Optimal Taxation and Market Power

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Motivation

- Market Power in output market affects:
  1. Efficiency: deadweight loss
  2. Inequality:
     - redistribution between wages $\searrow$ and profits $\nearrow$
     - inequality within wages and profits
- Should optimal income taxes reflect market power? How?

Motivation

This paper:

- Canonical Mirrlees taxation framework with
  - Endogenous Market Power
  - Distinguish: wage-earning workers vs profit-earning entrepreneurs
  - Heterogeneous agents with unobservable labor supply
- Address 2 questions:
  1. How does market power generate inefficiency and inequality?
  2. How can optimal taxation of labor and profits remedy inefficiency and inequality?
     - Correct distortions from labor supply incentives
     - Correct distortions from market power

     → Mirrleesian tax also acts as Pigouvian correction of output market externality

Results

1. In Laissez-faire: Market Power increases inequality
   - The wage rate declines $\Rightarrow$ Labor Share declines
   - Profits increase and Inequality between entrepreneurs increases

   $\rightarrow$ Lower Welfare
2. Optimal, second-best taxation has opposing effects:
   - Direct effect: correct externality of market power (Pigouvian)
     - Lowers marginal tax rate on labor and profits: provides incentives to supply labor
   - Indirect effect of market power on profit tax
     - Increases marginal profit tax:

       $\rightarrow$ through dependence of price elasticity on market structure

       $\rightarrow$ through productivity differences
     - Lowers marginal profit tax for higher types:

       $\rightarrow$ Reallocation and Redistribution
   - Simulations: when market power increases
     - Relative increase in marginal tax rate on profits versus wages
     - Increase tax revenue from entrepreneurs, decrease from workers

Related Literature

1. Markups and Inequality: Stern (1987); Myles (1989); Cremer and This (1994); Stiglitz (2012); Atkinson (2015); Baker and Salop (2015); Khan and Vaheesan (2017)
2. Ramsey Problem with Market Power: Atesagaoglu and Yazici (2021)
3. Bewley-Huggett-Aiyagari Economies: Boar and Midrigan (2021); Deb (2021)
4. Endogenous Markups: Atkeson and Burstein (2008); Edmond, Midrigan and Xu (2021); De Loecker, Eeckhout and Mongey (2021)
5. Mirrlees problem with Market Power: Kaplow (2019); Kushnir and Zubrickas(2019); Jaravel and Olivi (2019); Boar and Midrigan (2021)
   $\rightarrow$ with endogenous entrepreneurial effort; monopoly vs oligopsony; optimal profit tax;
6. Optimal Taxation with Endogenous Prices: Stiglitz (1982); Naito (1999, 2004); Saez (2004); Scheuer (2014); Sachs, Tsyvinski, and Werquin (2020); Cui, Gong, and Li (2021)
7. Optimal Taxation and Technology: Ales, Kurnaz, and Sleet (2015); Ales and Sleet (2016); Scheuer and Werning (2017); Ales, Bellofatto, and Wang (2017)
8. Optimal Taxation with Externalities: Sandmo (1975); Ng (1980); Bovenberg and van der Ploeg (1994); Kopczuk (2003); Farhi and Gabaix (2020)

The Model Setup

Environment. Static Economy. Final consumption good + composite intermediate good

Agents. agents with 2 occupations $o \in \{e, w\}$:

1. Entrepreneurs: type θ_e
2. Workers: type θ_w

$\rightarrow$ $\theta_o \approx F_o(\theta_o)$; measure $N_e = N$; $N_w = 1$

Preferences. Consumption c_o and effort l_o:

$$U_o(\theta_o) = c_o - \phi_o(l_o)$$

- when we use CES, then the EoS $\varepsilon_o \equiv \frac{\phi_o'(l_o)}{l_o \phi_o''(l_o)}$ is constant
- denote by $V_o(\theta_o)$ the optimal utility (evaluated at optimal c_o, l_o)

The Model Setup

Productivity. Heterogeneity enters the production function as efficiency units, depending on type θ_o and hours l_o:

$$x_o(\theta_o)l_o$$

- Workers: efficiency units are perfect substitutes $\rightarrow$ no sorting
- Entrepreneurs: one entrepreneur for one job

Market Structure.

