Labor Market Rigidities, Trade and Unemployment

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Motivation

- Institutional differences across countries can be a source of comparative advantage and trade
- Additionally, trade may affect differently countries with different institutions

Types of questions we want to address in this study:
- How is a country affected by a change in its trade partner’s labor market frictions?
- How do improvements in trading environments impact countries with different labor market frictions?

We are primarily interested in the effects on:
- welfare, unemployment, productivity and patterns of trade
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- There are substantial differences across countries in labor market institutions:
  - e.g., hiring costs, firing costs, and flexibility of hours
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• Institutions and Trade:
  – Labor market: Cuñat and Melitz (2007)

• Long-run structural unemployment:
  – Blanchard and Wolfers (2000) and Nickell et al. (2002)

• Trade and Unemployment:
  – Implicit contracts: Matusz (1986)
  – Search and matching: Davidson, Martin and Matusz (1999)
This Paper

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  – Outside sector produces homogenous good under perfect competition and constant returns to scale
  – Differentiated-good sector characterized by monopolistic competition with free entry, increasing returns, heterogenous firms, search friction in the labor market and wage bargaining
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- Two sectors:
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  - Differentiated-good sector characterized by monopolistic competition with free entry, increasing returns, heterogeneous firms, search friction in the labor market and wage bargaining
- Labor market frictions: hiring/firing costs, productivity of matching
- Two types of “shocks”: labor market frictions and trade impediments
Main Results

- Differences in labor market frictions constitute a source of comparative advantage

- Both countries gain from trade, but country with a more flexible labor market benefits the most

- A country benefits from improvements in its labor market flexibility, but this harms its trade partner—terms of trade vs. competitiveness

- However, both countries gain from a simultaneous proportional improvement in labor markets—policy complementarity across countries

- Country with a more flexible labor market is both more productive and enjoys a lower price level

- Interactions of trade and labor market frictions generate rich patterns of unemployment
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Outline

1. Introduction

2. Closed Economy

3. Open Economy
   - Welfare, Trade Patterns, and Productivity
   - Unemployment

4. Summary and Discussion
Preferences and Demand

- **Utility:**
  \[ U = q_0 + \frac{1}{\zeta} Q^\zeta, \quad 0 < \zeta < 1 \]
Preferences and Demand

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• Preferences for differentiated good and associated price index:

\[ Q = \left[ \int_{\omega \in \Omega} q(\omega)^\beta \, d\omega \right]^{1/\beta}, \quad \zeta < \beta < 1 \]
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- Demand functions:
  \[ Q = P^{\frac{-1}{1-\zeta}} \quad \text{and} \quad q_0 = E - P^{\frac{-\zeta}{1-\zeta}} \]
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  \[ Q = P^{-1} \left( 1 - \frac{1}{1-\zeta} \right) \quad \text{and} \quad q_0 = E - P^{-\zeta} \]
  \[ q(\omega) = p(\omega) \left( 1 - \frac{1}{1-\beta} \right) Q^{-\frac{\beta-\zeta}{1-\beta}} \]
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\[ q(\omega) = p(\omega)^{\frac{-1}{1-\beta}} Q^{\frac{\beta - \zeta}{1-\beta}} \]

• Indirect utility function:

\[ \mathbb{V} = E + \frac{1-\zeta}{\zeta} P^{\frac{-\zeta}{1-\zeta}} = E + \frac{1-\zeta}{\zeta} Q^\zeta \]
Technology and Market Structure

- Labor is the only factor of production
- Homogenous good requires one unit of labor per unit output and the market for this product is competitive:

\[ q_0 = h_0 = L - N \quad \text{and} \quad w_0 = p_0 = 1 \]
Technology and Market Structure

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- Homogenous good requires one unit of labor per unit output and the market for this product is competitive:
  \[ q_0 = h_0 = L - N \quad \text{and} \quad w_0 = p_0 = 1 \]
- Market for the brands of differentiated products is monopolistically competitive:
  - \( f_e \) is a fixed cost of entry with a variety \( \omega \)
  - upon entry, a random productivity \( \theta \) is drawn from \( G(\theta) \) and the production function is \( q(\omega) = \theta(\omega)h(\omega) \)
  - revenue then is
    \[
    R(\theta) \equiv p(\theta)q(\theta) = Q^{-(\beta-\zeta)}(\theta h(\theta))^\beta
    \]
  - \( f_d \) is a fixed cost of production
  - revenue should be sufficient to cover the fixed cost of production and labor costs
Labor Relations

