

# 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)  
→ 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  $\theta_e$
  2. Workers: type  $\theta_w$
- $\theta_o \approx F_o(\theta_o)$ ; 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  $\theta_o$  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  $i \in \{1, \dots, I\}$ : 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  $\sigma$ )

# THE MODEL SETUP

**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  $(i, j, \theta_e)$ :
  - $P_{ij}(\theta_e)$ : 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

$$\int_{\theta_e} \int_j \sum_{i=1}^I L_{w,ij}^*(\theta_e; W) dj d\theta_e = \int_{\theta_w} x_w(\theta_w) l_w^*(\theta_w; W) f_w(\theta_w) d\theta_w$$

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

# THE MODEL SETUP

## Policy, Taxation and the Planner's Objective.

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

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

where  $G$  is a social welfare function;  $\mathcal{P}$  is the Pareto weights schedule

- **Information:**
  - types  $\theta_o$  are not observable
  - labor income  $y(\theta_w)$ , profits  $\pi(\theta_e)$  are observable

⇒ 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.**

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

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

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

**Workers.**

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

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

## SOLUTION

**First-Order Conditions.**

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

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

$$\frac{P_{ij}(\theta_e)}{\mu(\theta_e)} \frac{\partial Q_{ij}(\theta_e)}{\partial l_{e,ij}(\theta_e)} [1 - T'_e(\pi_{ij}(\theta_e))] = \phi'_e(l_{e,ij}(\theta_e))$$

$$W x_w(\theta_w) [1 - T'_w(W \theta_w l_w(\theta_w))] = \phi'_w(l_w(\theta_w))$$

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

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

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

## 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

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

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

→ **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  $\theta'_w$ ) 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)

# THE PLANNER'S PROBLEM

## Incentive Compatibility of the Entrepreneur.

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

where

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

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

# 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

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

- IC depends on markup via  $\mu(\theta_e) \frac{\partial \ln P(Q_{ij}(\theta_e), \theta_e)}{\partial \theta_e}$ :
    - through strategic interaction via elasticity and  $l$
    - 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

$$\tau_e(\theta_e) = 1 - \frac{\phi'_e(l_e(\theta_e))}{\frac{P(\theta_e)}{\mu(\theta_e)} \frac{\partial \bar{Q}(\theta_e)}{\partial l_e(\theta_e)}}$$

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 and show for special cases:
  1. General Taxation Formula
  2. Homogenous types
  3. Heterogenous types

# OPTIMAL TAXATION

## GENERAL TAXATION FORMULAE

- Theorem 1

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

$$\frac{1}{1 - \tau_e(\theta_e)} = \frac{1 + [1 - \bar{g}_e(\theta_e)] \frac{1 - F_e(\theta_e)}{f_e(\theta_e)} \frac{1 + \varepsilon_e}{\varepsilon_e} \left[ \mu(\theta_e) \frac{\partial \ln P(Q(\theta_e), \theta_e)}{\partial \theta_e} + \frac{x'_e(\theta_e)}{x_e(\theta_e)} \right] + \mu(\theta_e) IRE(\theta_e) \left[ 1 + \frac{\xi}{\frac{\sigma}{\sigma-1} - \xi} \right]}{\mu(\theta_e) \left[ 1 - RE(\theta_e) \frac{\xi}{\frac{\sigma}{\sigma-1} - \xi} \right]}$$

where the Reallocation Effect  $RE(\theta_e)$  and Indirect Redistribution Effect  $IRE(\theta_e)$  are defined as

$$RE(\theta_e) \equiv \frac{\mu}{\mu(\theta_e)} - 1$$

$$IRE(\theta_e) \equiv \varepsilon_{Q-ij}(\theta_e) \left\{ [1 - g_e(\theta_e)] - \frac{[1 - \bar{g}_e(\theta_e)] [1 - F_e(\theta_e)]}{f_e(\theta_e)} \left[ \frac{1 + \varepsilon_e}{\varepsilon_e} \frac{l'_e(\theta_e)}{l_e(\theta_e)} + \frac{d \ln [\mu(\theta_e) \varepsilon_{Q-ij}(\theta_e)]}{d \theta_e} \right] \right\}$$

# OPTIMAL TAXATION

## HOMOGENOUS TYPES

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

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

- Without adverse selection, marginal tax rates **are negative and decrease** in market power
- Pigouvian correction: provide incentives (subsidy) to work harder

# OPTIMAL TAXATION

HETEROGENEOUS TYPES AND UNIFORM MARKUPS ( $\eta(\theta_e)$  CONSTANT)

- Tax formulae

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

$$\frac{1}{1 - \tau_e(\theta_e)} = \frac{1 + [1 - \bar{g}_e(\theta_e)] \frac{1 - F_e(\theta_e)}{f_e(\theta_e)} \frac{1 + \varepsilon_e}{\varepsilon_e} \left[ \mu \frac{\partial \ln P(Q(\theta_e), \theta_e)}{\partial \theta_e} + \frac{x'_e(\theta_e)}{x_e(\theta_e)} \right]}{\mu} + IRE(\theta_e) \frac{\frac{\sigma}{\sigma - 1}}{\frac{\sigma}{\sigma - 1} - \xi}$$

