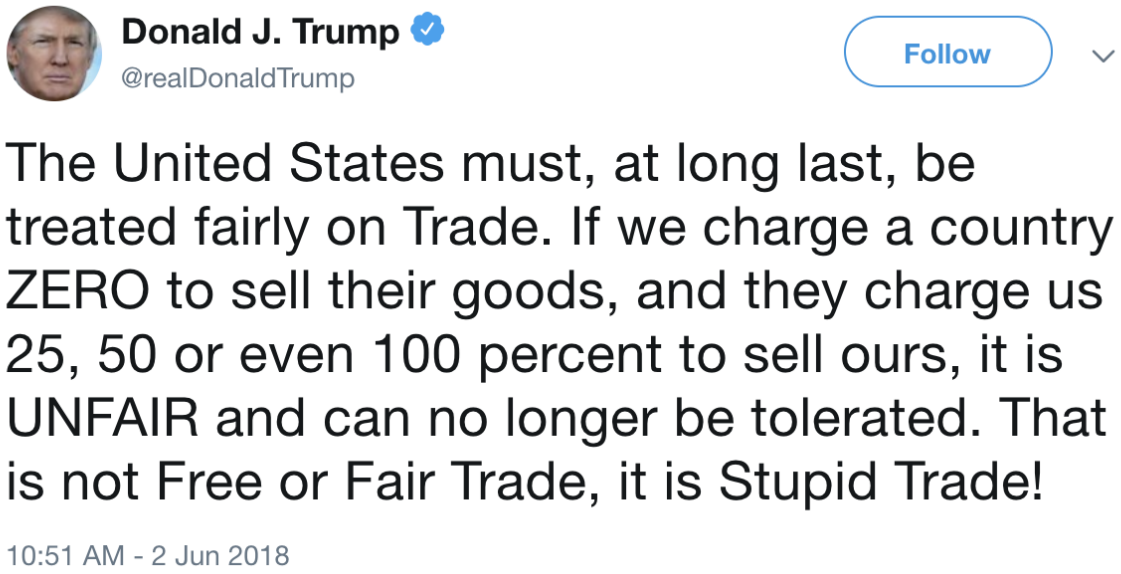
Estimating Policy Barriers to Trade

Brendan Cooley

Political Economy Graduate Colloquium

6 December 2018

Free and Fair?



- **Free:** Foreign firms enjoy same market access conditions as domestic competitors
- **Fair:** Barriers that do exist affect all trade partners symmetrically

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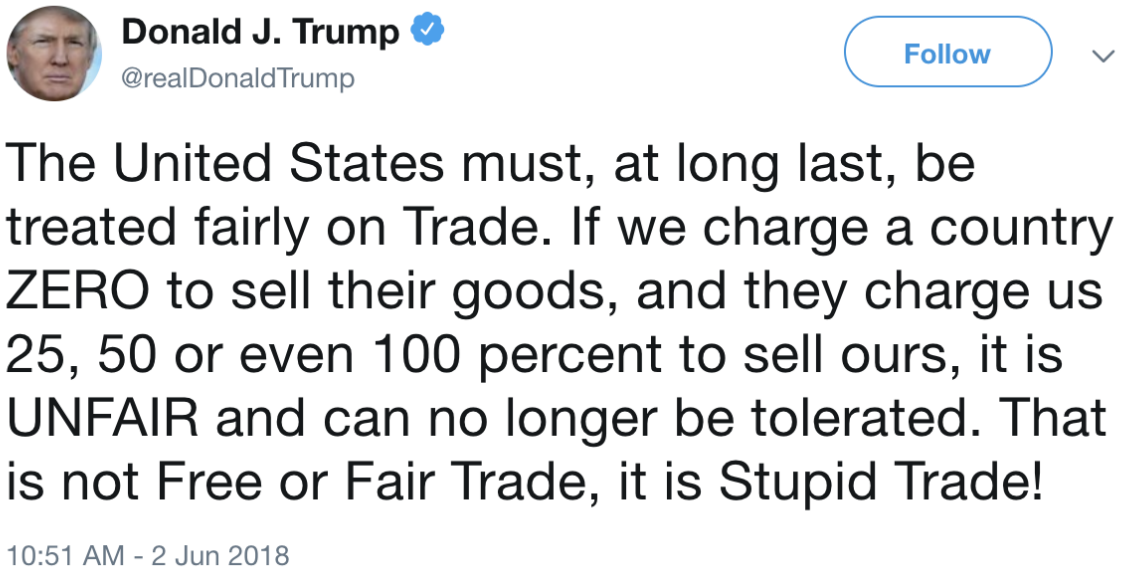

