Inequality and Unemployment in a Global Economy

Helpman, Itskhoki and Redding

Presented by Md. Deen Islam

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Introduction

- Two fundamental Issues in Economics
  - Allocation of resources across economic activities
  - Distribution of incomes across factors of production
- Contributions of this paper:
  - Develops a rich, flexible and tractable model for examining the impact of trade on these two issues
  - Provide predictions regarding trade, inequality and unemployment that match features of the data

Literature

- Trade and inequality with neoclassical labor market
  - Yeaple (2005) and Bustos (2009)
  - Ohnsorge and Trefler (2007) and Costinot and Vogel (2009)
  - Burstein and Vogel (2009)
- Trade, unemployment and inequality with labor market frictions
  - Davis and Harrigan (2008)
  - Egger and Kreickemeier (2009a,b) and Amiti and Davis (2009)
  - Felbermayr et al. (2008, 2009) and Helpman and Itskhoki (2000a)

Framework and Model Setup

- Framework
  - Use standard Diamond-Mortensen-Pissarides search and matching frictions into a Melitz (2003) model.
  - Introduce ex-post match specific heterogeneity in a worker's ability.
- Model Setup
  - Two countries: Home and Foreign (foreign is denoted by asterisk)
  - Continuum of risk neutral workers who are *ex ante* identical.
  - Real consumption index for the sector Q is

$$Q = [\int_{j \in J} q(j)^{\beta} dj]^{1/\beta}, \qquad 0 < \beta < 1$$

$$q(j) = A^{1/1-\beta} p(j)^{-1/1-\beta}$$

Model Setup

- Equilibrium revenue is:

$$r(j) = p(j)q(j) = Aq(j)^{\beta}$$

  Where p(j) and q(j) are price quantity of variety j, repectively, and A is a demand-shifter.

- Sunk entry cost is f_e, f_d is production fixed cost, and f_x is export fixed cost. θ denotes productivity parameter, which follows a Pareto distribution $(G_{\theta}(\theta) = 1 - (\theta_{min}/\theta)^{z} \quad where \quad z > 1)$.

Model Setup

- τ denotes iceberg variable trade cost
- Output is given by:

$$y = \theta h^{\gamma} \bar{a}$$

  where y denotes output, h denotes measure of worker hired and $\bar{a}$ denotes average ability of workers
- Ability *a* is drawn from a Pareto distribution:

$$G_a(a) = 1 - (a_{min}/a)^k$$

  for $a \geq a_{min} > 0$ and $k > 1$
- b is the search cost and $c{a_c}^{\delta}/\delta$ is the screening cost where $c > 0$ and $\delta > 0$ and a_c is the cutoff ability.

The Model

- For a screening threshold a_c we have;

$$h = n(\frac{a_{min}}{a_c})^k, \qquad \bar{a} = \frac{k}{(k-1)} a_c$$

- Higher screening $\Rightarrow$ higher average ability and lower hired worker. Screen will increase output if k is sufficiently low.
- Firm and worker bargain to share the revenue, corresponding shares are:
  Firm's share $= \frac{1}{1+\beta\gamma}$, Workers' share $= \frac{\beta\gamma}{1+\beta\gamma}$

The Model

- Firms profit maximization problem is given by;

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

- First order conditions are:

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

$$\frac{\beta(1-\gamma k)}{1+\beta\gamma} r(\theta) = c a_c(\theta)^{\delta}$$

Solution of the Model

- From first order conditions we get:

$$w(\theta) = \frac{\beta\gamma}{1+\beta\gamma}\frac{r(\theta)}{h(\theta)} = b\frac{n(\theta)}{h(\theta)} = b[\frac{a_c(\theta)}{a_{min}}]^k$$

$$r(\theta) = \kappa_r[c^{-\frac{\beta(1-\gamma k)}{\delta}} b^{-\beta\gamma}\Upsilon(\theta)^{(1-\beta)} A\theta^{\beta}]^{\frac{1}{\Gamma}}$$

$$\pi(\theta) = \frac{\Gamma}{1+\beta\gamma} r(\theta) - f_d - I_x(\theta) f_x$$

where $\Gamma \equiv 1 - \beta\gamma - \beta(1-\gamma k)/\delta$ and $\Upsilon(\theta) \equiv 1 + I_x(\theta)\tau^{-\frac{\beta}{1-\beta}}(\frac{A^*}{A})^{\frac{1}{1-\beta}}$