- Labor market is competitive for the homogenous good
- There is a search friction in the labor market of differentiated goods
  - Firms face a hiring cost $C(h) = bh, b > 0$
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  - Upon matching, a firm engages in multilateral bargaining with the workers, as in Stole and Zwiebel (1996)
  - Revenue $R(h, \theta)$ is divided according to Shapley values, so that the firm gets a fraction $1/(1 + \beta)$, as in Acemoglu et al. (2007)

$$w(h, \theta) = \frac{\beta}{1 + \beta} \frac{R(h, \theta)}{h}$$
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• Problem of the firm: $\max_h \left\{ (1 + \beta)^{-1} Q^{-\beta}(\theta h)^\beta - C(h) \right\}$

• Solution:

$$h(\Theta) = \phi_1^{\beta} b^{\frac{-1}{1-\beta}} Q^{\frac{-\beta-\zeta}{1-\beta}} \Theta, \quad \Theta \equiv \theta^{\frac{\beta}{1-\beta}}$$

$$w(\Theta) = \frac{\beta}{1+\beta} R(\Theta)/h(\Theta) = b$$
Labor Market

- We use DMP search and matching model
  - matching function:
    \[ H = M(V, N) = a_1^n V^n N^{1-n}, \quad 0 < \eta < 1 \]
  - cost of posting a vacancy: \( a_2 \)
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- We show that
  \[ C(h) = bh, \quad b = ax^\alpha, \quad a \equiv a_2/a_1, \quad x \equiv \frac{H}{N} \]
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• Indifference condition for workers:
  \[ x \cdot \bar{w} = w_0 = 1 \quad \Rightarrow \quad \begin{cases} 
  x = b^{-1} = a^{\frac{1}{1+\alpha}}, \\
  w(\Theta) = b = a^{\frac{1}{1+\alpha}}
\end{cases} \]
Equilibrium Conditions
Closed Economy

- Operating profits: \( \pi(\Theta) = \phi_1 \phi_2 b^{\frac{-\beta}{1-\beta}} Q^{\frac{\beta-\zeta}{1-\beta}} \Theta - f_d \)
- Production cutoff: \( \pi_d(\Theta_d) = 0 \)
- Free entry condition:
  \[ \int_{\Theta_d}^{\infty} \pi(\Theta) dG(\Theta) = f_e \]
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• Aggregate output of the differentiated product:

\[
Q^\beta = M \int_{\Theta_d}^{\infty} q(\Theta)^\beta dG(\Theta)
\]

• Supply and Demand: \( N = \phi_1^{\frac{1-\beta}{\beta}} Q^\zeta \)
Equilibrium Conditions

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- Operating profits: \( \pi(\Theta) = \phi_1 \phi_2 b^{\frac{-\beta}{1-\beta}} Q^{\beta - \frac{\beta - \zeta}{1-\beta}} \Theta - f_d \)

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- Rate of unemployment: \( u = (1 - x)N/L \)
Effects of Labor Market Institutions
Closed Economy

Proposition

*Improvements in labor market institutions* ($b \downarrow$):

(i) *reduce wages in the differentiated product sector;*

(ii) *increases Q and reduces P;*

(iii) *raise M and N proportionally;*

(iv) *raise H proportionately more, thereby tightening labor market;*
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(i) reduce wages in the differentiated product sector;
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(iii) raise M and N proportionally;
(iv) raise H proportionately more, thereby tightening labor market;
(v) reduce unemployment iff

$$b < 1 + \frac{\beta - \zeta}{\beta \zeta},$$

i.e. when labor market frictions are low to begin with;

(vi) raise welfare independently of the impact on unemployment

$$E = L \quad \Rightarrow \quad \mathbb{W} = L + \frac{1-\zeta}{\zeta} Q^\zeta$$
Effects of Labor Market Institutions

Closed Economy

Figure: Unemployment as a function of labor market friction
Open Economy: Preliminaries

- Countries are similar except for the labor market parameter: $b_j$
Open Economy: Preliminaries

- Countries are similar except for the labor market parameter: $b_j$
- There is a fixed cost ($f_x$) and a variable cost ($\tau > 1$) of exporting differentiated products

\[ q_{dj} = Q - \beta - \zeta_1 - \beta j p - 1 \]

\[ q_{xj} = \tau Q - \beta - \zeta_1 - \beta \left( -j \right) \left( \tau p xj \right) - 1 \]

