Inequality and Unemployment in a Global Economy

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Motivation
Trade and Inequality

- Two central propositions in trade:
  - Aggregate welfare gains from trade, but...
  - Distributional conflict: both winners and losers from trade

- 1980-90s: globalization and growing inequality
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• Traditional framework: Stolper-Samuelson Thm of HO model
  — Apparent empirical limitations
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• We propose an alternative framework:
  — Agent heterogeneity and selection into exporting
  — Reallocation within industries
  — Composition of workers across firms
Challenges for Traditional Theory

1. Growing income inequality in developing countries
   — e.g., Goldberg and Pavcnik (2007)

2. Little movement in relative prices
   — e.g., Lawrence and Slaughter (1993)

3. Reallocation of workers within industries
   — e.g., Levinsohn (1999) for Chile

4. Residual wage inequality
   — e.g., Attanasio et al. (2004) for Colombia

5. Unemployment as another source of inequality
Our Approach

• New analytical framework
  — consistent with a number of product and labor market facts

• Main ingredients:
  1. Firm productivity heterogeneity
  2. Unobservable worker ability heterogeneity:
     – general worker ability
     – match-specific productivity
  3. Random search and matching
  4. Costly screening by firms
  5. Production technology with complementarities

Main findings:
1. Trade increases inequality within sectors
   — for general asymmetric countries
   — robust to specifics of GE
2. Direct effect of trade is to increase unemployment
3. Welfare gains are ensured for risk-neutral agents
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Related Literature

- Heterogeneous firms and trade:
  - Melitz (2003), Yeaple (2005)

- Search and matching:
  - Diamond-Mortenson-Pissarides
  - Shimer and Smith (2000)

- Trade with search and matching frictions:
  - Davidson, Martin and Matusz (1999)
  - Helpman and Itskhoki (2007)

- Micro level studies of reallocation and productivity
  - e.g., Bernard and Jensen (1995)

- Firm recruitment policies and worker screening
  - e.g., Terpstra and Rozell (1993)
Model Outline

• Two asymmetric countries
• One heterogeneous factor: labor
• Melitz-type sector
• Static one-shot game

• **Timing:**
  1. Workers choose sector to search for job
  2. Workers are matched with firms
  3. Firms screen workers
  4. Firm bargain with hired workers

  — Workers that are not sampled or sampled but not hired are unemployed
Market Structure

• Revenues in the domestic market:

\[ r = Ay^\beta, \quad 0 < \beta < 1 \]

• Monopolistic competition as in Melitz (2003)
  — Fixed entry cost: \( f_e \)
  — Productivity draw \( \theta \sim \text{Pareto}(z) \)
  — Fixed production cost: \( f_d \)
  — Trade: variable iceberg cost \( \tau > 1 \) and fixed cost \( f_x \)
  — Revenue of the firm:

\[ r(\theta) = Y(\theta)^{1-\beta} Ay(\theta)^\beta, \]

\[ Y(\theta) = 1 + I_x(\theta) \cdot \tau^{-\frac{\beta}{1-\beta}} \left( \frac{A^*}{A} \right)^{\frac{1}{1-\beta}} \]
Production Technology

• Production function:

\[
y = \theta h^\gamma \bar{a} = \theta \left(\frac{1}{h}\right)^{1-\gamma} \int_0^h a_i \, di, \quad 0 < \gamma < 1
\]

— human capital complementarity (team production)
— managerial time as fixed factor (Rosen, 1982)

• Unobservable ability: \( a \sim \text{Pareto}(k) \)

• Search cost: \( b \cdot n \)

• Screening cost: \( \frac{c}{\delta} (a_c)^\delta \)

• Output:

\[
y = \kappa_y \theta n^\gamma a_c^{1-\gamma k}, \quad \gamma k < 1
\]
Firm’s Problem

- Wage bargaining (Stole and Zwiebel, 1996):
  \[ w(\theta) = \frac{\beta \gamma r(\theta)}{1 + \beta \gamma h(\theta)} \]

