Optimal Redistribution in an Open Economy

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How should society respond to increasing inequality?

• Conventional view: more redistribution
• My answer: depends on the source of inequality

1 Skill (increasing dispersion of ability): ▶ increase redistribution
2 Globalization (falling trade costs): ▶ increase less or even reduce
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Model of Trade and Inequality

- Melitz-based model:
  1. Heterogeneity in productivity
  2. Selection into exporting (fixed costs)
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• Stylized model of labor market:
  — One type of heterogeneous agents: worker-entrepreneurs
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- Data: more productive firms
  ... hire more productive workers
  ... are larger and pay higher wages
  ... are more likely to export
Why this model?

- **Conventional framework**: Stolper-Samuelson (HO model)

  Challenges:
  
  — Inequality in developing countries
  — Within-sector reallocation
  — Residual inequality
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• **Alternative framework:** Helpman-Itskhoki-Redding (2008a,b)
  
  — Heterogeneous firms and workers
  — Positive assortative matching
  — Rent-sharing
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- **This paper:** stylized version of HIR
Results

- Trade increases inequality
  - Participation: only most productive agents export
  - Gains from trade: disproportionately at the top
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  - Marginal taxes distort intensive margin
  - Distorted scale of production discourages entry
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• Extensive margin of trade:
  $\Rightarrow$ greater income inequality (inequality margin)
  $\Rightarrow$ greater efficiency loss from taxation (efficiency margin)
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• Redistribution rationalizes export entry subsidies
Related Literature

• Recent work on trade and inequality:
  — Verhoogen (2008), Amiti and Davis (2008)
  — Helpman, Itskhoki and Redding (2008a,b)

• Public Finance models with extensive margin:

• Compensation of losers from trade:
Outline

1. Economic Environment
2. Closed Economy
3. Open Economy
   - Optimal Linear Tax
   - Additional Tax Instruments
4. Summary and Discussion
Economic Environment

• Standard Public Finance Setup:
  — Heterogeneous agents with productivity $n \sim H(n)$
  — Linear production technology $y = n\ell$

\[ Q = \left[ \int y^n dH(n) \right]^{1/\beta}, \quad 0 \leq \beta \leq 1 \]
Economic Environment

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  — Heterogeneous agents with productivity $n \sim H(n)$
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• Each worker-entrepreneur produces distinct variety:

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Economic Environment

- Standard Public Finance Setup:
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- Each worker-entrepreneur produces distinct variety:

$$Q = \left[ \int y_n^\beta dH(n) \right]^{1/\beta}, \quad 0 \leq \beta \leq 1$$

- Real revenue of agent $n$:

$$r_n = Q^{1-\beta} y_n^\beta$$
Agents and Government

- Agent’s problem:

\[ \mathcal{U}_n \equiv \max_{c, y \geq 0} \mathcal{U} \left( c, \frac{y}{n} \right) \]

subject to budget constraint:

\[ c = r - T(r), \quad \text{where} \quad r = Q^{1-\beta} y^\beta \]
Agents and Government

• Agent’s problem:

\[ U_n \equiv \max_{c, y \geq 0} U \left( c, \frac{y}{n} \right) \]

subject to budget constraint:

\[ c = r - T(r), \quad \text{where} \quad r = Q^{1-\beta} y^\beta \]

• Government maximizes a Social Welfare Function:

\[ \max_{T(\cdot)} \int G(U_n) dH(n) \]

subject to individual optimality and GBC:

\[ \int T(r_n) dH(n) \geq 0 \]
Assumptions

- No income effects in labor supply:
  \[ \mathcal{U}(c, \ell) = c - v(\ell) \]

- Constant labor supply elasticity:
  \[ v(\ell) = \frac{1}{\gamma} \ell^\gamma \quad \Rightarrow \quad \varepsilon \equiv \frac{v'(\ell)}{\ell \cdot v''(\ell)} = \frac{1}{\gamma - 1} \]

- Constant relative inequality aversion:
  \[ G(\mathcal{U}) = \frac{1}{1 - \rho} \mathcal{U}^{1-\rho}, \quad \rho \geq 0 \]

- Restricted set of tax instruments:
  - Linear tax rate:
    \[ T(r) = -\Delta + tr, \quad \Delta = tR \]
  - Additional tax instruments
Closed Economy

Proposition

i. *Income inequality is determined uniquely by the ability distribution*

ii. *Optimal linear tax rate increases in income inequality*
Closed Economy

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Sketch of the Proof:

- **Lemma:** Distribution of relative revenues:
  \[ r_n \propto n^{\frac{\beta \gamma}{\gamma - \beta}} \]

- **Lemma:**
  
  Efficiency Margin = Intensive Margin of Labor Supply = \( \varepsilon \)

- **Lemma:** Inequality Margin increases in income inequality (variance of relative revenues)
Open Economy

