Inequality and Unemployment in a Global Economy

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Harvard International Workshop
October 29, 2008

Motivation

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

- Relationship between globalization and inequality is one of the most hotly-contested topics
  - e.g., what are the relative contributions of trade and technology to growing US inequality?

- Traditional framework for the analysis of distributional consequences of trade: Stolper-Samuelson Theorem of the H-O model

- Several empirical limitations have recently become apparent with the traditional framework

- We propose an alternative framework for examining the distributional consequences of globalization which overcomes these limitations

Challenges for Traditional Theory

1. Evidence of rising income inequality in both *developed* and *developing* countries following trade liberalization (e.g., Goldberg and Pavcnik, 2007)

2. *Residual wage inequality* is a major contributor to increasing income inequality (e.g., Attanasio et al., 2004, for Colombia)

3. Reallocation of workers *within industries* rather than across industries (e.g., Levinsohn, 1999, for Chile)

4. Response of *unemployment* is another channel for distributional effects of trade

Our Approach

- We propose a new framework for examining distributional consequences of trade which is consistent with empirical patterns

- 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 ensures aggregate welfare gains
  2. However, opening to trade increases social disparity, both wage inequality and unemployment:
     - in all countries, developed and developing
     - both within sectors and at the aggregate

Related Literature

- Heterogeneous firms and trade
  - Melitz (2003), Antras and Helpman (2004), Helpman, Melitz and Yeaple (2004), and Bernard, Redding and Schott (2007).
- Search and matching
  - Labor and Macro: Mortenson (1970, 2003), Pissarides (1974, 2000), Diamond (1982), and Burdett and Mortensen (1998).
  - Trade: Davidson et al. (1998, 1999), Felbermayr et al. (2008), and Helpman and Itskhoki (2008)
- Search and matching with worker heterogeneity
  - Shimer and Smith (2000), Albrecht and Vroman (2002), Postel-Vinay and Robin (2002), Davidson et al. (2008), and Lentz (2008).
- Firm recruitment policies and worker screening
  - Jackson et al. (1989), Terpstra and Rozell (1993), and Autor and Scarborough (2005).

Model Outline

- Two countries
- Two sectors
- One factor: labor
- 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

Preferences and Demand

- Quasi-linear utility function:

$$\mathbb{U} = q_0 + \frac{1}{\zeta} Q^{\zeta}, \qquad \zeta > 0$$

- CES preferences for differentiated products:

$$Q = \left[\int_{\omega \in \Omega} q(\omega)^{\beta} d\omega \right]^{\frac{1}{\beta}}, \qquad \zeta < \beta < 1$$

- Demand functions:

$$q(\omega) = Q^{-\frac{\beta - \zeta}{1 - \beta}} p(\omega)^{-\frac{1}{1-\beta}}, \qquad Q^{-(1-\zeta)} = P$$

- Indirect utility function:

$$\mathbb{V} = E + \frac{1 - \zeta}{\zeta} Q^{\zeta}$$

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- All goods are produced with labor
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- The market for brands of the differentiated product is monopolistically competitive as in Melitz (2003):
  - Fixed entry cost f_e in terms of the homogenous good
  - The firm then learns its productivity $\theta \sim \text{Pareto}(z)$:

$$G_\theta(\theta) = 1 - \left(\theta_{\min}/\theta\right)^z, \qquad z > 2$$

  - Fixed production cost f_d
  - Trade: variable iceberg cost $\tau > 1$ and fixed cost f_x
  - Revenue of the firm with output y

$$r = \Upsilon^{1-\beta} Q^{-(\beta-\zeta)} y^\beta, \qquad \Upsilon = 1 + I_x \cdot \tau^{-\frac{\beta}{1-\beta}} \left(Q^*/Q\right)^{-\frac{\beta-\zeta}{1-\beta}}$$

  - If revenue is insufficient to cover all costs, the firm exits

Production Technology

- Output of a firm with productivity θ and h employees with average ability $\bar{a}$:

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

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  — managerial time as fixed factor

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- Screening cost: $c \cdot a_c^{\delta}/\delta$ to screen workers with ability below a_c

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$$\bar{a} = \tfrac{k}{k-1} a_c \qquad \text{and} \qquad h = n \cdot \left(a_{\min}/a_c\right)^k$$

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

Firm's Problem

- Wage bargaining as in Stole and Zwiebel (1996):

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

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

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- Low productivity firms exit ($\theta < \theta_d$), average productivity firms serve the domestic market and high productivity firms also export ($\theta > \theta_x$)
- More productive firms:
  - — sample more workers
  - — are more selective
  - — hire more workers (provided $\delta > k$)
  - — pay higher wages $\rightarrow$ *size wage premium*
- Exporter fixed effects

Exporter Wage Premium

- Market access variable:

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

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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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- Employment and wages also increase discontinuously for exporters:

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

- Exporter wage premium is one of the empirical stylized facts (Bernard and Jensen, 1995)

Product and Labor Market Equilibrium

- Free entry condition:

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

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- 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:

$$xb = 1$$

  - — Hiring cost:

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

Gains from Trade

Proposition

Every country gains from trade.