Revenue of a $\Theta$-firm:

\[ R_j(\Theta) = \left[ Q - \beta - \zeta_1 - \beta j + I_{xj}(\Theta) \cdot \tau - \beta \right] 1 - \beta \Theta_1 - \beta h_j(\Theta) \]

Size of a $\Theta$-firm and the wage rate

\[ h_j(\Theta) = \phi_1 \beta_1 b - 1 \frac{1 - \beta j}{1 - \beta} \]

\[ w_j(\Theta) = b_j \Rightarrow w_j = x - 1 j = b_j = a_1 / (1 + \alpha) \]
Open Economy: Preliminaries

- Countries are similar except for the labor market parameter: $b_j$
- There is a fixed cost ($f_x$) and a variable cost ($\tau > 1$) of exporting differentiated products
- Home and Export demand curves:
  
  \[ q_{dj} = Q_{j}^{-\frac{\beta-\zeta}{1-\beta}} p_{dj}^{-\frac{1}{1-\beta}} \quad \text{and} \quad q_{xj} = \tau Q_{(-j)}^{-\frac{\beta-\zeta}{1-\beta}} (\tau p_{xj})^{-\frac{1}{1-\beta}} \]
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$$q_{xj} = \tau Q_{(-j)}^{\frac{-\beta-\zeta}{1-\beta}} (\tau p_{xj})^{\frac{-1}{1-\beta}}$$

- Revenue of a $\Theta$-firm:

$$R_j(\Theta) = \left[ Q_j^{\frac{-\beta-\zeta}{1-\beta}} + I_{xj}(\Theta) \cdot \tau^{\frac{-\beta}{1-\beta}} Q_{(-j)}^{\frac{-\beta-\zeta}{1-\beta}} \right]^{1-\beta} \Theta^{1-\beta} h_j(\Theta)^{\beta}$$
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  \]
- Size of a $\Theta$-firm and the wage rate
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  \]
  \[
  w_j(\Theta) = b_j \quad \Rightarrow \quad w_j = x_j^{-1} = b_j = a_j^{1/(1+\alpha)}
  \]
Cutoffs and Free Entry
Open Economy

- Operating profits are now: \( \pi_j(\Theta) = \pi_{dj}(\Theta) + l_{xj}(\Theta)\pi_{xj}(\Theta) \)

\[
\pi_{dj}(\Theta) = \phi_1 \phi_2 b_j^{\frac{-\beta}{1-\beta}} Q_j^{-\frac{\beta-\zeta}{1-\beta}} \Theta - f_d,
\]

\[
\pi_{xj}(\Theta) = \phi_1 \phi_2 b_j^{\frac{-\beta}{1-\beta}} \tau^{\frac{-\beta}{1-\beta}} Q_{(-j)}^{\frac{-\beta-\zeta}{1-\beta}} \Theta - f_x
\]

- Two cutoffs: \( \pi_{dj}(\Theta_{dj}) = 0 \) and \( \pi_{xj}(\Theta_{xj}) = 0 \)

- Free entry condition:

\[
\int_{\Theta_{dj}}^{\infty} \pi_{dj}(\Theta) dG(\Theta) + \int_{\Theta_{xj}}^{\infty} \pi_{xj}(\Theta) dG(\Theta) = f_e
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\]
Cutoffs and Free Entry

Open Economy

Figure: Cutoffs in a trading equilibrium
Welfare and Gains from Trade

Proposition

(i) Welfare is higher in the flexible country;
Welfare and Gains from Trade

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(ii) An improvement in labor market institutions in one country raises its welfare and reduces the welfare of its trade partner — terms of trade vs. competitiveness effects
Welfare and Gains from Trade

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(i) Welfare is higher in the flexible country;
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(iii) A simultaneous proportional improvement in labor market institutions in both countries raises welfare in both countries;
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Proposition
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Trade Patterns

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(i) *There are more firms and a larger fraction of firms export in the flexible country*
Trade Patterns

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(ii) The flexible country exports differentiated products on net and imports homogenous good
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(iii) The share of intra-industry trade is smaller the larger the proportional gap in labor market institutions
Proposition

(i) There are more firms and a larger fraction of firms export in the flexible country

(ii) The flexible country exports differentiated products on net and imports homogenous good

(iii) The share of intra-industry trade is smaller the larger the proportional gap in labor market institutions