1. Intermediate goods (CES composites, double nested)
   - Entrepreneurs $i \in \{1, ..., I\}$: finite number of Cournot competitors – EoS $\eta(\theta_e)$
   - J markets – EoS $\sigma < \eta(\theta_e)$
2. Final good: competitive aggregate of intermediate goods (EoS σ)

Technology. Lucas span-of-control technology:

$$Q_{ij}(\theta_e) = x_e(\theta_e) l_{e,ij}(\theta_e) \cdot L_{w,ij}(\theta_e)^{\xi}$$

where $L_{w,ij}(\theta_e)$: efficiency units of labor, $0 < \xi \leq 1$ and

$$Q_j(\theta_e) = \left[I^{-\frac{1}{\eta(\theta_e)}} \sum_{i=1}^{I} Q_{ij}(\theta_e)^{\frac{\eta(\theta_e)-1}{\eta(\theta_e)}} \right]^{\frac{\eta(\theta_e)}{\eta(\theta_e)-1}}$$

$$Q(\theta_e) = \left[J^{-\frac{1}{\sigma}} \int_j Q_j(\theta_e)^{\frac{\sigma-1}{\sigma}} dj \right]^{\frac{\sigma}{\sigma-1}}$$

$$Q = A \left[\int_{\theta_e} \chi(\theta_e) Q(\theta_e)^{\frac{\sigma-1}{\sigma}} d\theta_e \right]^{\frac{\sigma}{\sigma-1}}$$

The Model Setup

Prices, Wages and Market Clearing.

- For firm (i, j, θ_e):
  - $P_{ij}(\theta_e)$: price of intermediate good
  - $y(\theta_w)$: income of a worker
  - $\pi(\theta_e)$: profits of an entrepreneur
  - W the competitive wage for efficiency unit of labor
- Market clearing pins down unique wages W per efficiency unit of worker inputs

$$\int_{\theta_e} \int_j \sum_{i=1}^{I} L^{\star}_{w,ij}(\theta_e; W) dj d\theta_e = \int_{\theta_w} x_w(\theta_w) \, l^{\star}_w(\theta_w; W) f_w(\theta_w) d\theta_w$$

In equilibrium labor supply of worker θ_w is independent of firm θ_e: $l_{w,ij}(\theta_w; \theta_e) = l_w(\theta_w)$

The Model Setup

Policy, Taxation and the Planner's Objective.

- Government uses taxation to raise revenue R and maximizes social welfare:

$$\sum_{o\in\{w,e\}} N_o \int_{\theta^o} G\left(V_o(\theta_o)\right) \mathcal{P}_o(\theta_0) f_o\left(\theta_o\right) d\theta_o$$

  where G is a social welfare function; $\mathcal{P}$ is the Pareto weights schedule
- Information:
  - types θ_o are not observable
  - labor income $y(\theta_w)$, profits $\pi(\theta_e)$ are observable
  - $\Rightarrow$ Direct taxes can only depend on income
- The planner solves second best allocation using taxes $\mathcal{T} \equiv \{T_e, T_w, t_s\}$

Cournot Competitive Tax Equilibrium. Given $\mathcal{T}$, a competitive tax equilibrium allocation and price system, agents maximize utility and profits. The price system satisfies Cournot, wages are set competitively, all markets clear, and budget and social resource constraints are satisfied

Solution

Final Goods Market. Normalize the final goods price $P = 1$ and maximize profits:

$$\Pi = \max_{Q_{ij}^D(\theta_e)} Q - \int_{\theta_e} \int_j \left[\sum_{i=1}^{I} Q_{ij}^D(\theta_e) P_{ij}(\theta_e) \right] dj d\theta_e,$$

Entrepreneurs.

$$V_e(\theta_e) \equiv \max_{l_e, L_{w,ij}} c_e - \phi_e(l_e)$$

$$\text{s.t.} \quad c_e = \pi - T_e(\pi)$$

$$\pi = P_{ij}\left(Q_{ij}^S(\theta_e), \theta_e\right) Q_{ij}^S(\theta_e)(1 - t_s) - W L_{w,ij}(\theta_e)$$

Workers.

$$V_w(\theta_w) \equiv \max_{l_w} c_w - \phi_w(l_w)$$

$$\text{s.t.} \quad c_w = W x_w(\theta_w) l_w - T_w(W x_w(\theta_w) l_w)$$

Solution

First-Order Conditions.

$$P_{ij}\left(\theta_e\right) = \frac{\partial Q}{\partial Q_{ij}\left(\theta_e\right)}$$

$$\frac{W}{1-t_s} = \frac{\partial\left[P_{ij}\left(Q_{ij}\left(\theta_e\right),\theta_e\right)Q_{ij}\left(\theta_e\right)\right]}{\partial L_{w,ij}\left(\theta_e\right)}$$

$$\frac{P_{ij}\left(\theta_e\right)}{\mu\left(\theta_e\right)}\frac{\partial Q_{ij}\left(\theta_e\right)}{\partial l_{e,ij}\left(\theta_e\right)}\left[1-T_e'\left(\pi_{ij}\left(\theta_e\right)\right)\right] = \phi_e'\left(l_{e,ij}\left(\theta_e\right)\right)$$

$$Wx_w(\theta_w)\left[1-T_w'\left(W\theta_w l_w\left(\theta_w\right)\right)\right] = \phi_w'\left(l_w\left(\theta_w\right)\right)$$

