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 Theorem of HO model
  – Some 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
Empirical Motivation

1. **Reallocation** occurs largely within rather than between industries
   - e.g., Levinsohn (1999) for Chile

2. **Wage dispersion** across firms within sectors
   - Linked to productivity dispersion (e.g., Davis and Haltiwanger 1991)
   - Employer-size wage premium (e.g., Oi and Idson 1999)

3. **Wage differences** between exporters & non-exporters within sectors

4. **This exporter wage premium** is linked to workforce composition

5. **Labor market frictions** and unemployment
Our Approach

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

• Main ingredients:
  1. Heterogeneity in firm productivity
  2. Heterogeneity in worker ability
    – imperfectly observed match-specific ability
  3. Random search and matching
  4. Screening of workers by firms
  5. Production technology with complementarities

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

• Heterogeneous firms and trade:

• Search and matching:
  – Trade: Davidson et al. (1998, 1999), Felbermayr et al. (2008, 2009), Helpman & Itskhan (2007), and Tybout & Guner (2009)

• Trade and efficiency or fair wages:

• Trade and technology-skill complementarities:

• Firm recruitment policies and worker screening:
Road Map

1. Model Outline

2. Sectoral Equilibrium

3. Trade and Wage Inequality

4. Trade and Unemployment

5. General Equilibrium
   - Economy with an Outside Sector
   - Single-sector Economy
   - Risk Aversion
Model Outline

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

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

**Timing:**

1. Workers choose a sector to search for a 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
• CRRA preferences with CES demand across varieties within sectors
  – Firm revenue 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:

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

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

- Unobserved match-specific ability: \( a \sim \text{Pareto}(k) \)

- Search cost: \( b \cdot n \) (Diamond-Mortensen-Pissarides)

- 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):

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

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

- Firm solves:

\[
\pi(\theta) = \max_{\begin{align*}
n &\geq 0, \\
a_c &\geq a_{\text{min}}, \\
l_x &\in \{0,1\} \end{align*}} \left\{ \frac{1}{1 + \beta \gamma} Y^{1-\beta} A \left[ \kappa y \theta n^\gamma a_{c}^{1-\gamma k} \right]^\beta - b n - \frac{c}{\delta} a_{c}^\delta - l_x f_x - f_d \right\}
\]
Firm’s Problem

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

• Firm solves:

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

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

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

• Wage inequality across firms within sectors:
  – Employer-size wage premium (e.g. Oi and Idson 1999)
  – Rent-sharing (e.g. Van Reenen 1996)
Exporter Wage Premium

- Market access variable:

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

- Market access variable:

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

- Revenue across firms:

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

**Intuition:** profit is smooth, revenue jumps for exporters to cover \( f_x \)
Exporter Wage Premium

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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}} \]

• Revenue across firms:

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

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

• Exporters pay higher wages (Bernard and Jensen 1995, 1997)

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

• Exporters differ in workforce composition (Schank et al. 2007)
Wage Profiles
Open Economy vs. Autarky

Productivity, $\theta$

Wage rate, $w(\theta)$

$w^a(\theta)$

$w(\theta)$

$\theta_d$

$\theta_x$

$\theta^a_d$

$\theta^a$
Wage Distribution

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

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

• Consistent with evidence linking wage and productivity dispersion
  – Davis and Haltiwanger (1991)
  – Faggio, Salvanes and Van Reenen (2007)

• In the closed economy, \(\mu\) is a **sufficient statistic** for inequality
  – Coef. of Variation, Lorenz Curve (Gini Coef.), Theil Index

• In the open economy, the wage distribution is a mix of:
  – Truncated Pareto\((1 + 1/\mu)\) (non-exporting firms)
  – Pareto\((1 + 1/\mu)\) (exporting firms)
Wage Density
Open Economy

- Autarky: $w^{-}_{x} \rightarrow \infty$
- All firms export: $w^{+}_{x} \rightarrow w_{d}$
Wage Inequality

Lemma

In a trade equilibrium where 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

Lemma

In a trade equilibrium where 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

In a trade equilibrium where some but not all firms export, wage inequality in the differentiated sector is strictly greater than in autarky

