widetilde{\mathbb{E}}\left(\frac{u_c(\hat{z})}{u_c}\middle| z \geq \hat{z}\right) - \widetilde{\mathbb{E}}\left(\frac{u_c(\hat{z})}{u_c}\right)\right]$$

Minimizing distribution

$$\ln(m_k(\hat{z})) \propto -\frac{1}{\theta_k}\left[u(\hat{z}) + \xi(y(\hat{z}) - c(\hat{z}))\right]$$

- ex-post Bayesian given m
- m trades off utility and budgetary consequences

Quantitative Application

Calibration

Preferences

$$u(c,n) = \frac{c^{1-\sigma}}{1-\sigma} - \psi \frac{n^{1+\gamma}}{1+\gamma}$$

- set $\sigma = 1.5$, $\gamma = 2.0$, and $\psi = 7.5$

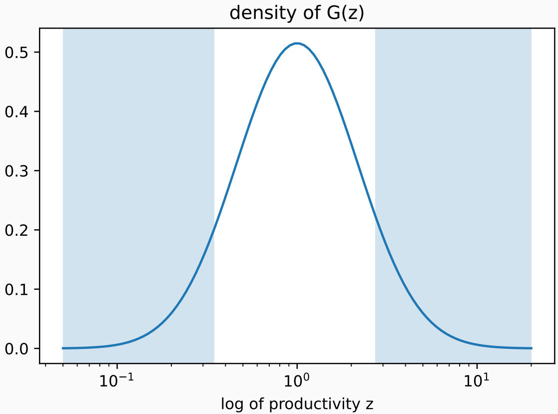
Shocks: $\ln(z) \sim N(\mu, \nu^2)$

- set $(\mu, \nu^2) = (0.0, 0.60)$

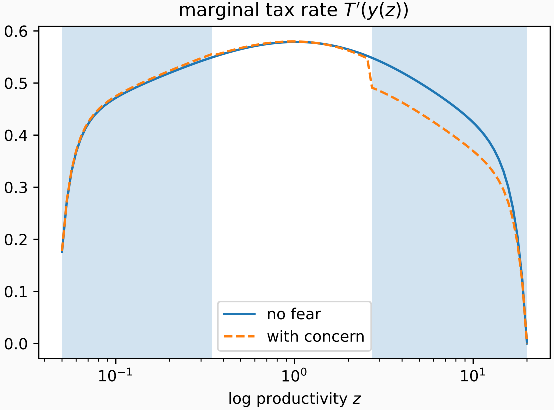
Benchmark model: mixture with 3 distributions

- partitions of $G(z)$ representing 10% “left tail” , 10% “right tail”, and 10-90% “middle class”
- set $\theta_{\text{left}} = \theta_{\text{right}} = \underline{\theta} < \overline{\theta} = \theta_{\text{middle}}$

Shock distribution under the benchmark model

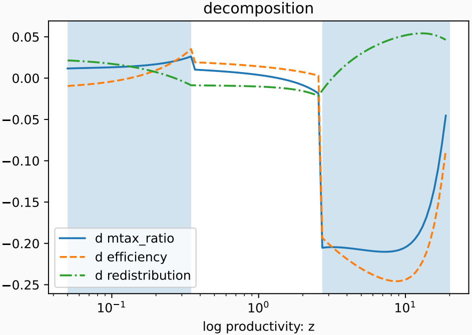


Results



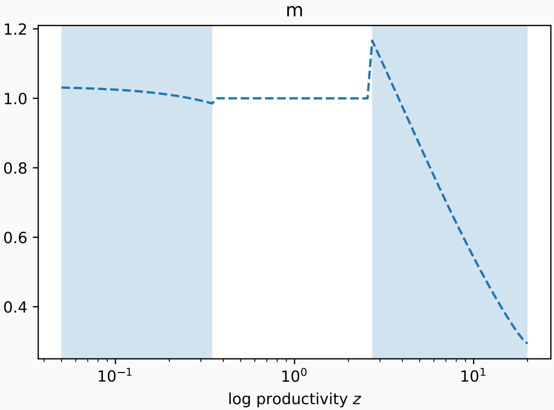
Marginal tax rates largely unaffected in the left tail and substantially lower in the right tail.