  — Hsieh and Klenow (2008)
  — Eaton, Kortum, Kramarz (2008)

- More productive firms:
  - sample more workers
  - are more selective
  - hire more workers (provided \( \delta > k \))
  - pay higher wages
Firm’s Problem

• Wage bargaining (Stole and Zwiebel, 1996):

\[ w(\theta) = \frac{\beta \gamma}{1 + \beta \gamma} \frac{r(\theta)}{h(\theta)} \]

• Firm solves:

\[ \pi(\theta) = \max_{n \geq 0, a_c \geq a_{\min}, l_x \in \{0,1\}} \left\{ \frac{1}{1 + \beta \gamma} Y^{1-\beta} A \left[ \kappa y \theta n^{\gamma} a_c^{1-\gamma k} \right]^{\beta} \right. \]

\[ - bn - \frac{c}{\delta} a_c^\delta - l_x f_x - f_d \left\} \]

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\left. - bn - \frac{c}{\delta} a_c^\delta - l_x f_x - f_d \right\}
\]

• \( \theta < \theta_d \) exit and \( \theta > \theta_x \) export

• More productive firms:
  — sample more workers
  — are more selective
  — hire more workers (provided \( \delta > k \))
  — pay higher wages

• Exporter fixed effects
Exporter Wage Premium

- Market access variable:

\[ Y(\theta) = \begin{cases} 
1, & \theta < \theta_x, \\
Y_x > 1, & \theta \geq \theta_x
\end{cases}, \quad Y_x = 1 + \tau^{\frac{-\beta}{1-\beta}} \left( \frac{A^*}{A} \right)^{\frac{1}{1-\beta}} \]
Exporter Wage Premium

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\end{cases}, \quad Y_x = 1 + \tau^{1-\beta} \left( \frac{A^*}{A} \right)^{1-\beta} \]

- Revenue across firms:

\[ r(\theta) = r_d Y(\theta)^{1-\beta} \left( \frac{\theta}{\theta_d} \right)^{\beta/\Gamma} \]

**Intuition:** profit is smooth, revenue jumps for exporters to cover \( f_x \)
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• Wages:

\[ w(\theta) = \frac{b}{h(\theta)/n(\theta)} = b \left( \frac{a_c(\theta)}{a_{\min}} \right)^k = w_d Y(\theta)^{\frac{(1-\beta)k}{\delta\Gamma}} \left( \frac{\theta}{\theta_d} \right)^{\frac{\beta k}{\delta\Gamma}} \]

— Bernard and Jensen (1995)
Wage Profiles
Open Economy vs. Autarky

Productivity, $\theta$

Wage rate, $w(\theta)$

$\theta_d$, $\theta^a_d$, $\theta_x$

$w(\theta)$, $w^a(\theta)$
Wage Distribution

• In autarky, wage distribution is Pareto\((1 + 1/\mu)\):

\[
G_w^a = 1 - \left( \frac{w_d}{w} \right)^{1+1/\mu}, \quad \mu = \frac{\beta k/\delta}{z\Gamma - \beta}
\]

— Helpman, Itskhoki and Redding (2008a)
— Faggio, Salvanes and Van Reenen (2007)

• \(\mu\) is a sufficient statistic for inequality
  — Coef. of Variation, Lorenz Curve (Gini Coef.), Thiel Index

• In open economy, wage distribution is a mix of:
  — Truncated Pareto\((1 + 1/\mu)\) (non-exporting firms)
  — Pareto\((1 + 1/\mu)\) (exporting firms)
Autarky: \( w_x^- \rightarrow \infty \)

All firms export: \( w_x^+ \rightarrow w_d \)
Wage Inequality

Lemma
In a trade equilibrium in which all firms export, wage inequality in the differentiated sector is the same as in autarky.

Proof: In both cases the wage distribution is Pareto\((1 + 1/\mu)\).
Wage Inequality

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In a trade equilibrium in which all firms export, wage inequality in the differentiated sector is the same as in autarky.

Proof: In both cases the wage distribution is Pareto\((1 + 1/\mu)\).

