The Long Run Effects of Trade Liberalization on Income Volatility and Occupational Mobility

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Applied Reading Group, 2020

Outline

Trade Liberalizations and Labor Markets

▶ Most trade liberalization analyses have focused on its impact on **average earnings**.

▶ Its effect on **income inequality** has also been studied (though considerably less).

▶ Little is known about its impact on **income volatility**.

Why is it Important?

Definition [Income Volatility]:

Variance of the **unpredictable component** of my income.

Example: Suppose,

$$\cdot\, y_t = y_t^{\text{Det.}} + \mu_t$$

$$\cdot\, \mu_t \sim \text{i.i.d.}(0, \sigma^2)$$

For **risk-averse** agents,

$$\uparrow \sigma^2 \Rightarrow \downarrow U(y_t)$$

What is known about Income Volatility and Trade?

Contemporaneous effects:
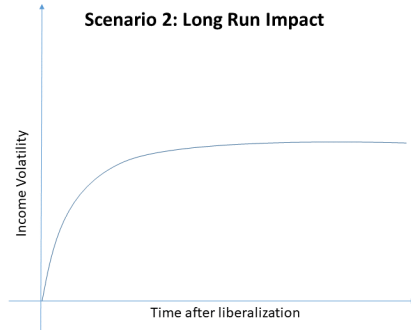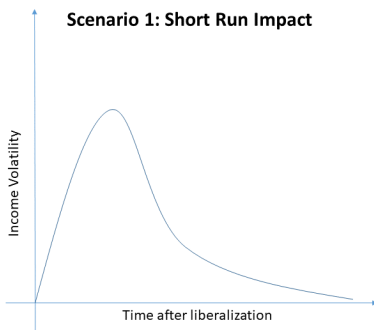Mexico [Krebs (2010; REST)] and the US [Krishna (2014; RES)]:

$$\downarrow \text{Tariffs}_t \Rightarrow \uparrow \text{Inc. Vol.}_t$$

Channels:
- ▶ Capital and labor **reallocation** across firms/sectors;
- ▶ $\downarrow$ Tariffs $\Rightarrow$ $\uparrow$ Exposure to **external shocks**.

Long-run effects of trade liberalization on Income Volatility?

Long vs. Short Run (Possible Scenarios)

Brazilian Trade Liberalization (1990-95)

Ideal to study trade policy changes' effects on labor markets:

- ▶ **Unilateral** and **unexpected**,
- ▶ **Large decline** in average tariffs (30.5% → 12.8%),
- ▶ **Steadiness** in the tariffs post-1995. ⟿ Average tariffs
- ▶ **Heterogeneity** in tariff cuts across industries. ⟿ Tariff cuts per sector
- ▶ Previous **"tariffication"**:
  - ▶ Non-tariff trade barriers were **replaced** by tariffs.

Impulse Response Function

Main econometric specification:

$$\hat{\sigma}^2_{r,t} - \hat{\sigma}^2_{r,1991} = \theta_t RTR_r + \Gamma' Z_{r,t} + \gamma_t(\hat{\sigma}^2_{r,1990} - \hat{\sigma}^2_{r,1986}) + \alpha_{s,t} + \varepsilon_{r,t}$$

for each $t \in \{1992, 1993 \cdots 2017\}$.

Notation:

- ▶ $\hat{\sigma}^2_{r,t}$: **Income volatility** in region r at time t;
- ▶ RTR_r: Regional **tariff reduction** (1990-95);
- ▶ $Z_{r,t}$: Regional **controls**;
- ▶ $\hat{\sigma}^2_{r,1990} - \hat{\sigma}^2_{r,1986}$: **Pre-trend** control;
- ▶ $\alpha_{s,t}$: State time-varying fixed effects.

Outline

Relação Anual de Informações Sociais (RAIS)

- (+) Annual **administrative dataset** (1986-2018) [Brazilian Ministry of Labor].
- (+) Job records including:
    - Worker and establishment **identifiers**,
    - **Workers:** Earnings, age, tenure, education, gender, occupation...
    - **Firms:** Geographic location, sector and size.
- (+) Firms fined for not reporting RAIS. Workers need it for government benefits.
- (+) RAIS is a **census**.
- (−) No information on **informal sector** [50% of labor force].

Outline

How are regions defined?