Market Clearing. $Q_{ij}^D\left(\theta_e\right) = Q_{ij}^S\left(\theta_e\right)$

$$Q = \int_{\theta_w} c_w(\theta_w) f_w(\theta_w) d\theta_w + \int_{\theta_e}\int_j \left[\sum_{i=1}^{I} c_{e,ij}\left(\theta_e\right)\right] dj d\theta_e + R,$$

$$\int_{\theta_e}\int_j \left[\sum_{i=1}^{I} L_{w,ij}\left(\theta_e\right)\right] dj d\theta_e = \int_{\theta_w} x_w\left(\theta_w\right) l_w\left(\theta_w\right) f_w(\theta_w) d\theta_w$$

Solution

Markups. The markup definition:

$$\mu_{ij}(\theta_e) \equiv \frac{P_{ij}(\theta_e)}{MC_{ij}(\theta_e)} = \frac{P_{ij}(\theta_e)}{\frac{W}{\frac{\partial Q_{ij}(\theta_e)}{\partial L_{w,ij}(\theta_e)}(1-t_s)}}, \quad \theta_e \in \Theta_e.$$

Lerner Rule: relation markup – inverse-demand elasticity $\mu(\theta_e) = \frac{1}{1+\gamma(\theta_e)}$

$$\gamma(\theta_e) \equiv \frac{\partial \ln P(Q_{ij}(\theta_e), \theta_e)}{\partial \ln Q_{ij}(\theta_e)}$$

Under Cournot (where $s_{ij}(\theta_e)$ is the market share of firm i in market j):

$$\gamma(\theta_e) = -\left[\frac{1}{\sigma} s_{ij}(\theta_e) + \frac{1}{\eta(\theta_e)}(1 - s_{ij}(\theta_e))\right] \geq -\frac{1}{\sigma}$$

Aggregate markup:

$$\mu \equiv \frac{\int_{\Theta_e} \mu(\theta) L_w(\theta) f_e(\theta) d\theta}{\int_{\Theta_e} L_w(\theta) f_e(\theta) d\theta}$$

Solution

Labor Share.

$$\nu_{ij}(\theta_e) \equiv \frac{WL_{w,ij}(\theta_e)}{P_{ij}(\theta_e)\, Q_{ij}(\theta_e)\,(1-t_s)}$$

- Apparent positive relation: $\frac{\partial \nu(\theta_e)}{\partial t_s}$
- But taxes also affect $L_w, l_e, l_w, P_{ij}, Q_{ij}$;
- In equilibrium (using firm's FOC), labor share is exogenous

$$\nu(\theta_e) = \frac{\xi}{\mu(\theta_e)}$$

- But: aggregate labor share is endogenous

$$\nu \equiv \frac{WN_w \int x_w(\theta_w)\, l_w(\theta_w)\, f_w(\theta_w)\, d\theta_w}{Q}$$

Solution

2 (weak) assumptions:

1. Wage increasing in TFP

$$\frac{1}{\varepsilon_w} + 1 - \xi\left(\varepsilon_e + 1\right) > 0$$

2. Labor demand decreasing in W

$$\frac{1}{\varepsilon_e + 1} + \frac{1}{\sigma - 1} > \xi$$

→ satisfied under "usual" estimated parameter values:

$$\eta \in [4, 10]$$
$$\sigma \in (1, 4]$$
$$\xi \in [0.7, 1]$$
$$\varepsilon_w \in [0.1, 0.5]$$
$$\varepsilon_e \in [0.1, 0.5]$$

The Laissez-faire Economy

- As market power increases ($I \searrow$), we see a decrease in:
  1. Wage rate W
  2. Aggregate Labor Share
  3. Output and Sales
  4. Labor Utility
- As market power increases ($I \searrow$), we see an ambiguous effect on:
  1. Profits
  2. Entrepreneur's Utility

  $\rightarrow$ increasing under conditions typically satisfied

The Planner's Problem

The planner offers a tax schedule (direct mechanism) $\mathcal{T}$:

Incentive Compatibility of the Worker. Choose l_w (report type θ'_w) s.t.:

$$V_w(\theta_w) = \max_{\theta'_w \in \Theta_w} V_w(\theta'_w | \theta_w) \equiv \max_{\theta'_w \in \Theta_w} c_w(\theta'_w) - \phi_w\left(\frac{y(\theta'_w)}{x_w(\theta_w) W}\right)$$

From the envelope theorem, the solution satisfies

$$V'_w(\theta_w) = l_w(\theta_w) \phi'_w(l_w(\theta_w)) \frac{x'_w(\theta_w)}{x_w(\theta_w)}$$

This IC condition is also sufficient under monotonicity of $y(\theta_w)$ (Mirrlees 1971)

Incentive Compatibility of the Entrepreneur.

$$V_e(\theta_e) = \max_{\theta' \in \Theta_e} V_e(\theta'_e|\theta_e) \equiv \max_{\theta' \in \Theta_e} c_e(\theta'_e) - \phi_e\left(l_e\left(\theta'_e|\theta_e\right)\right)$$

where

$$l_e\left(\theta'_e|\theta_e\right) = \min_{L_w, l_e} l_e$$

$$\text{s.t. } P\left(Q_{ij}(\theta_e), \theta_e\right) Q_{ij}(\theta_e)\left(1 - t_s\right) - WL_w = \pi\left(\theta'_e\right).$$