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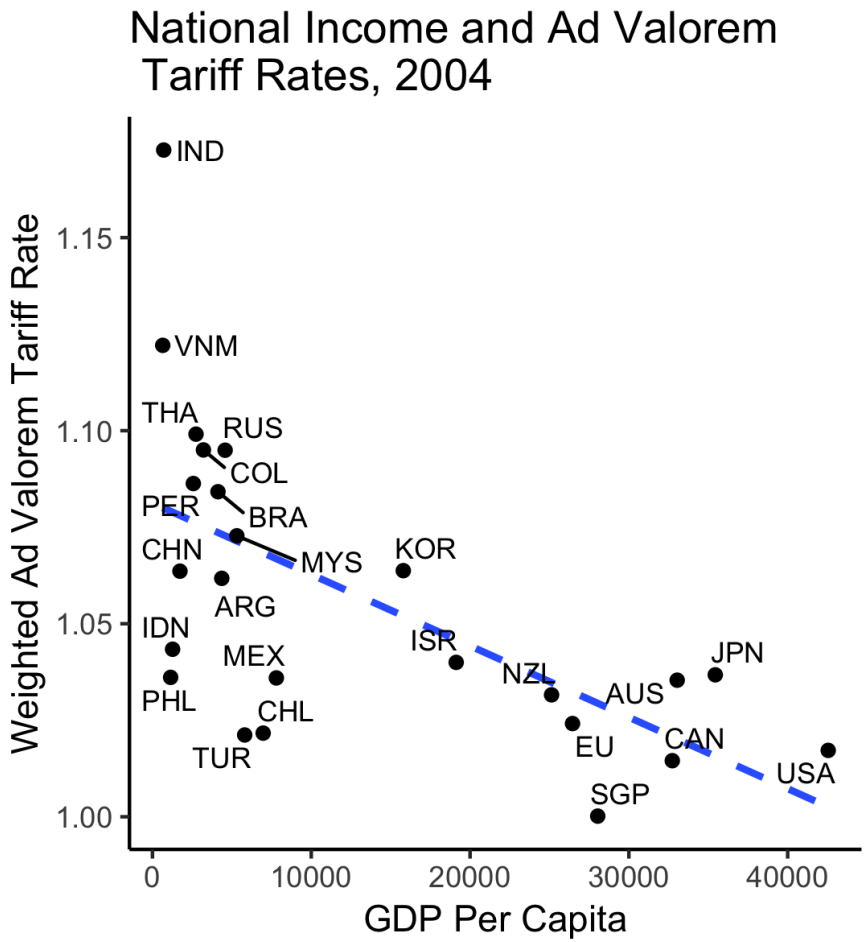
The Tariff System (GATT/WTO)

- **Free?** Applied tariff rates are low, ~5% on average (Baldwin 2016)
- **Fair?** WTO members (vast majority of world economy) commit to principle of non-discrimination (Most Favored Nation)



Varieties of Barriers

Direct

- Tariffs
- Non-Tariff Measures (NTMs)
  - Price controls, quotas, health and safety regulations, technical barriers
  - Mansfield and Busch (1995), Lee and Swagel (1997), Gawande and Hansen (1999), Kono (2006), Rickard (2012), Maggi, Mrázová, and Neary (2018)

Indirect (Behind-the-Border)

- Government procurement
  - Evenett and Hoekman (2004), Kono and Rickard (2014)
- Subsidies
- Excise taxes
- Regulations

Effective Discrimination: Target trade-disorting instruments to disproportionately affect disfavored trading partners.