Setup

- Source of trade: love-of-variety \((\beta < 1)\)
  - Krugman (1980); Helpman and Krugman (1985)
  - Broda and Weinstein (2006)

- Two symmetric countries

- No tariffs and efficient bargaining about national tax policies

- Variable iceberg trade cost \(\tau > 1\)

- Fixed costs of trade \(f_x\) (Melitz, 2003) \(\rightarrow\) selection
  - Evidence: Bernard-Jensen (2004); Das-Roberts-Tybout (2007)
Open Economy
Agent’s Problem

- Revenues:
  \[ r_n = \begin{cases} 
  Q^{1-\beta} y_n^{\beta}, & \text{non-exporter,} \\
  Y_x^{1-\beta} Q^{1-\beta} y_n^{\beta}, & \text{exporter} 
  \end{cases} \]
  \[ Y_x \equiv 1 + \tau^{-\frac{\beta}{1-\beta}} \]

- Consumption:
  \[ c_n = \Delta + (1 - t) r_n - I_n f_x \]

- Utility:
  \[ U_n = \max_{c, y, I_n} \left\{ c - v(y/n) \right\} \]

- Selection: \( n_x \) is exporting cutoff
Trade and Inequality

- **Result:** Trade increases inequality of revenues and utilities

\[
\begin{align*}
\text{Relative revenues:} & \quad r_n R \\
\propto & \begin{cases} 
\frac{n^{\beta \gamma}}{\gamma - \beta}, & n < n_x \\
\frac{\gamma}{1 - \beta} - \frac{\beta}{\gamma - \beta} n^{\beta \gamma}, & n \geq n_x 
\end{cases} \\
\end{align*}
\]

- Two limiting cases:
  - no agent exports \((n_x \rightarrow n_{\text{max}})\)
  - all agents export \((n_x \rightarrow n_{\text{min}})\)
Trade and Inequality

- **Result:** Trade increases inequality of revenues and utilities

- Relative revenues:

\[
\frac{r_n}{R} \propto \begin{cases} 
  n^{\frac{\beta \gamma}{\gamma - \beta}}, & n < n_x, \\
  Y_x^{\frac{1-\beta}{\gamma - \beta}} n^{\frac{\beta \gamma}{\gamma - \beta}}, & n \geq n_x,
\end{cases},
\]

\[
Y_x = 1 + \tau^{\frac{-\beta}{1-\beta}}
\]
Trade and Inequality

• **Result:** Trade increases inequality of revenues and utilities

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\end{cases}
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• **Two limiting cases:**
  
  — no agent exports \((n_x \rightarrow n_{\text{max}})\)
  
  — all agents export \((n_x \rightarrow n_{\text{min}})\)

\[
\frac{r_n}{R} = \frac{r_n^a}{R^a} \propto n^{\frac{\beta \gamma}{\gamma - \beta}}
\]
Relative Revenues
Illustration

Productivity, $n$
Relative Revenues, $r_n / R$

Autarky
Open Economy

$n_{min}$ $n_x$
Utilities

Illustration

Productivity, $n$

Individual Utility, $U_n$

Autarky

Open Economy

$n_{\text{min}}$

$n_x$
Proposition

*Holding the tax rate constant:*

i. All agents gain from trade, although these gains are not proportionally distributed;

ii. Inequality of relative revenues and utilities is higher in an open economy than in autarky given that some agents do not export;

iii. *Falling trade costs first increase and then decrease inequality.*

- Replicates Helpman, Itskhoki and Redding (2008):
  - inequality is higher in open economy
  - inequality is non-monotonic with the fraction of exporting agents
Inequality in Open Economy

Illustration

![](image)

\[ \frac{\text{var}(r/R)}{\text{var}(r^a/R^a)} \]

Variable Trade Cost, \( \tau \)

1 1.5 2 2.5

0.9 1 1.1 1.2 1.3

Graph showing the relationship between variable trade cost and the ratio of variances.
Optimal Redistribution

Proposition

In response to the same increase in inequality, optimal linear tax rate increases by less (or even falls) in the open economy relative to closed economy.
Optimal Redistribution

Proposition

*In response to the same increase in inequality, optimal linear tax rate increases by less (or even falls) in the open economy relative to closed economy.*

Intuition:

- Inequality Margin still increases in income inequality (variance of relative revenues)

- Efficiency Margin = Intensive Margin + Extensive Margin $> \varepsilon$
Optimal Linear Tax Rate

- General optimality condition:

\[ \frac{t}{1 - t} = \frac{1}{\tilde{\epsilon}} \cdot \alpha - (1 - \beta)(1 - \alpha), \quad 0 \leq \alpha \leq 1 \]

\[ -\frac{1 - \beta}{\beta} \leq t \leq \frac{1}{1 + \tilde{\epsilon}} \]