▶ Micro-regions defined by the **Brazilian Statistical Agency** (IBGE);

▶ Groups economically integrated contiguous municipalities;

▶ **475 micro-regions**;

▶ **Local labor market** $\Rightarrow$ 3.4% lived and worked in different micro-regions.

Measuring Income Volatility

We assume the following **Mincer equation**:

$$\log y_{i,j,r,t} = \alpha_{j,t} + \beta'_{t,r} \cdot x_{i,j,t} + u_{i,j,r,t}$$

i: individual; j: firm; r: region; and t: period.

Notation:

- ▶ $x_{i,j,t}$: Worker **observable characteristics**,
- ▶ $\beta'_{t,r}$: Time-varying region-varying coefficients,
- ▶ $\alpha_{j,t}$: Firm time-varying firm fixed effects,
- ▶ $u_{i,j,r,t}$: **Stochastic term**.

Measuring Income Volatility - Krebs (2010; REST)

The stochastic term is further **decomposed**:

$$u_{i,j,r,t} = \omega_{i,j,r,t} + \eta_{i,j,r,t}$$

1 Persistent component: Random walk:

$$\cdot \omega_{i,j,r,t} = \omega_{i,j,r,t-1} + \varepsilon_{i,j,r,t}$$
$$\cdot \varepsilon_{i,j,r,t} \sim \mathcal{N}(0, \sigma_{r,t}^2)$$

Income Process Literature:
Guvenan (2009); Storesletten (2004) $[\hat{\rho} \approx 1]$.

2 Transitory component: Isolates measurement error:

$$\cdot \eta_{i,j,r,t} \sim \mathcal{N}(0, \tilde{\sigma}_{r,t}^2).$$

Measuring Income Volatility - Krebs (2010; REST)

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Estimation – GMM

Thus,

$\hat{\sigma}^2_{r,t}$: estimate of **income volatility** in region r at time t.

Notice that,

$$\Delta_s u_{i,j,r,t} = u_{i,j,r,t+s} - u_{i,j,r,t} = \varepsilon_{i,j,r,t+1} + \varepsilon_{i,j,r,t+2} + \cdots \varepsilon_{i,j,r,t+s}$$
$$+ \eta_{i,j,r,t+s} - \eta_{i,j,r,t}$$

Moment conditions are:

$$\Rightarrow \mathrm{Var}[\Delta_s u_{i,j,r,t}] =$$
$$\sigma^2_{r,t+1} + \sigma^2_{r,t+2} + \cdots + \sigma_{r,t+s}{}^2 + \tilde{\sigma}^2_{r,t} + \tilde{\sigma}_{r,t+s}{}^2$$

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Regional Tariff Reduction (RTR_r)

Following Kovak (2013; AER):

$$RTR_r = -\sum_k \beta_{r,k}[\ln(1 + \tau_{k,1995}) - \ln(1 + \tau_{k,1990})]$$

$$\text{where} \quad \beta_{r,k} = \frac{\lambda_{r,k} \cdot \frac{1}{\phi_k}}{\sum_i \lambda_{r,i} \cdot \frac{1}{\phi_i}}.$$

⇥ Papers

Notation:

▶ k: industry,

▶ $\lambda_{r,k}$: industry k's **share of regional labor** (pre-liber.)
[Source: 1991 Census],

▶ ϕ_k: industry k's cost share of **non-labor factors** (pre-liber.)
[Source: 1990 National Accounts (IBGE)].

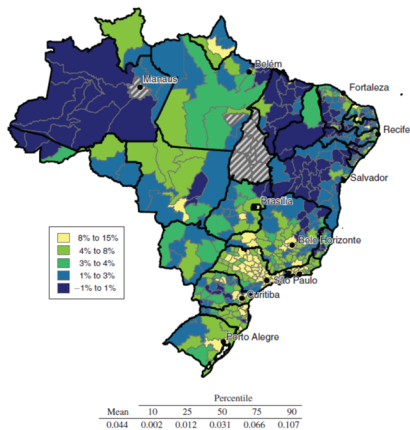# Regional Tariff Reduction – Dix-Carneiro (2017; AER)

Mean	Percentile					
	10	25	50	75	90
0.044	0.002	0.012	0.031	0.066	0.107

FIGURE 2. REGIONAL TARIFF REDUCTIONS

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Impulse Response Function

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Possible Confounders

Tariff cuts' exogeneity:

▶ **Highly correlated** $[-0.9]$ with the pre-lib. tariff levels;

▶ Pre-lib. levels date **from 1957** (Kume 2003).