The Planner's Problem

Under monotonicity assumption, the FOC $\frac{\partial V_e(\theta'_e|\theta_e)}{\partial \theta'_e}|_{\theta'_e=\theta_e} = 0$ is also sufficient and equivalent to

$$V'_e(\theta_e) = \phi'_e\left(l_e\left(\theta_e\right)\right) l_e\left(\theta_e\right)\left[\mu\left(\theta_e\right)\frac{\partial \ln P\left(Q_{ij}\left(\theta_e\right),\theta_e\right)}{\partial \theta_e} + \frac{x'_e\left(\theta_e\right)}{x_e\left(\theta_e\right)}\right]$$
$$= \phi'_e\left(l_e\left(\theta_e\right)\right) l_e\left(\theta_e\right)\left[\mu\left(\theta_e\right)\left(\frac{\chi'\left(\theta_e\right)}{\chi\left(\theta_e\right)} + \left[\frac{1}{\eta\left(\theta_e\right)} - \frac{1}{\sigma}\right]\frac{I-1}{I}\frac{Q'_{ij}\left(\theta_e\right)}{Q_{ij}\left(\theta_e\right)}\right) + \frac{x'_e\left(\theta_e\right)}{x_e\left(\theta_e\right)}\right]$$

- IC depends on markup via $\mu\left(\theta_e\right)\frac{\partial \ln P\left(Q_{ij}(\theta_e),\theta_e\right)}{\partial \theta_e}$:
    - through strategic interaction via elasticity and I
    - through productivity differences $\chi(\theta_e)$

  → multiplier effect

The Planner's Problem

Tax Wedges. We can describe the marginal distortions in second best with wedges

- $\tau_s(\theta_e)$ between marginal cost and marginal income of labor inputs $L_w(\theta_e)$

$$\tau_s(\theta_e) = 1 - \frac{W}{\frac{P(\theta_e)}{\mu(\theta_e)} \frac{\partial Q_{ij}(\theta_e)}{\partial L_w(\theta_e)}}$$

- $\tau_w(\theta_w)$ between marginal disutility of worker's labor supply l_w and its marginal productivity

$$\tau_w(\theta_w) = 1 - \frac{\phi_w'(l_w(\theta_w))}{\frac{P(\theta_e)}{\mu(\theta_e)} \frac{\partial Q_{ij}(\theta_e)}{\partial L_w(\theta_e)} \theta_w}$$

- $\tau_e(\theta_e)$ between marginal disutility of entrepreneur's labor supply l_e and marginal productivity

$$\tau_e(\theta_e) = 1 - \frac{\phi_e'(l_e(\theta_e))}{\frac{P(\theta_e)}{\mu(\theta_e)} \frac{\partial \overline{Q}(\theta_e)}{\partial l_e(\theta_e)}}$$

Multiple tax schemes implement same allocation $\rightarrow$ without loss: $t_s = 0$

Optimal Taxation

- Set up the Lagrangian of the Planner's objective with the feasibility constraints and the incentive constraints (written in terms of utility rather than income/profits)
- Take FOC with respect to utility and choice variables labor supply l_o and employment L_e
- Derive the tax formulae: general and for special cases
    1. General Taxation Formulae
    2. Homogenous types
    3. Heterogenous types

General Taxation Formulae

Theorem 1

$$\frac{1}{1-\tau_w(\theta_w)} = \frac{1+[1-\bar{g}_w(\theta_w)]\,\frac{1+\varepsilon_w}{\varepsilon_w}\,\frac{1-F_w(\theta_w)}{f_w(\theta_w)}\,\frac{x_w'(\theta_w)}{x_w(\theta_w)}}{\mu},$$

$$\frac{1}{1-\tau_e(\theta_e)} = \frac{\frac{1+[1-\bar{g}_e(\theta_e)]H(\theta_e)\frac{1}{\varepsilon^{\pi}_{1-\tau_e}(\theta_e)}}{\mu(\theta_e)} + \frac{\frac{\sigma}{\sigma-1}}{\frac{\sigma}{\sigma-1}-\xi} IRE(\theta_e)}{1-\frac{\xi}{\frac{\sigma}{\sigma-1}-\xi} RE(\theta_e)}.$$

where

$$RE(\theta_e) \equiv \frac{\mu}{\mu(\theta_e)} - 1, \quad \text{and} \quad IRE(\theta_e) \equiv \varepsilon_{Q_{-ij}}(\theta_e)\left\{[1-g_e(\theta_e)] - [1-\bar{g}_e(\theta_e)]\,H(\theta_e)\right\},$$