Proof:

i. From free entry condition: $\theta_x \downarrow \quad \Rightarrow \quad \theta_d \uparrow$

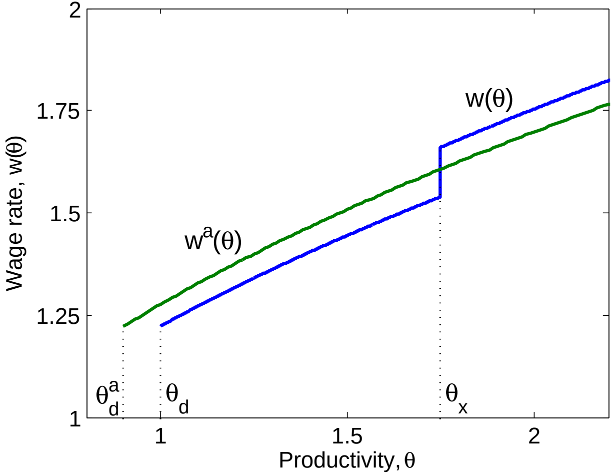
ii. From zero profit condition: $\theta_d \uparrow \quad \Rightarrow \quad Q \uparrow$

iii. From indirect utility function: $Q \uparrow \quad \Rightarrow \quad \mathbb{V} \uparrow$

Intuition: Trade tightens competition in product market, reduces prices and increases welfare

Wage Profiles

Open Economy vs. Autarky



Wage Distribution

- In autarky, wage distribution is Pareto:

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

- Shape parameter is a sufficient statistic for measures of inequality:

$$T_w^a = \mu - \ln(1+\mu)$$

- We use Theil index of inequality due to its decomposability:

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

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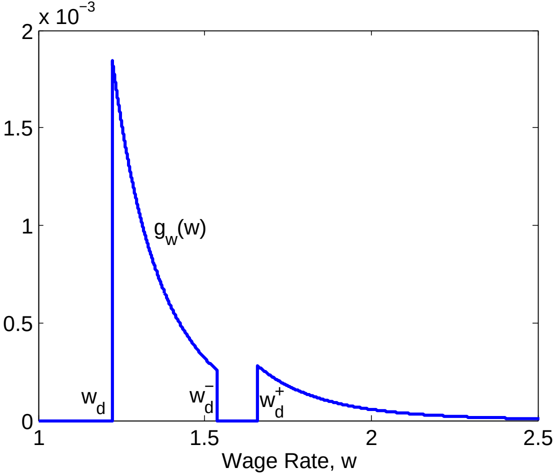
- Wage distribution in open economy:

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

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

Wage Density

Open Economy



- Autarky ($\rho \equiv \theta_d/\theta_x = 0$): $w_x^- \nearrow \infty$
- All firms export ($\rho \equiv \theta_d/\theta_x = 1$): $w_x^+ \searrow w_d$

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 with shape parameter $1 + 1/\mu$:

$$T_w^{\infty} = T_w^{a} = \mu - \ln(1 + \mu).$$

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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 $G_w(w)$
iii. Theil index is an expectation of a convex function:

$$T_w > T_w^a = \mu - \ln(1 + \mu)$$

Actual vs. Counterfactual Wage Distributions

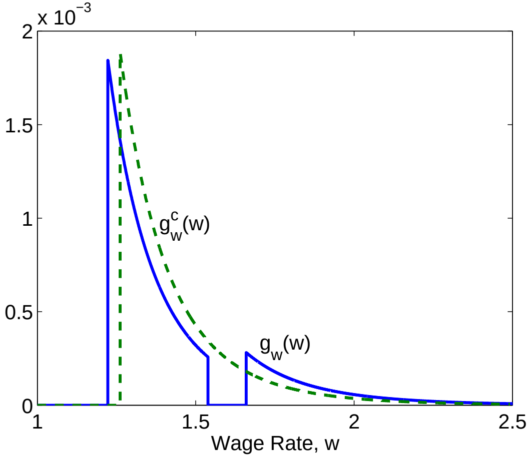

Figure: Wage Densities

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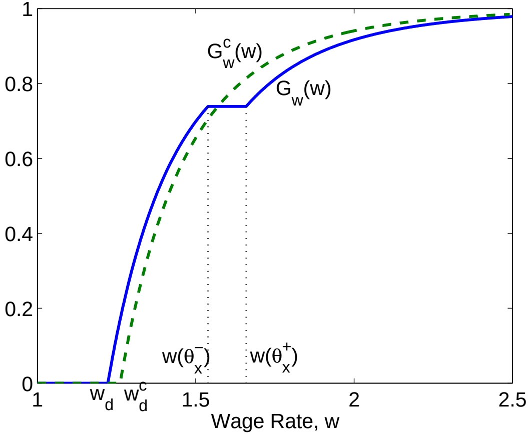

Figure: Wage CDFs

- Define a measure of trade openness:

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

Note that ρ^z equals the fraction of exporting firms.

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Corollary

Greater trade openness increases wage inequality when few firms export ($\rho \approx 0$) and reduces it when almost all firms export ($\rho \approx 1$).