Solution of the Model

- Labor market tightness and search cost
  - Search cost in standard Diamond-Mortensen-Pissarides is

$$b = \alpha_0 x^{\alpha_1}, \qquad \alpha_0 > 1, \qquad \alpha_1 > 0$$

  - Equilibrium search condition for worker is

$$\omega = xb, \quad where \quad b = \frac{\omega(\theta)h(\theta)}{n(\theta)}$$

  - From these two conditions we get

$$b = \alpha_0^{\frac{1}{1+\alpha_1}} \omega^{\frac{\alpha_1}{1+\alpha_1}} \quad and \quad x = (\frac{\omega}{\alpha_0})^{\frac{1}{1+\alpha_1}}$$

  Where $\alpha_0 > \omega$ so that $0 < x < 1$

Solution of the Model

- Productivity cutoff and Demand
  - Exit cutoff (θ_d) is determined by zero profit condition

$$\frac{\Gamma}{1+\beta\gamma}\kappa_r[c^{-\frac{\beta(1-\gamma k)}{\delta}}b^{-\beta\gamma}A\theta_d^{\beta}]^{\frac{1}{\Gamma}} = f_d$$

  - Export cutoff (θ_x) is determined by firm's indifference between catering domestic or foreign market

$$\frac{\Gamma}{1+\beta\gamma}\kappa_r[c^{-\frac{\beta(1-\gamma k)}{\delta}}b^{-\beta\gamma}A\theta_d^{\beta}]^{\frac{1}{\Gamma}}[\Upsilon_x^{(1-\beta)/\Gamma} - 1] = f_x$$

  - Demand shifter (A) is determined free entry condition

$$f_d\int_{\theta_d}^{\infty}[(\frac{\theta}{\theta_d})^{\frac{\beta}{\Gamma}} - 1]dG_\theta + f_x\int_{\theta_x}^{\infty}[(\frac{\theta}{\theta_x})^{\frac{\beta}{\Gamma}} - 1]dG_\theta = f_e$$

- Combining firm's first order condition and productivity cutoff, we can rewrite firm specific variables as follows:

$$r(\theta) = \Upsilon(\theta)^{\frac{1-\beta}{\Gamma}} \cdot r_d \cdot \left(\frac{\theta}{\theta_d}\right)^{\frac{\beta}{\Gamma}}, \qquad r_d \equiv \frac{1+\beta\gamma}{\Gamma} f_d,$$

$$h(\theta) = \Upsilon(\theta)^{\frac{1-\beta}{\Gamma}(1-k/\delta)} \cdot h_d \cdot \left(\frac{\theta}{\theta_d}\right)^{\frac{\beta(1-k/\delta)}{\Gamma}}, \quad h_d \equiv \frac{\beta\gamma}{\Gamma}\frac{f_d}{b}\left[\frac{\beta(1-\gamma k)}{\Gamma}\frac{f_d}{c a_{\min}^{\delta}}\right]^{-k/\delta},$$

$$w(\theta) = \Upsilon(\theta)^{\frac{k(1-\beta)}{\delta\Gamma}} \cdot w_d \cdot \left(\frac{\theta}{\theta_d}\right)^{\frac{\beta k}{\delta\Gamma}}, \qquad w_d \equiv b\left[\frac{\beta(1-\gamma k)}{\Gamma}\frac{f_d}{c a_{\min}^{\delta}}\right]^{k/\delta},$$

- Here Firm's revenue, firm's size and wage paid by the firm increase discretely at the productivity threshold for entry into export market.

- Wage and Productivity

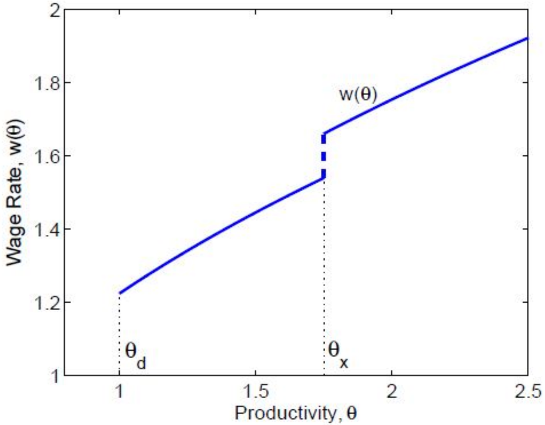

Figure 1: Wages as a function of firm productivity

Model's Predictions

- Wage distribution of workers employed by domestic firms

$$G_{w,d}(w) = \frac{1 - \left(\frac{w_d}{w}\right)^{1+1/\mu}}{1 - \rho^{z - \frac{\beta(1-k/\delta)}{\Gamma}}} \qquad \text{for } w_d \leq w \leq w_d / \rho^{\frac{k\beta}{\delta\Gamma}}.$$