- E.g. high agricultural duties by developed countries disproportionately harm developing countries

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Approach

Trade Costs: Policy distortions and transportation costs to access market i in excess of those faced by firms in country i

Overview

1. Build model of international economy subject to trade costs (Eaton and Kortum 2002)
2. Derive structural relationship linking trade costs to price levels, trade flows, market shares of home producers
    - Anderson and Van Wincoop (2003), Waugh (2010), Simonovska and Waugh (2014), Sposi (2015), Waugh and Ravikumar (2016)
3. Decompose trade costs into economic (transportation costs) and political (policy barriers) components
4. Model transportation costs, combine with data on variables in (2) to separately estimate magnitude of policy barriers

$\tau_{ij} - 1 \geq 0$ - ad valorem tariff equivalent of policy barriers country i imposes on country j

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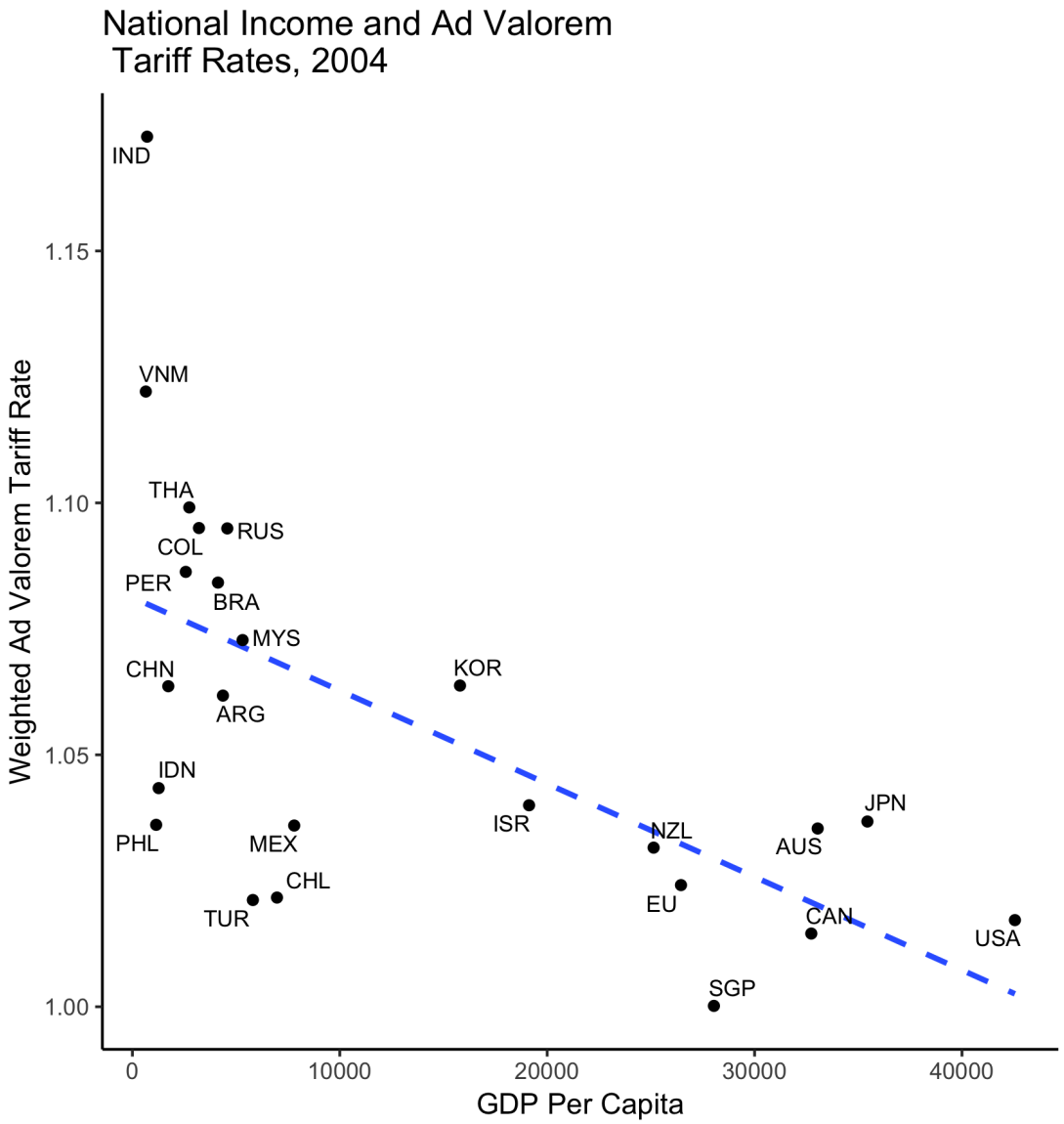
Bottom Line