Proposition

Wage inequality is strictly greater in trade equilibrium when some but not all firms export.

Proof:

i. Consider a counterfactual *autarkic* wage distribution \(G^C_w(w)\) with shape param. \(1 + 1/\mu\) and the same mean as in the open economy

ii. \(G^C_w(w)\) second-order stochastically dominates \(G_w(w)\)
Actual vs. Counterfactual Wage Distributions

Figure: Wage Densities
Actual vs. Counterfactual Wage Distributions

Figure: Wage CDFs
Wage Inequality
Corollary

- Define a measure of trade openness:

\[ \rho \equiv \frac{\theta_d}{\theta_x} \in [0, 1] \]

- \( \rho^Z \) equals the fraction of exporting firms

- Inequality is lowest in autarky (\( \rho = 0 \)) and when all firms export (\( \rho = 1 \))

- Inequality is strictly greater when some but not all firms export (\( 0 < \rho < 1 \))
  
  - Intuition: some but not all workers are employed by exporters who pay high wages

- Inequality is increasing (decreasing) in trade openness when the fraction of exporting firms \( \rho^Z \) is low (high)
Wage Inequality

Corollary

\[ \text{Theil Index, } T_w = \mu - \ln(1 + \mu) \]

\[ \text{Trade Openness, } \rho = \frac{\theta_d}{\theta_x} \]
Unemployment

- Sectoral unemployment rate:

\[ u = \frac{L - H}{L} = 1 - \frac{H}{N} \frac{N}{L} = 1 - \sigma x \]
Unemployment

- **Sectoral unemployment rate:**
  \[ u = \frac{L - H}{L} = 1 - \frac{H N}{N L} = 1 - \sigma x \]

- **Labor market tightness:** \( x = \frac{N}{L} \)
  \[ bx = \omega \quad \text{and} \quad b = \alpha_0 x^{\alpha_1} \]
Unemployment

- **Sectoral unemployment rate:**
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- **Labor market tightness:** \( x = \frac{N}{L} \)
  \[ bx = \omega \quad \text{and} \quad b = \alpha_0 x^{\alpha_1} \]

- **Hiring rate:**
  \[ \sigma = \frac{H}{N} = \varphi(\rho) \cdot \sigma^a, \quad \sigma^a = (1 + \mu)^{-1} \cdot \frac{h_d}{n_d} \]

  — **Property:** \( \varphi(\rho) < \varphi(0) = 1 \) for all \( \rho > 0 \)
Unemployment

- Sectoral unemployment rate:
  \[ u = \frac{L - H}{L} = 1 - \frac{H \cdot N}{N \cdot L} = 1 - \sigma x \]

- Labor market tightness: \( x = \frac{N}{L} \)
  \[ bx = \omega \quad \text{and} \quad b = \alpha_0 x^{\alpha_1} \]

- Hiring rate:
  \[ \sigma = \frac{H}{N} = \varphi(\rho) \cdot \sigma^a, \quad \sigma^a = (1 + \mu)^{-1} \cdot \frac{h_d}{n_d} \]
  
  - Property: \( \varphi(\rho) < \varphi(0) = 1 \) for all \( \rho > 0 \)

**Proposition**

*Holding \( \omega \) constant, unemployment rate is higher in a trade equilibrium than in autarky.*

- Intuition: Reallocation towards more productive and selective firms
Income Inequality

- Income inequality takes into account both wage inequality and unemployment rate

- Theil Index and Gini Coefficient:
  \[ T_i = T_w - \ln(1 - u) \]
  \[ G_i = u + (1 - u)G_w \]

Proposition

*The distribution of income is more unequal in a trade equilibrium than in autarky.*

- Both unemployment and wage inequality are higher in a trade equilibrium
General Equilibrium

1. Economy with Outside Sector
   - Constant expected income, $\omega = 1$
   - Constant labor market tightness, $x$
   - Aggregate welfare gains from trade
   - Compositional effects at the aggregate
General Equilibrium