$$H(\theta_e) \equiv \frac{1-F_e(\theta_e)}{f_e(\theta_e)}\left\{\frac{\frac{\sigma-1}{\sigma}\frac{1+\varepsilon_e}{\varepsilon_e}\frac{d}{d\theta_e}\left[\ln\frac{X(\theta_e)}{\mu(\theta_e)}\right]}{\frac{1+\varepsilon_e}{\varepsilon_e}\left(\frac{\sigma}{\sigma-1}-\xi\right)-1} + \frac{d\ln\left[\mu(\theta_e)-\xi\right]}{d\theta_e}\right\}$$

$$\mu = \int_{\theta_e}\mu(\theta_e)\,\omega(\theta_e)\,d\theta_e \quad \text{and} \quad \mu(\theta_e) = \frac{1}{1-\left[\frac{1}{\eta(\theta_e)}\frac{I-1}{I}+\frac{1}{\sigma}\frac{1}{I}\right]}$$

$$\omega(\theta_e) = \frac{\left[[1-\tau_e(\theta_e)]\left(\frac{X(\theta_e)}{\mu(\theta_e)}\right)^{\frac{\varepsilon_e+1}{\varepsilon_e}\frac{\sigma}{\sigma-1}}\right]^{\frac{1}{\frac{1+\varepsilon_e}{\varepsilon_e}\left(\frac{\sigma}{\sigma-1}-\xi\right)-1}} f_e(\theta_e)}{\int_{\theta_e}\left[[1-\tau_e(\theta_e)]\left(\frac{X(\theta_e)}{\mu(\theta_e)}\right)^{\frac{\varepsilon_e+1}{\varepsilon_e}\frac{\sigma}{\sigma-1}}\right]^{\frac{1}{\frac{1+\varepsilon_e}{\varepsilon_e}\left(\frac{\sigma}{\sigma-1}-\xi\right)-1}} f_e(\theta_e)\,d\theta_e}.$$

COROLLARY 1 When $\frac{1+\varepsilon_e}{\varepsilon_e}\left(\frac{\sigma}{\sigma-1}-\xi\right)=2$, we have

$$\mu=\frac{\left(\frac{\sigma}{\sigma-1}+\xi\right)\int_{\theta_e}\overline{\gamma}(\theta_e)\mu\left(\theta_e\right)d\theta_e}{2\xi}-\frac{\sqrt{\Delta}}{2\xi},$$

where

$$\overline{\gamma}(\theta_e)=\frac{\gamma(\theta_e)}{\int_{\theta_e}\gamma(\theta_e)d\theta_e},$$

$$\gamma(\theta_e)=\frac{\left(\frac{X(\theta_e)}{\mu(\theta_e)}\right)^{\frac{\varepsilon_e+1}{\varepsilon_e}\frac{\sigma}{\sigma-1}}f_e\left(\theta_e\right)}{1+\left[1-\bar{g}_e(\theta_e)\right]H(\theta_e)\left[\frac{1}{\varepsilon_e}\mu\left(\theta_e\right)-\frac{1+\varepsilon_e}{\varepsilon_e}\xi+\frac{1}{\sigma-1}\right]+\left[\mu\left(\theta_e\right)-\frac{\sigma}{\sigma-1}\right]\left[1-g_e(\theta_e)\right]},$$

$$\Delta=\left(\frac{\sigma}{\sigma-1}-\xi\right)^2\left[\int_{\theta_e}\overline{\gamma}(\theta_e)\mu\left(\theta_e\right)d\theta_e\right]^2-4\frac{\sigma}{\sigma-1}\xi\left[\int_{\theta_e}\mu\left(\theta_e\right)^2\overline{\gamma}(\theta_e)d\theta_e-\left(\int_{\theta_e}\overline{\gamma}(\theta_e)\mu\left(\theta_e\right)d\theta_e\right)^2\right].$$

Homogenous types

- Homogenous agents within group ($g_o = 1$)
- Optimal tax is first best tax, and satsifies (for any I):

$$\tau_w^h = \tau_e^h = 1 - \mu$$

→ Without adverse selection, marginal tax rates are negative and decrease in market power

→ Pigouvian correction: provide incentives (subsidy) to work harder

Monopolistic Competition with Uniform Markups

$\eta(\theta_e)$ constant

- Tax formulae: When $I = 1$, the optimal profit tax simplifies as:

$$\frac{1}{1-\tau_e(\theta_e)} = \frac{1+\left[1-\bar{g}_e(\theta_e)\right]\frac{1+\varepsilon_e}{\varepsilon_e}\frac{1-F_e(\theta_e)}{f_e(\theta_e)}\left[\mu\frac{\chi'(\theta_e)}{\chi(\theta_e)}+\frac{x_e'(\theta_e)}{x_e(\theta_e)}\right]}{\mu}, \forall\theta_e \in \Theta_e.$$