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

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

3. **negatively** for higher  $\theta_e$  through  $IRE$ : lower  $\tau_e$  provides incentives  $I_e \nearrow \rightarrow Q \nearrow \rightarrow p \searrow \rightarrow \pi \searrow$



# OPTIMAL TAXATION

## HETEROGENEOUS TYPES AND HETEROGENEOUS MARKUPS

$$\frac{1}{1 - \tau_e(\theta_e)} = \frac{1 + [1 - \bar{g}_e(\theta_e)] \frac{1 - F_e(\theta_e)}{f_e(\theta_e)} \frac{1 + \varepsilon_e}{\varepsilon_e} \left[ \mu(\theta_e) \frac{\partial \ln P(Q(\theta_e), \theta_e)}{\partial \theta_e} + \frac{x'_e(\theta_e)}{x_e(\theta_e)} \right] + \mu(\theta_e) IRE(\theta_e) \left[ 1 + \frac{\xi}{\frac{\sigma}{\sigma-1} - \xi} \right]}{\mu(\theta_e) \left[ 1 - RE(\theta_e) \frac{\xi}{\frac{\sigma}{\sigma-1} - \xi} \right]}$$

- RE: 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
- The denominator of the main formula is

$$\mu(\theta_e) \left[ 1 - RE(\theta_e) \frac{\xi}{\frac{\sigma}{\sigma-1} - \xi} \right] = \mu(\theta_e) + [\mu(\theta_e) - \mu] \frac{\xi}{\frac{\sigma}{\sigma-1} - \xi}$$

It is larger than  $\mu(\theta_e)$  iff  $\mu(\theta_e) > \mu$

# DISCUSSION AND ROBUSTNESS

1. Non-linear Sales Tax
2. Capital Investment
3. Quantity Regulation

# NUMERICAL ANALYSIS

## PARAMETERIZATION

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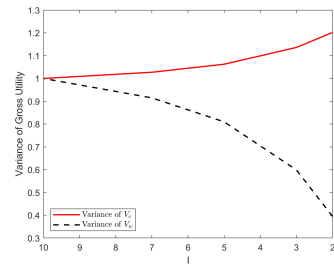
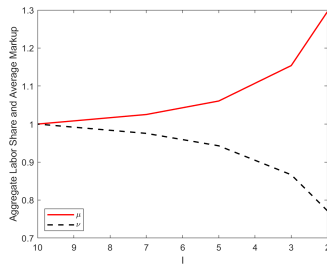
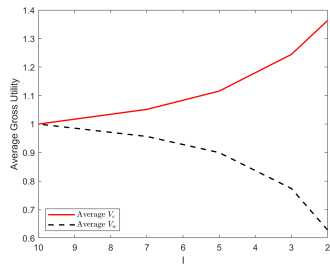
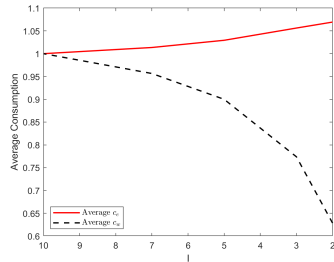
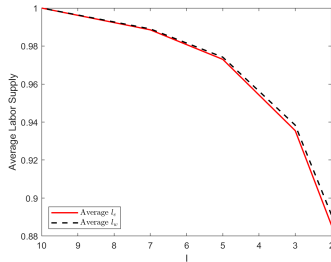
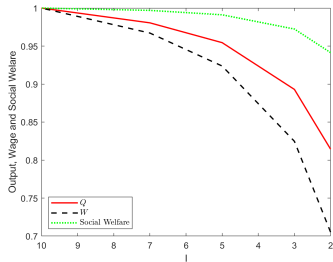
$G(V) = \frac{V^{1-k}}{1-k}$	social welfare function
$k \in \{1, 3\}$	concavity of the social welfare function; $k = 1$ is benchmark
$f_o(\theta_o) = 1$	PDF of skills
$N_e = 0.2$	measure of entrepreneurs
$A = 10^4$	the TFP of final good production technology $Q$
$\xi = 0.85$	concavity of technology $Q_{ij}$
$\sigma = 1.5$	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))

