# 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

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- 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

## 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:

$$r = Ay^{\beta}, \qquad 0 < \beta < 1$$

- 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:

$$r(\theta) = \Upsilon(\theta)^{1-\beta} A y(\theta)^{\beta},$$

$$\Upsilon(\theta) = 1 + I_x(\theta) \cdot \tau^{-\frac{\beta}{1-\beta}} \left(\frac{A^*}{A}\right)^{\frac{1}{1-\beta}}$$

## Production Technology

- Production function:

$$y = \theta h^{\gamma} \bar{a} = \theta \left( \frac{1}{h} \right)^{1-\gamma} \int_0^h a_i \mathrm{d}i, \qquad 0 < \gamma < 1$$

  — 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: $\frac{c}{\delta} \left( a_c \right)^{\delta}$

- Output:

$$y = \kappa_y \theta n^{\gamma} a_c^{1-\gamma k}, \qquad \gamma k < 1$$

# Firm's Problem

- Wage bargaining (Stole and Zwiebel, 1996):

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

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

# Firm's Problem

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

- Firm solves:

$$\pi(\theta) = \max_{\substack{n \geq 0, \\ a_c \geq a_{\min}, \\ I_x \in \{0,1\}}} \left\{ \frac{1}{1+\beta\gamma} \Upsilon^{1-\beta} A \left[ \kappa_y \theta n^{\gamma} a_c^{1-\gamma k} \right]^{\beta} - bn - \frac{c}{\delta} a_c^{\delta} - I_x f_x - f_d \right\}$$

Sectoral Equilibrium

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- $\theta < \theta_d$ 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

▸ Sectoral Equilibrium

# Exporter Wage Premium

- Market access variable:

$$\Upsilon(\theta) = \begin{cases} 1, & \theta < \theta_x, \\ \Upsilon_x > 1, & \theta \geq \theta_x \end{cases}, \qquad \Upsilon_x = 1 + \tau^{\frac{-\beta}{1-\beta}} \left( \frac{A^*}{A} \right)^{\frac{1}{1-\beta}}$$

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- Revenue across firms:

$$r(\theta) = r_d \Upsilon(\theta)^{\frac{1-\beta}{\Gamma}} \left( \frac{\theta}{\theta_d} \right)^{\beta/\Gamma}$$

Intuition: profit is smooth, revenue jumps for exporters to cover $f_x$

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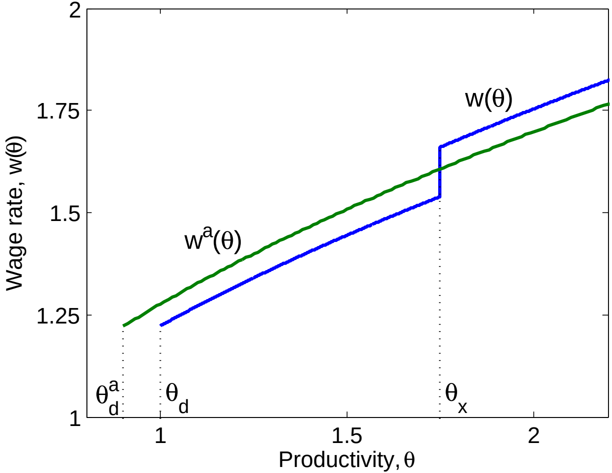
- Wages:

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

— Bernard and Jensen (1995)

# Wage Profiles

## Open Economy vs. Autarky



# Wage Distribution

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

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

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

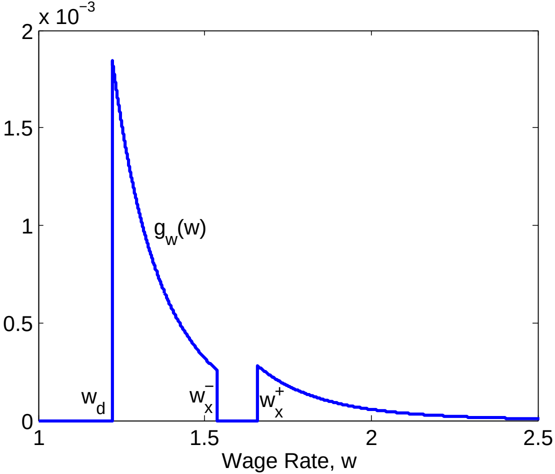
- $\mu$ is a sufficient statistic for inequality
  — Coef. of Variation, Lorenz Curve (Gini Coef.), Thiel Index

- In open economy, wage distribution is a mix of:
  — Truncated Pareto$(1 + 1/\mu)$ (non-exporting firms)
  — Pareto$(1 + 1/\mu)$ (exporting firms)

▸ Open Economy Wage Distribution

# Wage Density

## Open Economy




- Autarky: $w_x^- \longrightarrow \infty$
- All firms export: $w_x^+ \longrightarrow w_d$

# 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$(1 + 1/\mu)$.

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## Proposition

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

Proof:

i. Consider a counterfactual *autarkic* wage distribution $G_w^c(w)$ with shape param. $1 + 1/\mu$ and the same mean as in the open economy
ii. $G_w^c(w)$ second-order stochastically dominates $G_w(w)$