National Income and Ad Valorem Tariff Rates, 2004
Weighted Ad Valorem Tariff Rate
1.15
1.10
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30000
40000
GDP Per Capita
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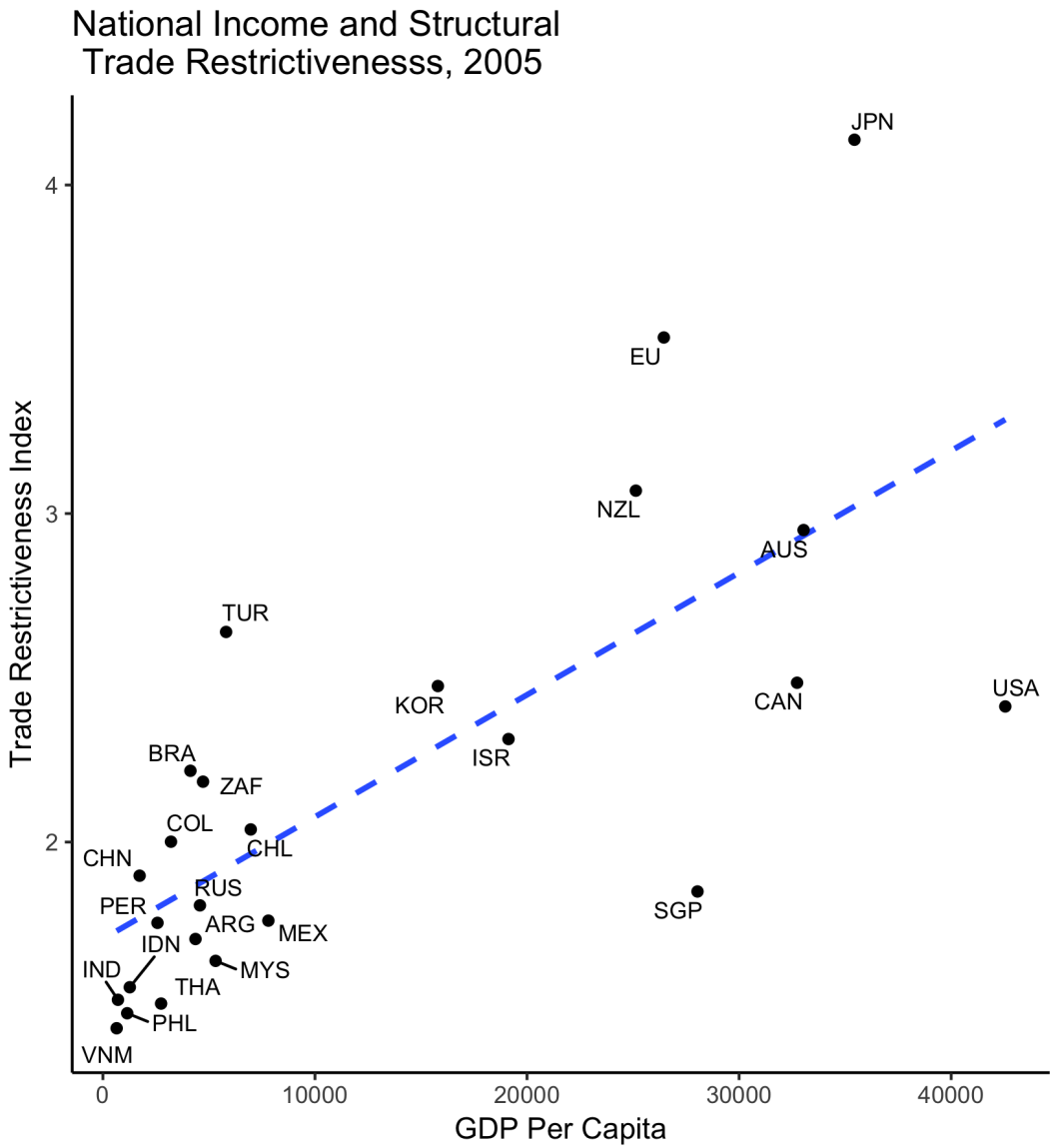
National Income and Structural
Trade Restrictivenesss, 2005