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 $G_w(w)$

Theil Index
Actual vs. Counterfactual Wage Distributions

Figure: Wage Densities
Actual vs. Counterfactual Wage Distributions

Figure: Wage CDFs
Wage Inequality
Additional Results

• Define a measure of trade openness: \( \rho \equiv \frac{\theta_d}{\theta_x} \in [0, 1] \)
  – where \( \rho \) equals the fraction of exporting firms

• Inequality: lowest in autarky (\( \rho = 0 \)) or if all firms export (\( \rho = 1 \))

• Inequality: strictly greater when only some firms export (\( 0 < \rho < 1 \))
  – Intuition: some but not all workers are employed by exporters who pay higher wages than non-exporters

• Inequality is increasing (decreasing) in trade openness when the fraction of exporting firms \( \rho \) is low (high)

• Average wages conditional on being employed are higher in the open economy than in autarky

• In the open economy, wages in terms of the numeraire are higher at exporters and lower at non-exporters than in autarky
Theil Index, $T_w = \mu - \ln(1+\mu)$
Unemployment

- Sectoral unemployment rate:

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

• Sectoral unemployment rate:

\[
U = \frac{L - H}{L} = 1 - \frac{HN}{NL} = 1 - \sigma x
\]

• Labor market tightness: \( x = \frac{N}{L} \)

\[
\begin{align*}
(bx = \omega) \\
(b = \alpha_0 x^{\alpha_1})
\end{align*}
\]

\[
\Rightarrow x = \left( \frac{\omega}{\alpha_0} \right)^{\frac{1}{1+\alpha_1}}
\]
Unemployment

• Sectoral unemployment rate:

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

• Labor market tightness: \( x = \frac{N}{L} \)

\[
\begin{align*}
bx &= \omega \\
\frac{b}{\alpha_0} &= \alpha_1 \\
\Rightarrow \\
x &= \left( \frac{\omega}{\alpha_0} \right)^{1 + \alpha_1}
\end{align*}
\]

• 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:

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

• Labor market tightness: \( x = \frac{N}{L} \) 

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\begin{align*}
bx &= \omega \\
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\]

\[ \Rightarrow \quad x = \left( \frac{\omega}{\alpha_0} \right)^{\frac{1}{1+\alpha_1}}, \]

• Hiring rate:

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

**Proposition**

*Holding \( \omega \) constant, the 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

- 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 wage inequality and unemployment are higher in a trade equilibrium than in autarky
Economy with an Outside Sector

- Constant expected income: $\omega = 1$
- Constant labor market tightness: $x$
- Expected welfare gains from trade
- Aggregate variables depend on sectoral composition
General Equilibrium

1. Economy with an Outside Sector
   - Constant expected income: $\omega = 1$
   - Constant labor market tightness: $x$
   - Expected welfare gains from trade
   - Aggregate variables depend on sectoral composition

2. One-sector Economy
   - Expected income $\omega$ increases with trade (expected welfare gains)
   - Additional *income effect* for unemployment: $x$ increases
   - No sectoral compositional effects
General Equilibrium

1. Economy with an Outside Sector
   - Constant expected income: \( \omega = 1 \)
   - Constant labor market tightness: \( x \)
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2. One-sector Economy
   - Expected income \( \omega \) increases with trade (expected welfare gains)
   - Additional income effect for unemployment: \( x \) increases
   - No sectoral compositional effects

3. Risk Aversion (with an Outside Sector)
   - Uncertainty affects sectoral composition (risk premium: \( \omega > 1 \))
   - Trade increases income risk: \( \omega \) increases
   - Additional risk effect for unemployment: \( x \) increases
   - Two counteracting effects on expected welfare
Summary

• New theoretical framework to examine the relationship between trade and inequality:
  – composition of workers across firms
  – reallocation within industries

• Trade: expected welfare gains but greater social disparity

• Further trade liberalization has non-monotonic effects on inequality
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• Current and future research:
  – HIR (work in progress): Risk and Uncertainty in a Global Economy
  – Helpman-Itskhoki-Muendler-Redding (work in progress): Empirical Evidence using Brazilian data
  – Itskhoki (2008): Optimal Redistribution in an Open Economy
Thank You