- The higher the markup μ, the lower the tax rate on labor τ_w
- The profit tax τ_e depends:
  1. negatively on markup directly (as with identical entrepreneurs):
  2. positively on markup indirectly (multiplier of μ via $\chi(\theta_e)$ and I):

$$\left[\mu\frac{\partial \ln P\left(Q\left(\theta_e\right),\theta_e\right)}{\partial\theta_e}+\frac{x_e'\left(\theta_e\right)}{x_e\left(\theta_e\right)}\right]$$

  3. negatively for higher θ_e through *IRE*: lower τ_e provides incentives $l_e \nearrow \to Q \nearrow \to p \searrow \to \pi \searrow$

Oligopolistic Competition with Uniform Markups

Let $\eta(\theta) = \eta$ be constant then explicit formula:

(I) The optimal profit tax wedge satisfies:

$$\frac{1}{1-\tau_e(\theta_e)} = \frac{1 + [1 - \bar{g}_e(\theta_e)]\, H(\theta_e) \frac{1}{\varepsilon^{\pi}_{1-\tau_e}(\theta_e)}}{\mu} + \frac{\frac{\sigma}{\sigma-1}}{\frac{\sigma}{\sigma-1} - \xi} IRE(\theta_e);$$

In addition, let the social welfare weights be exogenous, then we can sign the effect of markups on taxes:

(II) For any $\theta_e \in \Theta_e$, $\tau_e(\theta_e)$ increases in μ iff

$$g_e(\theta_e) < \frac{\xi(\sigma-1)}{\sigma} \left\{ 1 + [1 - \bar{g}_e(\theta_e)]\, H(\theta_e) \left[\frac{\varepsilon_e + 1}{\varepsilon_e} \left(\frac{\sigma}{\sigma-1} - \xi \right) - 1 \right] \right\};$$

$\frac{1-\tau_w(\theta_w)}{1-\tau_e(\theta_e)}$ increases in μ iff

$$g_e(\theta_e) < 1 + [1 - \bar{g}_e(\theta_e)]\, H(\theta_e) \left[\frac{\varepsilon_e + 1}{\varepsilon_e} \left(\frac{\sigma}{\sigma-1} - \xi \right) - 1 \right];$$

(III) When $g_e(\theta_e) = \bar{g}_e(\theta_e)$ and $H(\theta_e) > 0$, $\tau_e(\theta_e)$ increases in μ if $g_e(\theta_e) \leq \frac{\xi(\sigma-1)}{\sigma}$; $\frac{1-\tau_w(\theta_w)}{1-\tau_e(\theta_e)}$ increases in μ if $g_e(\theta_e) < 1$.

- IRE: now there is gain from using taxes to reallocate production to more productive firms
- Reallocation measures efficiency gain from moving labor towards high productivity firms

Discussion and Robustness

1. Non-linear Sales Tax
   - Can improve welfare over linear taxes, but cannot achieve first best
2. Conditioning Taxes on Markups
   - Markups are hard to calculate for the planner
   - Even if possible, cannot achieve first best
   - Like taxing profits
3. Capital Investment
4. Quantity Regulation