Trade Restrictiveness Index
GDP Per Capita
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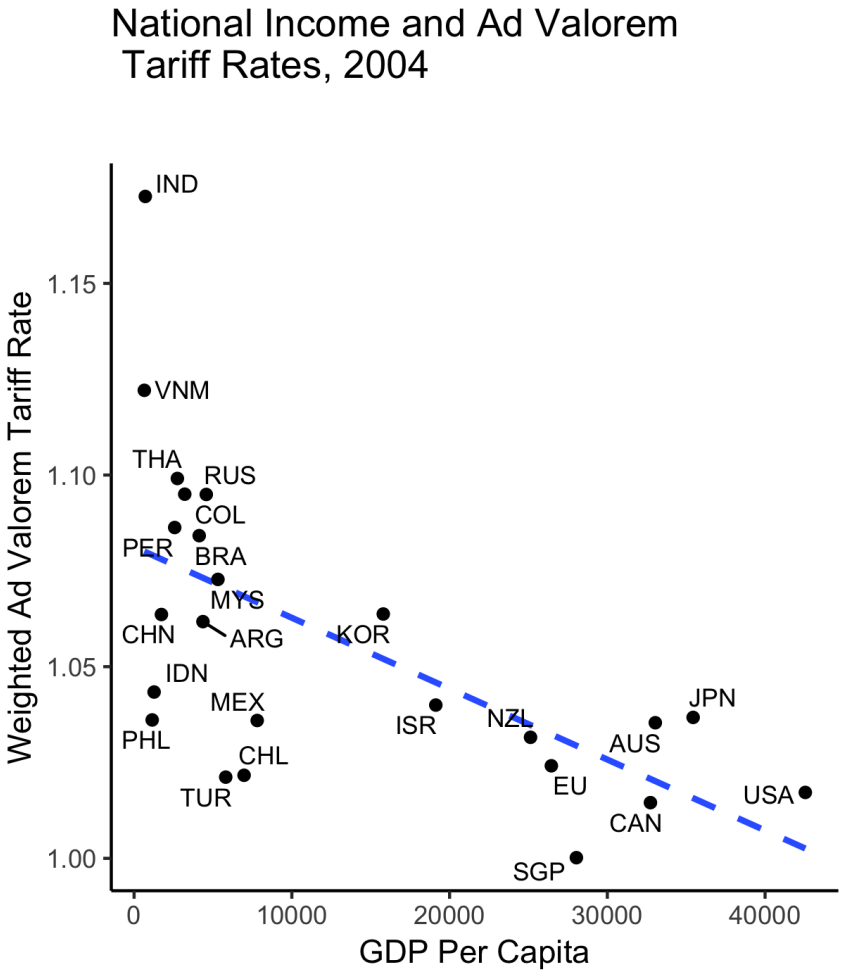
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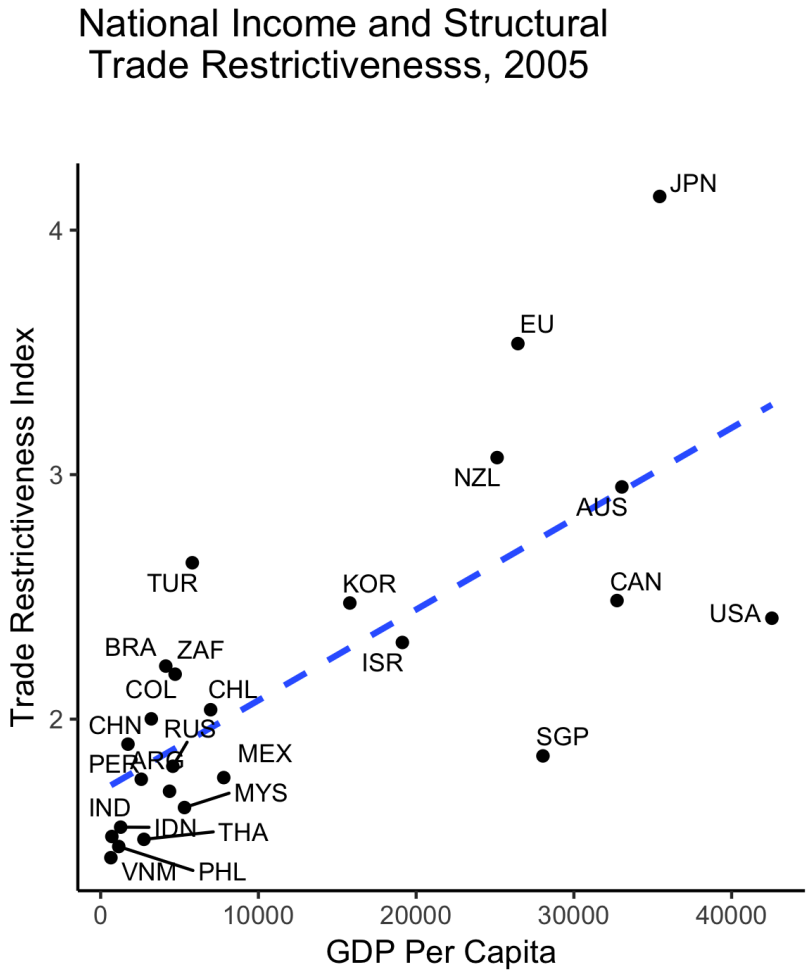
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Model Intuition