Wage Inequality in the Open Economy

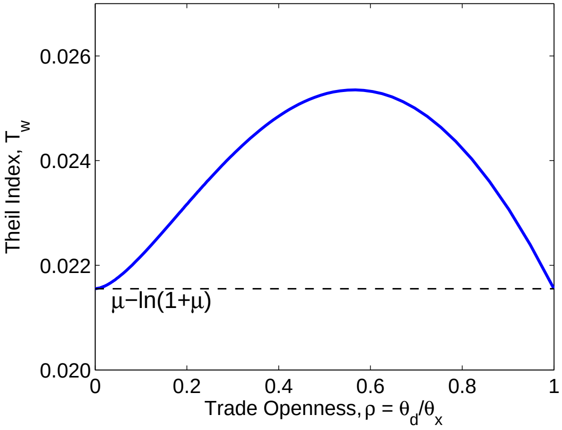

Figure: Theil Index of Wage Inequality

- Sectoral unemployment rate:

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

- Hiring rate:

$$\sigma = \frac{H}{N} = \varphi(\rho) \cdot \sigma^a, \qquad \sigma^a = \frac{1}{1+\mu}\left(\frac{a_{\min}}{a_d}\right)^k$$

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Proposition

Unemployment rate is higher in a trade equilibrium than in autarky.

— Trade does not affect LM tightness (x), but reduces hiring rate (σ)
— Intuition: trade leads to reallocation of business towards more productive and more selective firms

Income Inequality
in the Open Economy

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

- Result for the Theil index:

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

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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

Aggregate Inequality and Unemployment

- So far we discussed sectoral inequality and unemployment
- Aggregate inequality and unemployment compound an additional compositional effect:

$$\mathbf{u} = \frac{L}{\bar{L}} \cdot u \qquad \text{and} \qquad \mathbf{T}_{\boldsymbol{\iota}} = \frac{L}{\bar{L}} \cdot T_{\iota}$$

- When countries are nearly symmetric, trade leads to an increase in the relative size of the differentiated sector ($L/\bar{L}$)

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Proposition

As long as countries are sufficiently similar, aggregate unemployment and aggregate income inequality are higher in both countries in the trade equilibrium than in autarky.

Determinants

of Inequality and Unemployment

- Inequality and unemployment increase in trade openness ρ when a small fraction of firms export ($\rho \approx 0$)

- Trade openness of a country, ρ, increases as:
  - trade costs f_x and τ fall
  - the country reduces relative labor market frictions (b/b^* or c/c^* fall), given that the two countries were initially similar enough

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  - the country reduces relative labor market frictions (b/b^* or c/c^* fall), given that the two countries were initially similar enough
- Therefore, unemployment and inequality increase as trade cost fall and labor market institutions improve given that only a small fraction of firms export
- These are exactly the changes that improve welfare

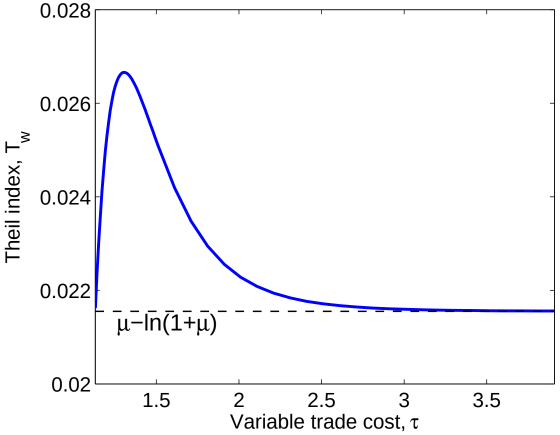

Figure: Wage inequality a a function τ

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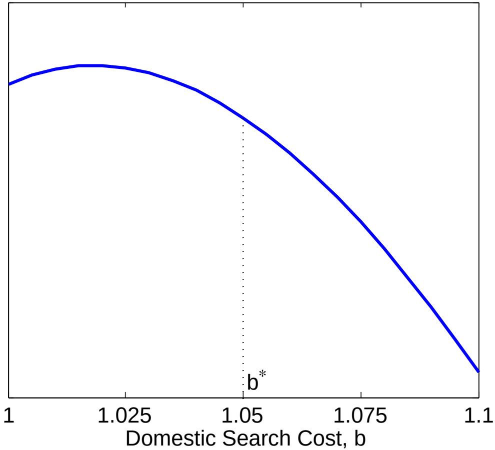

Figure: Wage inequality as a function of b

Conclusion

- Tradition approach to the analysis of distributional consequences of trade emphasizes specialization across industries and changes in relative factor rewards
- We propose an alternative framework that emphasizes heterogeneity across firms and workers within industries and labor market friction:
  - Trade leads to reallocation both across and within industries
  - Trade intensifies hiring and selection practices and affects the composition of workers across firms and the wage distribution
- Opening up to trade has unambiguous aggregate welfare gains, but is also associated with an increase in social disparity, i.e. with greater inequality and unemployment
- When a country is open to trade, further globalization has non-monotonic effect on inequality and unemployment
- Our framework is highly stylized, but it remains tractable and amenable to a number of extensions