1. Economy with Outside Sector
   - Constant expected income, $\omega = 1$
   - Constant labor market tightness, $\lambda$
   - Aggregate welfare gains from trade
   - Compositional effects at the aggregate

2. One-sector Economy
   - Expected income $\omega$ increases with trade (welfare gains)
   - Income effect on unemployment: $\lambda$ increases
   - No compositional effects
General Equilibrium

1. Economy with Outside Sector
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   - Expected income $\omega$ increases with trade (welfare gains)
   - Income effect on unemployment: $x$ increases
   - No compositional effects

3. Risk-aversion (with outside sector)
   - Uncertainty affects sectoral composition (risk premium)
   - Trade increases uncertainty: $x$ increases to compensate
   - Two opposite effects on welfare
Summary

• New framework:
  — composition of workers across firms
  — reallocation within industries

• Trade: greater welfare at the cost of greater social disparity

• Further trade liberalization has non-monotonic effects on inequality
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- Trade: greater welfare at the cost of greater social disparity

- Further trade liberalization has non-monotonic effects on inequality

- HIR (work in progress): Risk and Uncertainty in a Global Economy

- Helpman-Itskhoki-Muendler-Redding (work in progress): (Semi-) Structural estimation using Brazilian data

- Itskhoki (2008): Optimal Redistribution in an Open Economy
Product and Labor Market Equilibrium

• Free entry condition:

\[ \int_{\theta_d}^{\infty} \pi_{d}(\theta) \, dF(\theta) + \int_{\theta_x}^{\infty} \pi_{x}(\theta) \, dF(\theta) = f_e \]

• Labor Market:
  — Labor market tightness (probability of being matched):

\[ x = \frac{N}{L} \]

  — Expected wage conditional on matching:

\[ w(\theta) \frac{h(\theta)}{n(\theta)} = b \]

  — Worker indifference:

\[ xb = \omega \]

  — Hiring cost:

\[ b = \alpha_0 x_1^\alpha \]
Theil Index

• Theil index of inequality:

\[ T_w = \int \frac{w}{\bar{w}} \ln \frac{w}{\bar{w}} \, dG_w(w) \]

• Decomposition into Within and Between-group Inequality:

\[ T_w = T_{w,W} + T_{w,B} = \sum_j \frac{\phi_j \bar{w}_j}{\bar{w}} T_{w,j} + \sum_j \frac{\phi_j \bar{w}_j}{\bar{w}} \ln \frac{\bar{w}_j}{\bar{w}} \]

• Theil index of income inequality with unemployment:

\[ T_l = T_w - \ln(1 - u) \]

• Theil index for Pareto \((1 + 1/\mu)\):

\[ T_w = \mu - \ln(1 + \mu) \]

Back to Theorem  
Back to Corollary
Wage Distribution
Open Economy

• Wage distribution in open economy:

\[
G_w(w) = \begin{cases} 
S_{h,d} \cdot G_{w,d}(w), & w_d \leq w < w_x^- \equiv w_d \left( \frac{\theta_x}{\theta_d} \right)^{\frac{\beta k}{\delta T}}, \\
S_{h,d}, & w_x^- \leq w < w_x^+ \\
S_{h,d} + (1 - S_{h,d}) G_{w,x}(w), & w \geq w_x^+ \equiv w_d \left( \frac{\theta_x}{\theta_d} \right)^{\frac{\beta k}{\delta T}} Y_x \left( \frac{1 - \beta}{\delta T} \right)
\end{cases}
\]

• \(G_{w,d}\) is truncated Pareto with shape parameter \(1 + 1/\mu\):

\[
G_{w,d}(w) = \left[ 1 - \left( \frac{w_d}{w} \right)^{1+1/\mu} \right] / \left[ 1 - \left( \frac{w_d}{w_x^-} \right)^{1+1/\mu} \right]
\]

• \(G_{w,x}\) is Pareto with shape parameter \(1 + 1/\mu\):

\[
G_{w,x}(w) = 1 - \left( \frac{w_x^+}{w} \right)^{1+1/\mu}
\]

• \(S_{h,d}\) is the share of workers employed in non-exporting firms