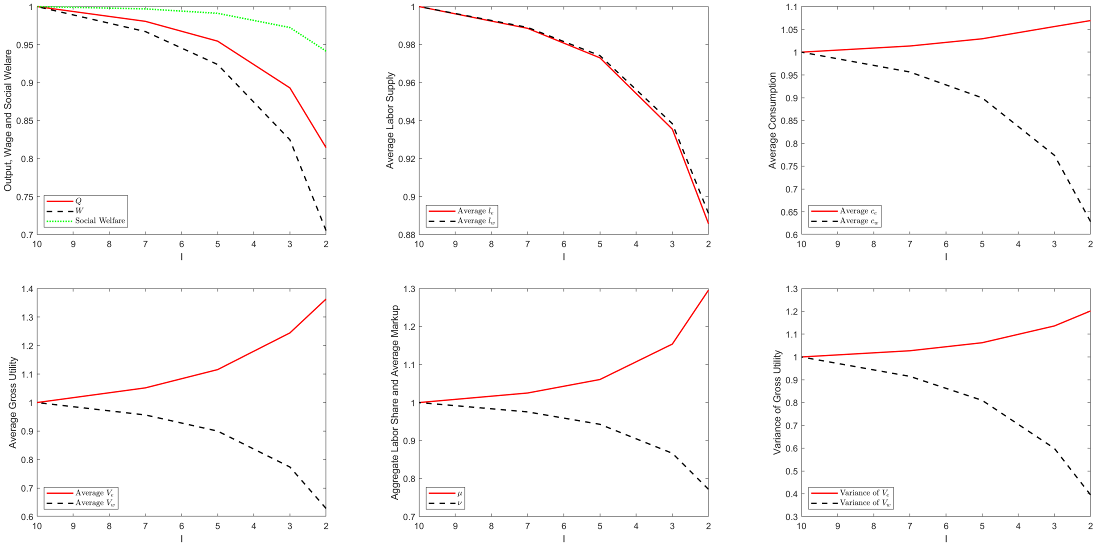
Numerical Analysis

Parameterization

$G(V) = \frac{V^{1-k}}{1-k}$	social welfare function
$k \in \{1, 3\}$	concavity of the social welfare function; $k = 1$ is benchmark
$f_o(\theta_o) = 1$	PDF of skills
$N_e = 0.2$	measure of entrepreneurs
$A = 10^4$	the TFP of final good production technology Q
$\xi = 0.85$	concavity of technology Q_{ij}
$\sigma = 1.5$	elasticity of substitution between submarkets
$\eta(\theta_e) = 10 - 8\theta_e$	elasticity of substitution within submarkets
$x_o(\theta_o) = \theta_o$	individual-level productivity
$\chi(\theta_e) = \theta_e$	distribution parameter
$\varepsilon_o = 0.33$	the elasticity of labor supply (Chetty (2012))

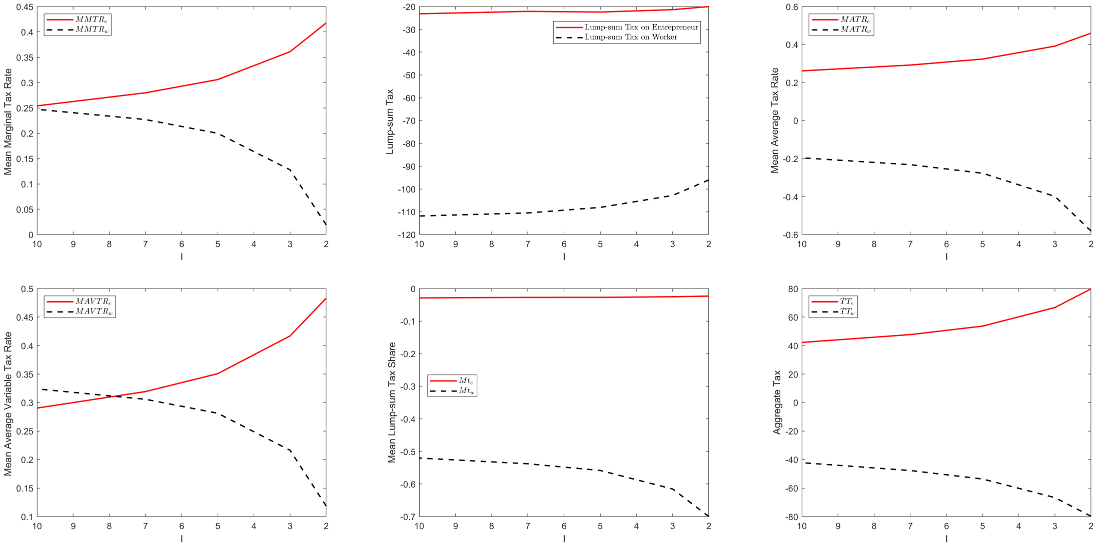
Numerical Analysis

Laissez-Faire



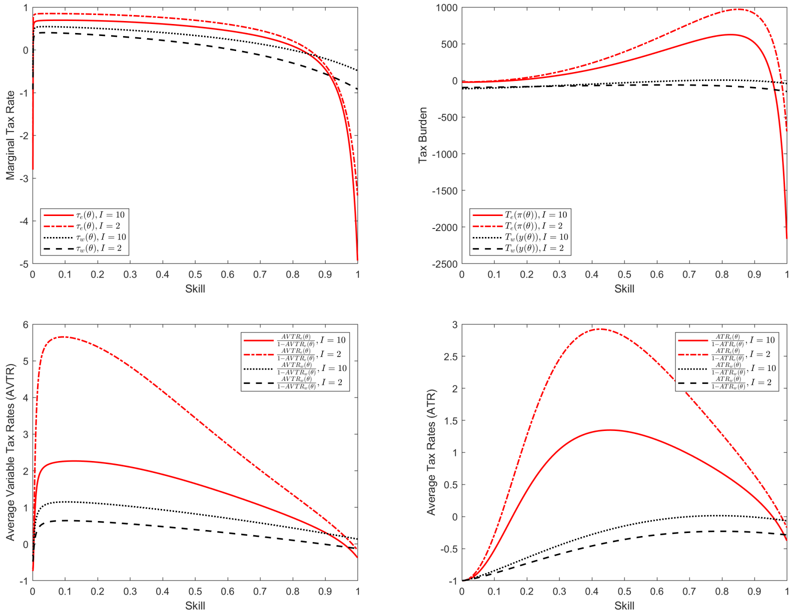
Numerical Analysis

Optimal Taxation – by Market Power I



Numerical Analysis

Optimal Taxation – by Skill



Conclusion

- Market power in output market distorts wages and profits
- Optimal Income Taxation needs to take into account market power
  - Direct effect: lower marginal tax rate on labor and profits
  - Indirect effect:
    - Increases marginal profit tax:
      $\rightarrow$ through dependence of price elasticity on market structure and productivity difference
    - Lowers marginal profit tax for higher types:
      $\rightarrow$ Reallocation and Redistribution
- Simulations. Net effect of market power:
  - increase in marginal tax rate on profits and decrease on labor
  - same for total tax burden