- Efficiency
- Max revenue
Optimal Linear Tax Rate

• General optimality condition:

\[
\frac{t}{1 - t} = \frac{1}{\tilde{\varepsilon}} \cdot \alpha - (1 - \beta)(1 - \alpha), \quad 0 \leq \alpha \leq 1
\]

• Efficiency Margin:

\[
\tilde{\varepsilon} \equiv \frac{d \ln Q}{d \ln (1 - t)} = \varepsilon \cdot \begin{cases} 
1, & \text{no trade/no selection,} \\
1 + \kappa_x, & \text{trade with selection}
\end{cases}
\]

• Inequality Margin:

\[
\alpha \equiv \int \frac{G'(U_{n})}{\lambda} \frac{r_{n} - R}{R} dH(n) = -\text{cov} \left( \frac{G'(U)}{\lambda}, \frac{r}{R} \right) \\
= -\beta_{U} \cdot \text{var} \left( \frac{r}{R} \right)
\]
Policy Response to Inequality

Open Economy

![Graph showing policy response to inequality in an open economy. The x-axis represents the variable trade cost, $\tau$, and the y-axis represents the marginal tax rate, $t$. The graph illustrates how the marginal tax rate changes with varying trade costs, highlighting the concept of autarky.]
Policy Response to Inequality
Open Economy
Policy Response to Inequality

Open versus Closed Economy

Inequality Margin, $\alpha$
Linear Tax Rate, $t$

Closed Economy
Open Economy
with extensive margin

$\alpha^a$
$\alpha_{\text{max}}$
Additional Tax Instruments

1. Can government target **entry** directly?

2. **Marginal** vs **Average** tax rates
Additional Tax Instruments

1. Can government target *entry* directly?

2. Marginal vs Average tax rates

   - Natural candidates for additional tax instruments:
     - export market entry subsidy ($s$)
     - differential tax rates on exporters and non-exporters ($t_d$, $t_x$)

   - A type of a two-bracket tax system
Additional Tax Instruments

1. Can government target entry directly?

2. Marginal vs Average tax rates

- Natural candidates for additional tax instruments:
  - export market entry subsidy ($s$)
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- A type of a two-bracket tax system

- Analytical characterization of optimal entry
- Numerical analysis of optimal tax schedules
Optimal Entry

- Utilitarian Welfare ($\rho = 0$):

$$W^\circ = Q - \pi_x f_x - \int v \left( \frac{y_n}{n} \right) dH(n)$$
Optimal Entry

- Utilitarian Welfare ($\rho = 0$):

$$W^\circ = Q - \pi_x f_x - \int v \left( \frac{y_n}{n} \right) dH(n)$$

Proposition

i. *Entry is efficient when intensive margin is undistorted:*

$$t = - \frac{1 - \beta}{\beta} \implies s^\circ = 0$$

ii. *There is too little entry when intensive margin is distorted:*

$$t > - \frac{1 - \beta}{\beta} \implies 0 < s^\circ / f_x < 1$$

iii. $ds^\circ / t_d < 0$ and $ds^\circ / t_x > 0$

iv. *Optimal entry subsidy for $\rho > 0$, $s^* < s^\circ$*
Numerical Analysis
Parameter Calibration

• Pareto ability distribution with shape parameter 2.2
  — upper end of the empirical ability distribution in Saez (2001)

• Elasticity of substitution $= 4 \ (\beta = 3/4)$

• Labor supply elasticity $\varepsilon = 1/2$
  — Tuomala (1990) and Saez (2002)

• Inequality aversion $\rho = 2$
  — Saez (2002)

• Fixed trade cost $f_x$ such that 35% of output is produced by exporting agents and exports accounts for 18% of consumption
  — Bernard and Jensen (1999)
Average and Marginal Tax Rates

Three Instruments

Figure: Average and Marginal Tax Rates for Different Skill Levels
($\tau = 1.3$)
Optimal Entry

Additional Tax Instruments

Figure: Optimal Entry, $n_x$
Marginal Tax Rates

Additional Tax Instruments

Figure: Optimal Marginal Tax Rates, $t_d$ and $t_x$
Marginal Tax Rates

Additional Tax Instruments

Figure: Optimal Marginal Tax Rates, $t_d$ and $t_x$
Inequality Outcome

Additional Tax Instruments

Figure: Inequality of Relative Revenues, $\text{var}(r/R)$
• Trade intensifies both inequality and efficiency margins through selection into exporting (extensive margin of trade)

• An optimal tax system should balance equity, efficiency and, in particular, entry decisions

• Negative marginal tax rates for agents at the threshold

• Greater inequality may be a necessary outcome to reap the most gains from trade
Discussion

• Second dimension of heterogeneity: fixed costs

• General non-linear taxes in the open economy
Discussion

• Second dimension of heterogeneity: fixed costs

• General non-linear taxes in the open economy

• Other activities with extensive margin: technology adoption

• The role of free entry condition

• Losers from trade

• Optimal unemployment insurance