Potential Confounder:

▶ Drive Income volatility across regions within a state;

▶ **Correlated** RTR_r;

▶ **Not captured** by Pre-Trend control.

Nonetheless, control for other post-liberalization shocks:

▶ Global commodity price boom.

Outline

How does Regional Occupational Mobility Respond?

▶ Do the effects of trade liberalization on occ. mobility **fade or persist**?

Outline

Classificação Brasileira de Ocupações (CBO)

- ▶ Brazil's **occupational classification** system (Ministry of Labor).

- ▶ Three editions: 1994, 2002 and 2010.

- ▶ **Describes** for each occupation (4-digit CIIU):
    - ▶ **Activities** performed,
    - ▶ **Skills and educational level** required,
    - ▶ **Resources**, equipment and utensils employed,
    - ▶ 6-digit CIIU code of occupations that compose it.

CBO Example – Electrical/Electronic Engineers

CIIU Code: 2143
Description:

- ▶ Execute electrical, electronic and telecommunications services.
- ▶ Install, administer and inspect systems and equipment,
- ▶ Study electrical, electronic and telecommunication processes...

Formation and Experience:

- ▶ Formation in Electric, electronic or telecommunications engineering.
- ▶ On average, 4 years of experience for engineers...

Resources:

- ▶ Internet access, e-mail...

Occupations:

- ▶ 2143-05 Electrical engineer; 2143-10 Electronic Engineer...

Measuring Regional Occupational Mobility

Extensive margin:

▶ $m_{r,t}$: % of workers changing occupation in region r at time t.

Coarse measure $\Rightarrow$ not all occupation switches are the same.

Notion of Distance:

$$\text{Baker} \rightarrow \text{Chef}$$

$$\neq$$

$$\text{Banker} \xrightarrow{\hspace{3cm}} \text{Construction Worker}.$$

Distance between Occupations – Gothman et al. (2010)

Occupation O is **characterized** by vector:

$$q_O = (q_{O,1}; q_{O,2}; \cdots q_{O,19})$$

Where,

> $q_{O,i}$: **Intensity** of task "i" in occupation "O"
> (% of workers in "O" performing task "i") ▸ Example

Definition:

$$\text{Dist}_{O,O'} = 1 - \text{Ang}_{O,O'} = 1 - \frac{\sum_i q_{O,i} q_{O',i}}{\left(\sum_j q_{O,j}^2 \times \sum_k q_{O,k}^2 \right)^{1/2}}$$

Adaptation using the Brazilian CBO

Electrical/Electronic Engineers:
CIIU Code: 2143

Description:

▶ Activity 1

▶ Activity 2

▶ Activity 3

▶ Activity 4

▶ Activity 5

Adaptation using the Brazilian CBO

Electrical/Electronic Engineers:
CIIU Code: 2143

Description:
- Activity 1
- Activity 2
- Activity 3
- Activity 4
- Activity 5

Task 1   Task 2   Task 3

Classification via text analysis [Mihayvol (2019; ISCO)].

Distance between Occupation (using CBO)

1 **Redefine** intensities:

$\tilde{q}_{O,i} = \%$ of **activities** in task "i" for occupation "O".

$$\tilde{q}_O = (3/5, 1/5, 1/5)$$

2 **Adjust distances** accordingly,

$$\widetilde{\text{Dist}}_{O,O'} = 1 - \frac{\sum_i \tilde{q}_{O,i}\tilde{q}_{O',i}}{\left(\sum_j \tilde{q}_{O,j}^2 \times \sum_k \tilde{q}_{O,k}^2\right)^{1/2}}$$

3 **Important:** Check $\widetilde{\text{Dist}}_{O,O'}$ and $\text{Dist}_{O,O'}$ in GQCS or other.

Outline

Regional Response of Occupational Mobility

1 **Definition:** $m_{r,t}$: Average $\widetilde{\text{Dist}}_{O,O'}$ in region r at time t.

2 **Impulse Response Function**:

$$m_{r,t} - m_{r,1991} = \theta_t RTR_r + \Gamma' Z_{r,t} + \gamma_t (m_{r,1990} - m_{r,1986}) + \alpha_{s,t} + \varepsilon_{r,t}$$

for each $t \in \{1992, 1993 \cdots 2002\}$.