- Wage distribution of workers employed by exporters

$$G_{w,x}(w) = 1 - \left[\frac{w_d}{w} \Upsilon_x^{\frac{k(1-\beta)}{\delta\Gamma}} \rho^{-\frac{k\beta}{\delta\Gamma}}\right]^{1+1/\mu} \qquad \text{for } w \geq w_d \Upsilon_x^{\frac{k(1-\beta)}{\delta\Gamma}} / \rho^{\frac{k\beta}{\delta\Gamma}}.$$

- Here both distributions have same shape parameter $1 + 1/\mu$, where $\mu \equiv \frac{\beta k/\delta}{z\Gamma - \beta}$ and $0 < \mu < 1$, and $\rho \equiv \frac{\theta_d}{\theta_x}$.

Model's Predictions

- Wage Inequality in the Closed Economy
  - The Coefficient of Variation of Wage is $\mu\sqrt{1-\mu^2}$
  - The Gini Coefficient is $\frac{\mu}{2+\mu}$
  - The Theil Index is $\mu - \log(1+\mu)$
- Higher $\mu \Rightarrow$ higher wage dispersion of the wage distribution and so higher wage inequality.
- Higher μ is due to lower z (Davis and Haltiwanger, 1991; Faggio et al.,2007)

Model's Prediction

- Wage Inequality and Trade liberalization
  - If $\rho = 0$ before and after trade liberalization $\Rightarrow$ No change in Inequality.
  - If $\rho = 1$ before and after trade liberalization $\Rightarrow$ No change in Inequality.
  - If initially $\rho = 0$ or $\rho = 1$ and after trade liberalization $0 < \rho < 1 \Rightarrow$ Increase in Inequality.

Model's Prediction

- $0 < \rho < 1$: Counterfactual Analysis

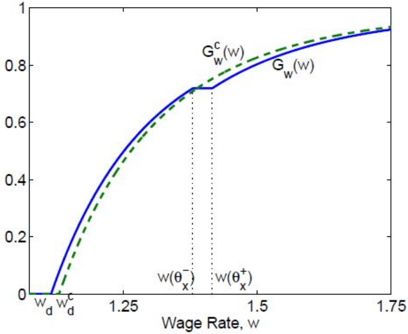

Figure 2: Cumulative distribution function of wages

Here $G_w(w)$ is open economy wage distribution and $G_w^c(w)$ is counterfactual wage distribution.

- $G_w^c(w)$ SOSD $G_w(w) \Rightarrow$ Higher Wage Inequality in Open Economy.

Model's Prediction

- Unemployment and Trade
  - Unemployment rate (u) is given by

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

  Here σ is the hiring rate and x is the labor market tightness.

- In partial equilibrium analysis, the greater trade openness, the larger magnitudes of σ and x, so the greater unemployment rate.
- In general equilibrium analysis, the greater trade openness may or may not affect σ and x, so the impact on unemployment rate is uncertain.

Model's Prediction: General Equilibrium

- Under risk neutrality, opening trade in one-sector economy has following impacts:
  - Increases expected worker income $(\omega) \Rightarrow$ *ex ante* welfare.
  - Increases labor market tightness (x) and search costs (b).
- Under risk aversion, opening trade in two-sector economy has following impacts:
  - Increases expected worker income $(\omega) \Rightarrow$ *ex ante* welfare.
  - Increases labor market tightness (x) and search costs (b).

Conclusion

- Complementarities between workers' ability and firm productivity $\Rightarrow$ Screen workers. Larger firms have higher returns to screening
- Opening of the closed economy to trade reallocates resources to more productive firms, more productive firms screen more intensively and have workforces of higher average ability.
- Opening of trade increases the dispersion of firm revenue, and rises wage inequality.
- Wage inequality is at first increasing and later decreasing in trade openness.
- Impact on unemployment is uncertain, depends on the hiring rate and labor market tightness.