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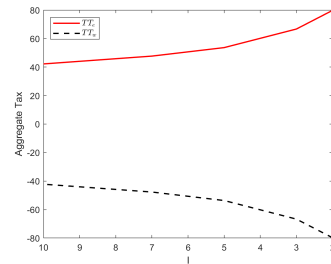
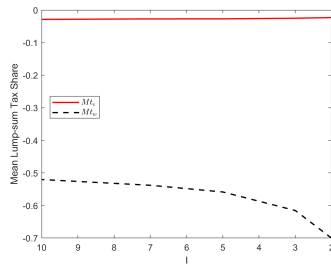
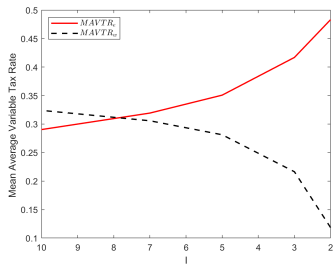
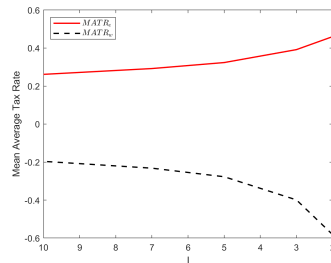
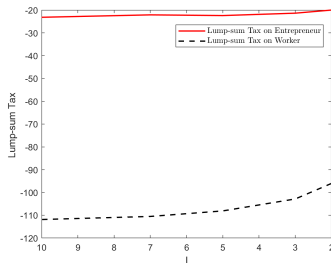
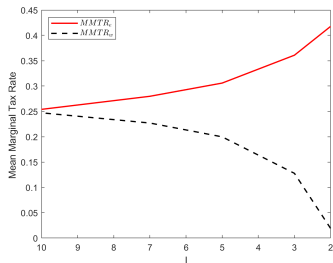
# NUMERICAL ANALYSIS

## LAISSEZ-FAIRE



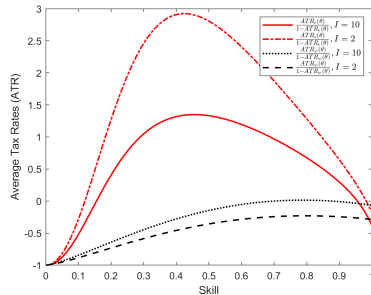
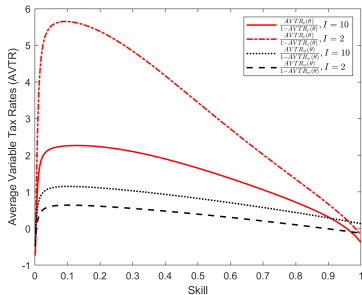
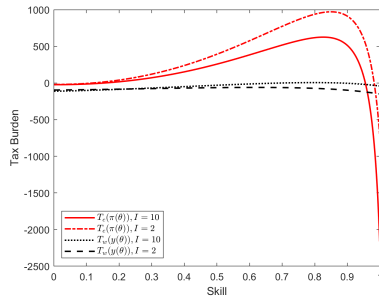
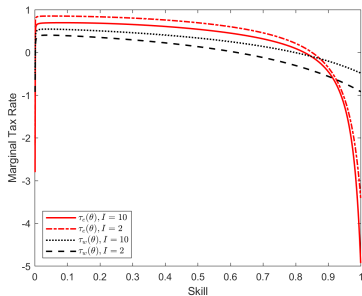
# NUMERICAL ANALYSIS

## OPTIMAL TAXATION – BY MARKET POWER /



# 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:
      - through dependence of price elasticity on market structure and productivity difference
    - **Lowers** marginal profit tax for higher types:
      - Reallocation and Redistribution
- Simulations. Net effect of market power:
  - increase in marginal tax rate on profits and decrease on labor
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# CONCLUSION

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  - Simulations. Net effect of market power:
    - increase in marginal tax rate on profits and decrease on labor
    - same for total tax burden
- ∴ Income taxation cannot resolve root cause (market power), but optimal taxes depend on it



# 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 condition is satisfied for  $\mu < 2.8$

# THE PLANNER'S PROBLEM

Assumption A1.

- (i)  $\pi(\theta_e)$  is differentiable, strictly positive, and positive increasing in  $\theta_e$ ;
- (ii)  $\mu_{ij}(\theta_e) \frac{\partial \ln P(Q_{ij}(\theta_e), \theta_e)}{\partial \theta_e} + \frac{x'_e(\theta_e)}{x_e(\theta_e)}$  is strictly positive.

# OPTIMAL TAXATION

## OLIGOPOLY ( $I > 1$ ) AND HETEROGENEOUS MARKUPS

- Special case: Utilitarian SWF and uniform types  $\theta_e$ :

$$\tau_w^\#(\theta_w) = 1 - \mu$$

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

- Marginal tax on profits is decreasing for large enough  $\mu(\theta_e)$ , i.e. regressive
- There exist  $\theta_e^*$ , 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:

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

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

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

⇒ We can focus on  $\tau_e, \tau_w$

# NUMERICAL ANALYSIS

## SUMMARY OF TAX MEASURES

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$t_o$	Lump-sum tax (depends on occupation)
$\tau_o(\theta_o)$	Marginal tax rate
$T_o(y(\theta_o))$	Tax burden
$ATR_o(\theta_o) = \frac{T_o(y(\theta_o))}{y(\theta_o)}$	Average tax rate
$AVTR_o(\theta_o) = \frac{T_o(y(\theta_o)) - t_o}{y(\theta_o)}$	Average variable tax rate
$TT_o = N_o \int_{\theta_o} T_o(y(\theta_o)) f_{\theta_o}(\theta_o) d\theta_o$	Total tax burden
$MMTR_o = \int_{\theta_o} \tau_o(\theta_o) f_{\theta_o}(\theta_o) d\theta_o$	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

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