Theil Index is Convex

# Actual vs. Counterfactual Wage Distributions

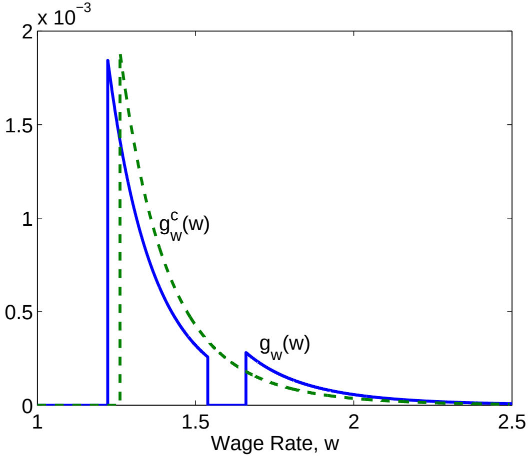


Figure: Wage Densities

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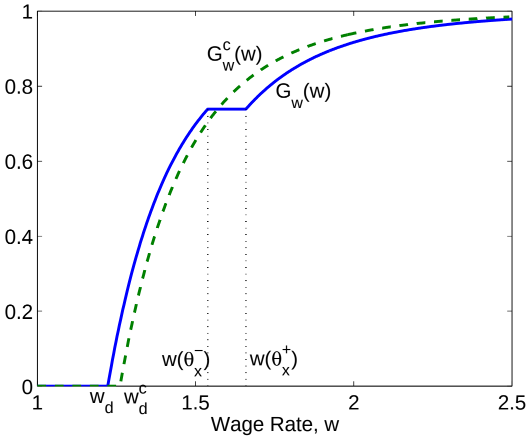



Figure: Wage CDFs

# Wage Inequality

## Corollary

- Define a measure of trade openness:

$$\rho \equiv \theta_d / \theta_x \in [0, 1]$$

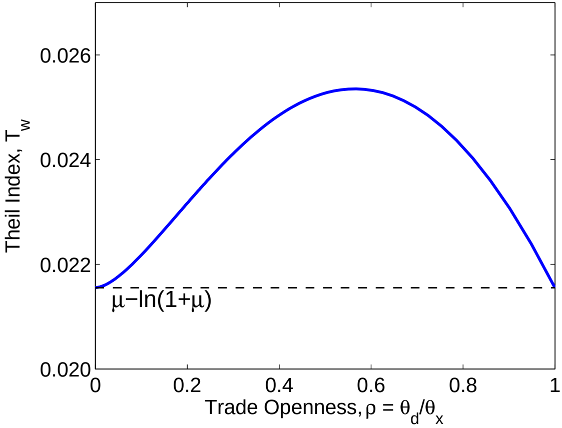
  — $\rho^z$ equals the fraction of exporting firms

- 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)



0.026
0.024
0.022
0.020
Theil Index, T_w
μ−ln(1+μ)
0
0.2
0.4
0.6
0.8
1
Trade Openness, ρ = θ_d/θ_x


▸ Theil Index

# Unemployment

- Sectoral unemployment rate:

$$u = \frac{L - H}{L} = 1 - \frac{H}{N}\frac{N}{L} = 1 - \sigma x$$

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$$bx = \omega \qquad \text{and} \qquad b = \alpha_0 x^{\alpha_1}$$

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- Hiring rate:

$$\sigma = H/N = \varphi(\rho) \cdot \sigma^a, \qquad \sigma^a = (1 + \mu)^{-1} \cdot h_d / n_d$$

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

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## 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:

$$\mathcal{T}_\iota = \mathcal{T}_w - \ln(1-u)$$

$$\mathcal{G}_\iota = u + (1-u)\mathcal{G}_w$$

## 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, $x$
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   - Expected income $\omega$ increases with trade (welfare gains)
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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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- 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:

$$\int_{\theta_d}^{\infty} \pi_d(\theta) \mathrm{d}F(\theta) + \int_{\theta_x}^{\infty} \pi_x(\theta) \mathrm{d}F(\theta) = f_e$$

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

$$x = N/L$$

  - — Expected wage conditional on matching:

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

  - — Worker indifference:

$$xb = \omega$$

  - — Hiring cost:

$$b = \alpha_0 x_1^{\alpha}$$

▸ Back to Firm's Problem ▸ Back to Unemployment

# Theil Index

- Theil index of inequality:

$$T_w = \int \frac{w}{\bar{w}} \ln \frac{w}{\bar{w}} \mathrm{d} G_w(w)$$

- 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:

$$T_\iota = T_w - \ln(1-u)$$

- 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:

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

- $G_{w,d}$ is truncated Pareto with shape parameter $1 + 1/\mu$:

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

- $G_{w,x}$ is Pareto with shape parameter $1 + 1/\mu$:

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

- $S_{h,d}$ is the share of workers employed in non-exporting firms

▸ Back to Wage Distribution