$$\ln \frac{T'}{1-T'}[\hat{z}] = \underbrace{\ln\left(\frac{1+\varepsilon^u(\hat{z})}{\varepsilon^c(\hat{z})}\right) - \ln\left(\frac{\hat{z}d\widetilde{G}(\hat{z})}{\widetilde{G}(\hat{z})}\right)}_{\text{“efficiency”}} + \underbrace{\ln\left[\widetilde{\mathbb{E}}\left(\frac{u_c(\hat{z})}{u_c}\middle| z \geq \hat{z}\right) - \widetilde{\mathbb{E}}\left(\frac{u_c(\hat{z})}{u_c}\right)\right]}_{\text{“redistribution”}}$$



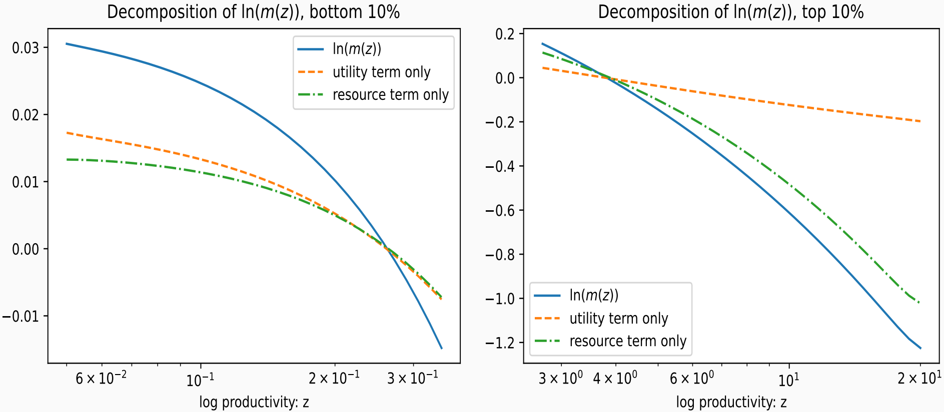
Virtually all the difference is due to “efficiency” terms in the robust Diamond–Saez formula.

Why are marginal taxes lower for rich people?



Why asymmetry in tails?

$$\ln(m_k(\hat{z})) \propto -\frac{1}{\theta_k}\left[u(\hat{z}) + \xi(y(\hat{z}) - c(\hat{z}))\right]$$



Summing up

- Redistribution to low productivity agents

  $\longrightarrow$ utilities and budgetary consequences “flat” on the left and “steep” on the right

- Fear of “too little” tax revenues $>$ Fear of “too many” people who need transfers

  $\longrightarrow$ lower progressivity

Two-dimensional case

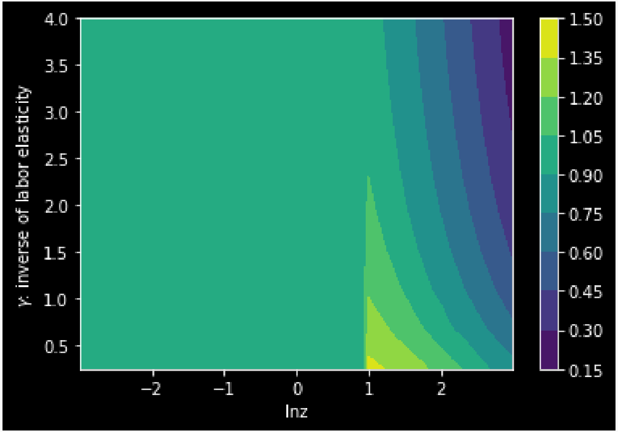
Households differ in productivity and labor supply elasticity

- Benchmark model: joint distribution (z, γ)
  - productivity z as before
  - elasticity parameter $\gamma \sim U[\underline{\gamma}, \overline{\gamma}]$ with $\gamma \perp z$

- Approximate tax schedule with piecewise linear splines

Table 1: Optimal labor tax schedule

Labor income tax bracket $y \in$	$[0, 0.1]$	$[0.1, 0.48]$	$[0.48, 0.86]$	$[0.86, 1.24]$	$[1.24, 1.62]$	$[1.62, 2.0]$	$[2.0, \infty)$
				Marginal tax rates			
No concern (%)	61.0	64.1	63.9	65.3	60.3	66.5	60.0
With concern (%)	59.6	62.9	63.6	61.5	60.1	57.7	53.6



Fear productive agents are scarce and more elastic.

Conclusion

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- Acknowledging distributional uncertainty points to lower progressivity
- Insights robust to choices of benchmark distributions, restrictions on tax functions
- Working on dynamics