- N countries $i \in \{1, ..., N\}$ with representative consumers
  - Value C-D mixture of tradable goods and nontradable services
  - Earn wage w_i for every unit of labor endowment L_i supplied
- Competitive economy, stochastic technology
  - Production requires labor and bundle of intermediate inputs

Structural Relationship

$$d_{ij} = \left(\frac{\lambda_{ij}}{\lambda_{jj}}\right)^{-\frac{1}{\theta}} \frac{P_i}{P_j} \tag{1}$$

- d_{ij} - trade costs
- λ_{ij} - share of j's producers in i's market for tradables
- λ_{jj} - share of j's producers in home market for tradables
- P_i - price level of tradables
- θ - trade elasticity

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Consumption

Consumer's Problem

$$\begin{aligned} \max \quad & Q_i^{\alpha_i} S_i^{1-\alpha_i} \\ \text{subject to} \quad & P_i Q_i + P_i^s S_i \leq w_i L_i \end{aligned} \tag{2}$$

CES Preferences over Tradable Varieties

$$Q_i = \left(\int_{[0,1]} q_i(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}} \tag{3}$$

Tradable Price Index

$$P_i = \left(\int_{[0,1]} p_i(\omega)^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \tag{4}$$

Expenditure on Tradables

$$E_i^q = \alpha_i I_i + D_i = P_i Q_i^\star$$

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Production

Costs

$$c_i = w_i^{1-\beta} P_i^{\beta} \tag{5}$$

- w_i - cost of labor
- P_i - cost of composite intermediate good
  - equivalent to composite consumption good

$$E_i^x = \beta X_i$$

Local Prices

$$p_{ii}(\omega) = \frac{c_i}{z_i(\omega)} \tag{6}$$

Technology (Frechet)

$$F_i(z) = \Pr\left\{z_i(\omega) \leq z\right\} = \exp\left\{-T_i z^{-\theta}\right\} \tag{7}$$

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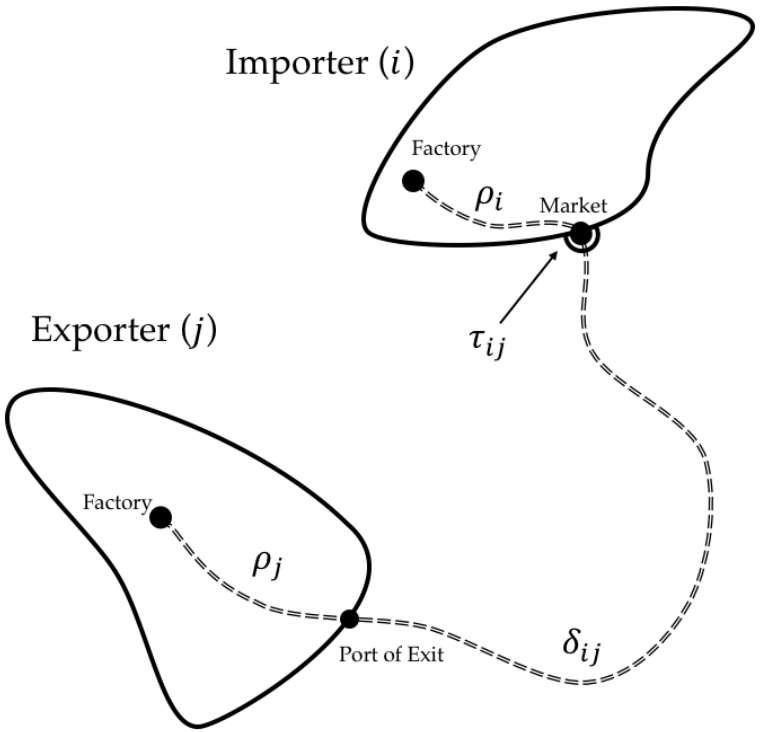