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∴ Income taxation cannot eliminate the root cause of market power; need antitrust

→ but: optimal taxes depend on extent of market power

Optimal Taxation and Market Power

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The Laissez-faire Economy

- Profits are increasing in market power ($I \searrow$) iff:

$$\mu_{ij}(\theta_e) \leq \frac{\xi}{\frac{\varepsilon_e}{1+\varepsilon_e} + \frac{\varepsilon_w}{\varepsilon_w+1}\xi}$$

- Entrepreneur utility V_e increases iff:

$$\mu_{ij}(\theta_e) \leq \frac{\xi + \frac{\varepsilon_e}{\varepsilon_e+1}}{\frac{\varepsilon_e}{\varepsilon_e+1} + \frac{\varepsilon_w}{1+\varepsilon_w}\xi}$$

  which is a weaker condition than profits increasing

- For typical parameters ($\varepsilon_e = \varepsilon_w = 0.25; \xi = 0.85$), the first condition is satisfied for all firms with markup $\mu < 2.3$ and the second is condition is satisfied for $\mu < 2.8$

Assumption A1.
(i) $\pi(\theta_e)$ is differentiable, strictly positive, and positive increasing in θ_e;
(ii) $\mu_{ij}(\theta_e) \frac{\partial \ln P\left(Q_{ij}(\theta_e), \theta_e\right)}{\partial \theta_e} + \frac{x_e'(\theta_e)}{x_e(\theta_e)}$ is strictly positive.

Optimal Taxation

Oligopoly ($I > 1$) and Heterogeneous Markups

- Special case: Utilitarian SWF and uniform types θ_e:

$$\tau_w^{\#}(\theta_w) = 1 - \mu$$
$$\tau_e^{\#}(\theta_e) = 1 - \mu(\theta_e) + [\mu(\theta_e) - \mu] \frac{\xi}{\xi - \frac{\sigma}{\sigma - 1}}$$

- Marginal tax on profits is decreasing for large enough $\mu(\theta_e)$, i.e. regressive
- There exist θ_e^*, for any $\theta_e < \theta_e^* : \tau_e^{\#}(\theta_e) > \tau_w^{\#}$; for any $\theta_e \geq \theta_e^* : \tau_e^{\#}(\theta_e) \leq \tau_w^{\#}$
- Tradeoff: between redistribution and reallocation

The Planner's Problem

- From the FOCS, the optimal taxes can be expressed in terms of the wedges:

$$\begin{aligned} \tau_s &= t_s \\ \tau_w(\theta_w) &= 1 - \left[1 - T'_w(y(\theta_w))\right](1 - t_s) \\ \tau_e(\theta_e) &= 1 - \left[1 - T'_e(\pi(\theta_e))\right](1 - t_s) \end{aligned}$$

- Multiple tax schemes can implement the same allocation (sales tax independent of output)
- Can always implement the same outcome with $t_s = 0$:

$$\text{If } t'_s \neq 0 \quad \Rightarrow \quad 1 - T_o(y) = [1 - T_o(y)](1 - t'_s)$$

$\Rightarrow$ We can focus on τ_e, τ_w

Numerical Analysis

Summary of Tax Measures

t_o	Lump-sum tax (depends on occupation)
$\tau_o\left(\theta_o\right)$	Marginal tax rate
$T_o\left(y(\theta_o)\right)$	Tax burden
$ATR_o\left(\theta_o\right) = \frac{T_o(y(\theta_o))}{y(\theta_o)}$	Average tax rate
$AVTR_o\left(\theta_o\right) = \frac{T_o(y(\theta_o)) - t_o}{y(\theta_o)}$	Average variable tax rate
$TT_o = N_o \int_{\theta_o} T_o\left(y\left(\theta_o\right)\right) f_{\theta_o}\left(\theta_o\right) d\theta_o$	Total tax burden
$MMTR_o = \int_{\theta_o} \tau_o\left(\theta_o\right) f_{\theta_o}\left(\theta_o\right) d\theta_o$	Mean marginal tax rate
$MATR_o = \frac{TT_o}{N_o \int_{\theta_o} y(\theta_o) f_{\theta_o}(\theta_o) d\theta_o}$	Mean average tax rate
$MAVTR_o = \frac{TT_o - t_o * N_o}{N_o \int_{\theta_o} y(\theta_o) f_{\theta_o}(\theta_o) d\theta_o}$	Mean average variable tax rate
$Mt_o = \frac{t_o}{\int_{\theta_o} y(\theta_o) f_{\theta_o}(\theta_o) d\theta_o}$	Mean lump-sum tax share

Note: we denote profits by $\pi(\theta_e) = y(\theta_e)$.