Trade Liberalization and Regional Dynamics

Rafael Dix-Carneiro\textsuperscript{1}  Brian K. Kovak\textsuperscript{2}

\textsuperscript{1}Duke University  NBER and BREAD

\textsuperscript{2}Carnegie Mellon University - Heinz College  NBER and IZA

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Regional Effects of Trade

- Freer trade generates overall economic gains but is also likely to create winners and losers (Stolper and Samuelson 1941)

- 60 years of work examining trade’s effects on workers with different skills or in different industries

- Starting late 2000s: trade has vastly different effects on workers in different local labor markets
  - Effects determined by regional industry mix

- Trade’s costs and benefits are unevenly distributed geographically, not just across industries or skills
Slow Adjustment to Trade

- No / Perfect mobility in trade theory: short- / long-run models
- Policy makers: what happens in the short- to medium-run? How do we get to the long run?

- Recent work on transitional dynamics of trade liberalization
  - Structural estimation/calibration followed by simulation

- We document observed dynamics of adjustment following real-world trade liberalization
Contributions

- Literature finding substantially different effects of trade shocks across local labor markets
  - Topalova (2007), Kovak (2013), Autor, Dorn and Hanson (2013), and many others
  - Effects estimated over windows of 7/10 years.

- We estimate the evolution of the local effects of the early 1990s Brazilian trade liberalization
  - Discrete liberalization shock → empirical labor market dynamics
  - Compare existing medium-run estimates to short- and long-run
Brazilian Trade Liberalization

Tariff Changes 1990-1995

Change in ln(1+tariff), 1990-95

Empirical Approach

Follow Kovak (2013): trade-induced labor demand shocks

Regional Tariff Reductions

\[ RTR_r = - \sum_i \beta_{ri} d \ln(1 + \tau_i) \]

\[ \beta_{ri} = \frac{\lambda_{ri} \frac{1}{\varphi_i}}{\sum_j \lambda_{rj} \frac{1}{\varphi_j}} \]

- \( i \): industry
- \( \tau_i \): tariff rate in industry \( i \)
- \( d \): long difference from 1990-1995
- \( \lambda_{ri} \): share of regional employment in industry \( i \)
- \( \varphi_i \): 1 minus labor share of value added
Regional Tariff Reductions

90-10 gap ≈ 0.10
Data Description

Administrative Data: RAIS

- **Census** of Brazilian *formal* labor market

- Establishment-level information
  - geographic location (municipality), industry, employment

- Worker-level information
  - gender, age, education (9 categories), earnings

- Years: 1986-2010
Empirical Approach

Compare evolution of outcomes across regions facing larger vs. smaller tariff cuts

\[ y_{rt} - y_{r,1991} = \theta_t RTR_r + \alpha_{st} + \gamma_t (y_{r,1990} - y_{r,1986}) + \epsilon_{rt}, \]

- \( y_{rt} \): value of region \( r \) outcome in post-lib year \( t \)
- \( \alpha_{st} \): state fixed effects
- \( \theta_t \): effect of liberalization on change in outcome by year \( t \).
- RAIS analysis also includes pre-liberalization outcome trend control, \( (y_{r,1990} - y_{r,1986}) \)

- Outcomes
  - formal employment
  - formal earnings premium: \( \hat{\mu}_{rt} \) from \( \ln(earn_{jri}) = \mu_{rt} + \phi_{it} + X_{jt} \beta_t + \epsilon_{jrit} \)
Dynamics in Labor Demand

- \( r = 1, \ldots, R \) regions and \( i = 1, \ldots, I \) industries
- CRS Cobb-Douglas production (shares may vary by \( i \))

\[ Y_{ri} = A_{ri} L_{ri}^{1-\varphi_i} \left( T_{ri}^{\zeta_i} K_{ri}^{1-\zeta_i} \right)^{\varphi_i} \text{ where } \varphi_i, \zeta_i \in (0, 1) \]

- \( L_r \) labor, perfectly mobile between industries within regions
- \( T_{ri} \) fixed factor (e.g., resources), specific to region and industry
- \( K_{ri} \) capital, specific to region and industry, may change through depreciation and investment
- \( A_{ri} \) region-industry Cobb-Douglas productivity shifter

- Competitive markets. Exogenous output price \( P_i \)

- Examine effects of changing vector of output prices (liberalization)
Dynamics in Labor Demand

- Factor market clearing, zero profits, and cost minimization imply equilibrium relation

\[
\hat{w}_r = \sum_i \beta_{ri} \hat{P}_i + \sum_i \beta_{ri} \hat{A}_{ri} - \delta_r \left( \hat{L}_r - \sum_i \lambda_{ri} (1 - \zeta_i) \hat{K}_{ri} \right)
\]

where \( \beta_{ri} \equiv \frac{\lambda_{ri}}{\sum_j \lambda_{rj} \frac{1}{\varphi_j}} \) and \( \delta_r \equiv \frac{1}{\sum_k \lambda_{rk} \frac{1}{\varphi_k}} \).
Number of formal establishments proxy for regional capital stock
Dynamics in Labor Demand
Evidence for Slow Capital Adjustment

Immediate investment response, slow depreciation response
Dynamics in Labor Demand
Evidence for Slow Capital Adjustment

Immediate investment response, slow depreciation response

Job creation and destruction defined as in Davis and Haltiwanger (1990)
Dynamics in Labor Demand
Evidence for Agglomeration Economies

Assume in the long run...