$$p_{ji}(\omega) = d_{ji}\, p_{ii}(\omega)$$

$$d_{ij} = \rho_j \delta_{ij} \tau_{ij} \tag{8}$$

$$\tau_{ij} = 1 \implies \text{no policy distortion}$$

$$p_i^\star(\omega) = \min_{j \in \{1,\ldots,N\}} \{p_{ij}\}$$

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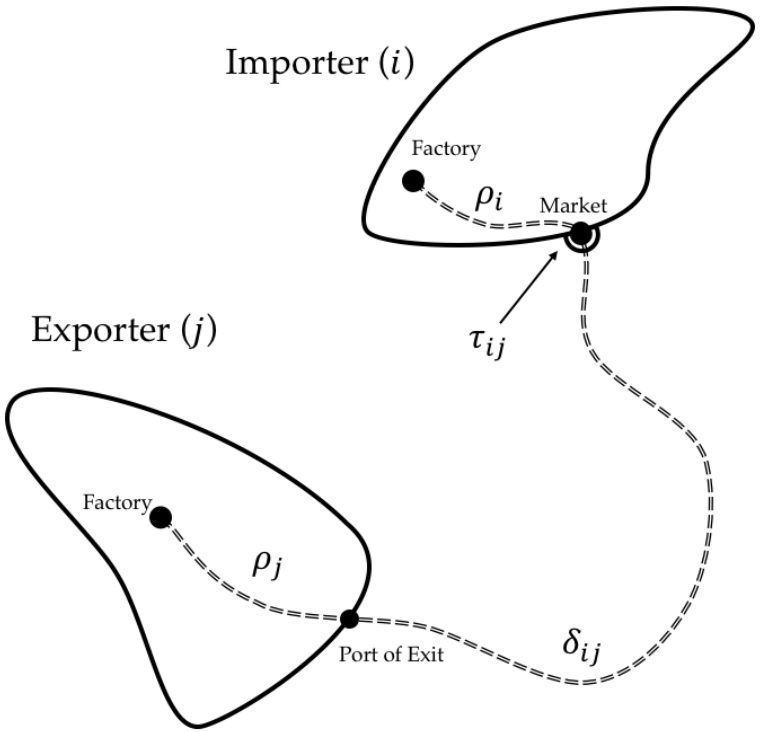

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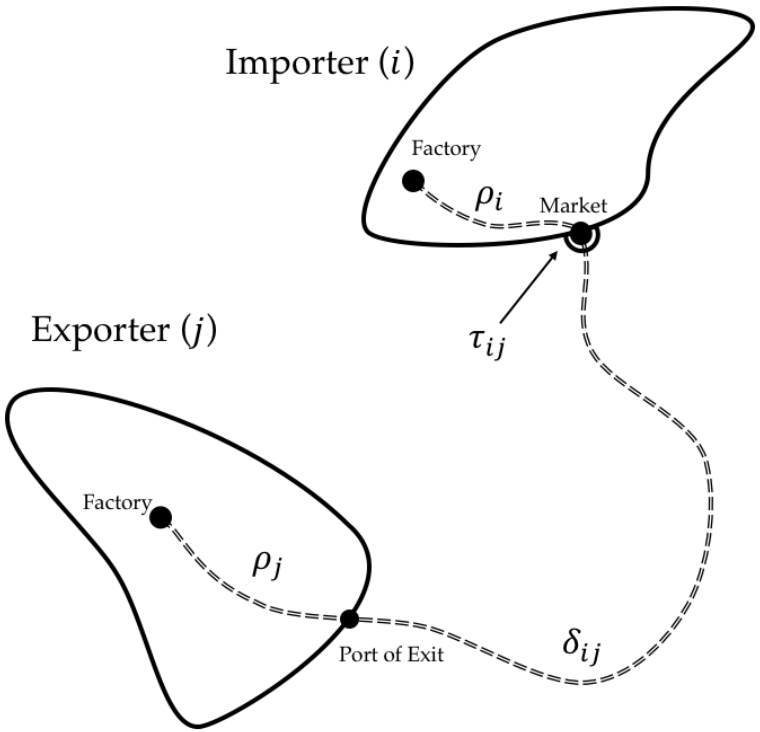