(iv) If productivity is distributed Pareto, total volume of trade increases in the proportional gap in labor market institutions and decreases in the trade costs
Consider the following measure of productivity:

$$TFP_j \equiv \frac{M_j}{H_j} \left[ \int_{\Theta_{dj}}^{\infty} \Theta \frac{1-\beta}{\beta} h_{dj}(\Theta) dG(\Theta) + \int_{\Theta_{xj}}^{\infty} \Theta \frac{1-\beta}{\beta} h_{xj}(\Theta) dG(\Theta) \right]$$

Proposition

(i) $TFP_j$ does not depend on $b_j$ in the closed economy;

(ii) $TFP_j$ is higher in any trading equilibrium than in autarky.

Proposition Assuming individual productivity draws are distributed Pareto:

(i) $TFP_j$ is higher in the flexible country;

(ii) An improvement in $b_j$ raises $TFP_j$ and reduces $TFP_{(-j)}$;

(iii) A reduction in $\tau$ raises $TFP_j$ in both countries.
Productivity

Consider the following measure of productivity:

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Consider the following measure of productivity:

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(i) \( TFP_j \) is higher in the flexible country;
(ii) An improvement in \( b_j \) raises \( TFP_j \) and reduces \( TFP_{(-j)} \);
(iii) A reduction in \( \tau \) raises \( TFP_j \) in both countries.
Productivity and Price Level

Price Level:

\[ P_j = 1 - \frac{1-\zeta}{\zeta} P_j^{-\frac{\zeta}{1-\zeta}} = 1 - \frac{1-\zeta}{\zeta} Q_j^\zeta. \]
Productivity and Price Level

Price Level:

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Proposition

The price level is lower and, hence, the real exchange rate is higher (depreciated) in the flexible country, which also has higher productivity.

Note that the last part of this proposition implies an effect opposite in direction to Balassa-Samuelson.

Contrast with Ghironi and Melitz (2006)
Unemployment

Symmetric Countries: \( b_A = b_B = b \)

In this case

\[
\hat{u} = \left( \frac{1}{b - 1} - \frac{\beta \zeta}{\beta - \zeta} \right) \hat{b} - \frac{\beta \zeta}{\beta - \zeta} \delta_d + \delta_x \hat{\tau}
\]

Proposition

In a symmetric world economy:

(i) improvements in the labor market institutions, common to both countries, reduce unemployment if and only if frictions in the labor market are low to begin with;

(ii) reductions in trade impediments raise unemployment and welfare.
In this case we show:

\[ \hat{u}_A = \left( \frac{1}{b-1} - \psi_{NA} \right) \hat{b}_A, \quad \psi_{NA} > \frac{\beta \zeta}{\beta - \zeta} \]
\[ \hat{u}_B = \psi_{NB} \hat{b}_A, \quad \psi_{NB} > 0 \]

**Proposition**

*In the vicinity of a symmetric equilibrium:*

(i) the flexible country has a lower rate of unemployment if and only if the levels of frictions in the labor markets are low;

(ii) an improvement in the country’s labor market institutions reduces the rate of unemployment in its trade partner, yet it reduces home unemployment if and only if the initial level of frictions in the labor markets are low.
Unemployment

Asymmetric Countries: Response to Labor Market Frictions

Figure: Unemployment as a function of labor market friction: $b_B = 1.3$
Unemployment

Asymmetric Countries: Response to Labor Market Frictions

Figure: Unemployment as a function of labor market friction: $b_B = 1.1$
Figure: Unemployment as a function of $\tau$: $b_A = 1.20$ and $b_B = 1.12$
Unemployment

Asymmetric Countries: Response to Trade Frictions

Figure: Unemployment as a function of $\tau$: $b_A = 1.35$ and $b_B = 1.12$
Unemployment

Asymmetric Countries: Response to Trade Frictions

Figure: Unemployment as a function of $\tau$: $b_A = 1.9$ and $b_B = 1.6$
Summary and Policy Implications

- Interaction of labor market rigidities and trade frictions generate rich patterns of unemployment:
  - Trade may raise unemployment in both countries
  - Both countries gain from trade, but more flexible country gains proportionately more
  - Improvements in a country's labor market institutions raise its welfare and hurt the trade partner:
  - Yet, a simultaneous proportional improvement in both labor markets raises welfare in both countries
  - Trade liberalization and labor market deregulation are complementary
  - Labor market reforms in one country are likely to encourage labor market reforms in its trade partners
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