Notation:

▶ RTR_r: Regional tariff reduction,

▶ θ_t: Parameter of interest.

Conclusions and Steps to Follow

Conclusions:

▶ Brazil's liberalization: ideal to study **long-run effects** on labor markets.

▶ Long-run effects on Income Volatility and Occup. Mobility are **yet to be understood**.

Steps to follow:

1 Calculate $\hat{\sigma}_{r,t}^2$ and $m_{r,t}$ from data.

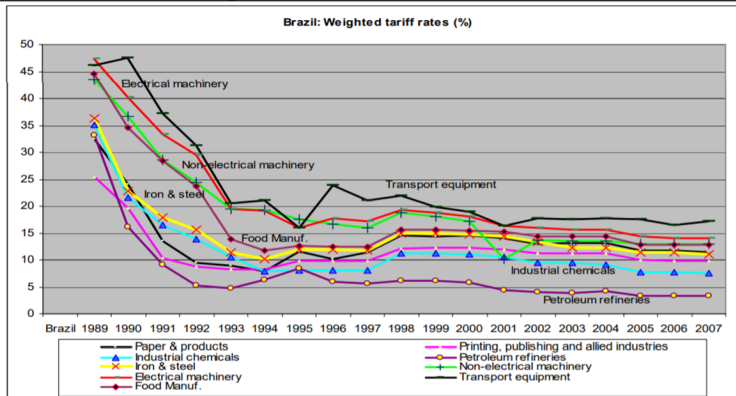2 Estimate the Impulse Response Functions,

3 Study **mechanisms**.

Other Ideas:

▶ **Monetize** $\hat{\sigma}_{r,t}^2$ and $m_{r,t}$.

Thank you!

Average tariffs in Brazil – Chandra (2009; WB)

Figure 13: Brazil – trade liberalization

Brazil: Weighted tariff rates (%)

Legend	
Paper & products	Printing, publishing and allied industries
Industrial chemicals	Petroleum refineries
Iron & steel	Non-electrical machinery
Electrical machinery	Transport equipment
Food Manuf.	

Source: TRAINS database

‹ Brazil Trade Liberalization

Tariff Changes per Industry – Kume (2003)
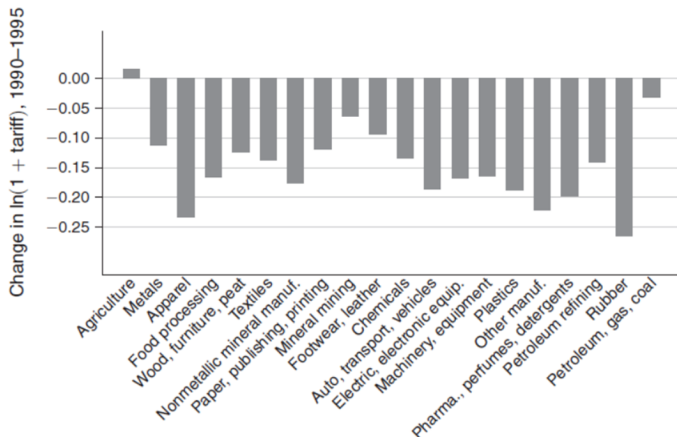
Example – German Qualification and Career Survey

Summary Statistics of Task Data

	Mean	Standard Deviation	Example Teacher (%)	Example Baker (%)
Analytical tasks:	55.02	49.75	63.7	32.4
Research, evaluate, or measure	25.11	43.37	34.0	13.6
Design, plan, or sketch	10.21	30.28	17.6	3.6
Correct texts or data	23.85	42.62	39.6	6.4
Calculate or do bookkeeping	26.02	43.87	11.3	22.5
Program	8.35	27.66	8.4	.4
Execute laws or interpret rules	7.85	26.89	17.2	.8
Analytical is main task	31.56	46.48	15.9	13.1
No. observations	52,718		1,067	472

SOURCE.—Qualification and Career Surveys, 1979, 1985, 1991/92, 1997/98.

◄ Distance between Occupation

Papers that use RTR_r

- ▶ Kovak (2013; AER);
- ▶ Dix-Carneiro and Kovak (2017; AER);
- ▶ Dix-Carneiro and Kovak (2019; IER);
- ▶ Dix-Carneiro, Soares and Ulyssea (2018; AEJ).

Tariff measures per industry: Kume, Piani and Souze (2003; IPEA).

◂ Regional Tariff Reduction