Constant elasticity agglomeration function
(Glaeser Gottlieb 2008, Kline Moretti 2014):

\[ \hat{A}_{ri} = \kappa \hat{L}_r \]

Constant elasticity labor supply:

\[ \hat{L}_r = \frac{1}{\eta} \hat{w}_r \]

Perfectly mobile capital

\[ \hat{R}_r = \hat{R}, \quad \forall r \]
Dynamics in Labor Demand
Evidence for Agglomeration Economies

- Imposing these assumptions yields the following expressions

\[
\hat{w}_r = \frac{\eta}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \sum_i \beta_{ri} \hat{P}_i - \frac{\varphi(1 - \zeta)\eta}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \hat{R}
\]

\[
\hat{L}_{ri} = \frac{1}{\varphi \zeta} \hat{P}_i - \frac{1}{\varphi \zeta} \cdot \frac{\eta[1 - \varphi(1 - \zeta)] - \kappa}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \sum_i \beta_{ri} \hat{P}_i - \frac{\varphi(1 - \zeta)}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \hat{R}
\]

- Test for agglomeration economies

\[
\hat{L}_{ri} = \gamma_0 + \gamma_1 \hat{P}_i + \gamma_2 RTR_r + \epsilon_{ri}
\]

\[
\gamma_2 < 0 \Rightarrow \kappa > 0
\]
Dynamics in Labor Demand
Evidence for Agglomeration Economies

Test for agglomeration economies

<table>
<thead>
<tr>
<th>Change in log Region x Industry Employment:</th>
<th>All industries (1)</th>
<th>Tradable industries (2)</th>
<th>Tradable industries (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional tariff reduction (RTR)</td>
<td>-6.183***</td>
<td>-6.708***</td>
<td>-6.704***</td>
</tr>
<tr>
<td></td>
<td>(0.631)</td>
<td>(0.675)</td>
<td>(0.694)</td>
</tr>
<tr>
<td>Industry price change controls</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Industry fixed effects (20)</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Observations</td>
<td>4,648</td>
<td>4,174</td>
<td>4,174</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.119</td>
<td>0.120</td>
<td>0.222</td>
</tr>
</tbody>
</table>

\[ \hat{\gamma}_2 < 0 \Rightarrow \kappa > 0 \], i.e. agglomeration economies are present
Dynamics in Labor Demand

Quantification

- Estimating agglomeration elasticity, $\kappa$
  - Estimate $1/\eta$ from $\hat{L}_r = (1/\eta)\hat{w}_r$, with RTR as IV for $\hat{w}_r$
  - Estimate $\kappa$ using non-linear least squares from each of

$$\hat{w}_r = \frac{\eta}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \sum_i \beta_{ri} \hat{P}_i - \frac{\varphi(1 - \zeta)\eta}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \hat{R}$$

$$\hat{L}_{ri} = \frac{1}{\varphi \zeta} \hat{P}_i - \frac{1}{\varphi \zeta} \cdot \frac{\eta[1 - \varphi(1 - \zeta)] - \kappa}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \sum_i \beta_{ri} \hat{P}_i - \frac{\varphi(1 - \zeta)}{\eta[1 - \varphi(1 - \zeta)] - \kappa + \varphi \zeta} \hat{R}$$

Bootstrap entire procedure to account for correlation between $\hat{\eta}$ and $\hat{\kappa}$
### Agglomeration elasticity estimates

| Panel A: Inverse labor supply elasticity ($\eta$) | 0.363***  
|                                               | (0.060) |
| Panel B: Agglomeration elasticity ($\kappa$)  | (1)  
| Specific factors' share of non-labor inputs ($\zeta$): | low (0.152) | mid (0.349) | high (0.545) |
| Wage-based agglomeration elasticity ($\kappa$) | 0.042*  
|                                               | (0.023) |
| Employment-based agglomeration elasticity ($\kappa$) | 0.215***  
|                                               | (0.032) |

- Estimates within range of prior literature (Melo et al. 2009)
- Kline and Moretti (2014) find 0.2
Summary

Contributions

▶ Empirically describe the dynamics of labor market transition in response to trade liberalization
  ▶ Dynamic context for existing static regional results
  ▶ Challenge conventional wisdom on equalizing migration

▶ Mechanism that qualitatively and quantitatively explains growing effects
  ▶ Finite elasticity of regional labor supply
  ▶ Agglomeration economies
  ▶ Slow adjustment of complementary factors

▶ Benefits and costs from trade liberalization unevenly distributed across space for years after liberalization