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Equilibrium

Total Expenditure on Tradables

$$X_i = \underbrace{E_i^q + E_i^x}_{E_i} - D_i \tag{9}$$

Trade Shares

$$\Omega_{ij}^{\star} = \left\{ \omega \in [0,1] \mid p_{ij}(\omega) \leq \min_{k \neq j} \{p_{ik}\} \right\}$$

$$\lambda_{ij}(\boldsymbol{w}) = \frac{1}{E_i} \int_{\Omega_{ij}^{\star}} p_{ij}(\omega) q_i \left(p_{ij}(\omega) \right) d\omega \tag{10}$$

Market Clearing

$$X_i = \sum_{j=1}^{N} \lambda_{ji}(\boldsymbol{w}) E_j \tag{11}$$

Definition: An *international equilibrium* is a vector of wages $\boldsymbol{w}$ such that Equations 9, 10, and 11 hold for all $i \in \{1, ..., N\}$.

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$$X_i = \underbrace{E_i^q + E_i^x}_{E_i} - D_i \tag{9}$$

Trade Shares

$$\Omega_{ij}^{\star} = \left\{ \omega \in [0,1] \mid p_{ij}(\omega) \leq \min_{k \neq j} \{p_{ik}\} \right\}$$

$$\lambda_{ij}(\boldsymbol{w}) = \frac{1}{E_i} \int_{\Omega_{ij}^{\star}} p_{ij}(\omega) q_i \left(p_{ij}(\omega) \right) d\omega \tag{10}$$

Market Clearing

$$X_i = \sum_{j=1}^{N} \lambda_{ji}(\boldsymbol{w}) E_j \tag{11}$$

Definition: An *international equilibrium* is a vector of wages $\boldsymbol{w}$ such that Equations 9, 10, and 11 hold for all $i \in \{1, ..., N\}$.

Isolating Policy Barriers (I)

Trade Shares (w/ Frechet)

$$\lambda_{ij}(\boldsymbol{w}) = \frac{T_j \left(d_{ij} w_j^{1-\beta} P_j^{\beta} \right)^{-\theta}}{\sum_j T_j \left(d_{ij} w_j^{1-\beta} P_j^{\beta} \right)^{-\theta}}$$

$$= \frac{T_j \left(\underbrace{\rho_j \delta_{ij} \tau_{ij}}_{d_{ij}} w_j^{1-\beta} P_j^{\beta} \right)^{-\theta}}{\frac{1}{\gamma} P_i^{-\theta}}$$

In Differences

$$\frac{\lambda_{ij}}{\lambda_{jj}} = \left(\underbrace{\delta_{ij} \tau_{ij} \frac{P_j}{P_i}}_{\text{observables}} \right)^{-\theta}$$

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Isolating Policy Barriers (II)

$$\tau_{ij} = \left(\frac{\lambda_{ij}}{\lambda_{jj}}\right)^{-\frac{1}{\theta}} \frac{P_i}{P_j} \underbrace{\frac{1}{\delta_{ij}}}_{\substack{\text{freight cost} \\ \text{correction}}} \tag{12}$$

Prices (I)

Data

- International Comparison Program (World Bank)
- M tradable expenditure categories $m \in \{1, ..., M\}$

$$P_i = \sum_{m=1}^{M} e_i^m P_i^m$$

Expenditure on Tradables

$$\alpha_i = \frac{1}{I_i} \sum_{m=1}^{M} e_i^m$$

$$E_i = \underbrace{I_i + \beta X_i}_{\text{gross consumption}} - \underbrace{(1 - \alpha_i) I_i}_{\text{services exp.}}$$

Home Expenditure

$$\lambda_{jj} = E_j \left(1 - \sum_{i \neq j} \lambda_{ji} \right)$$

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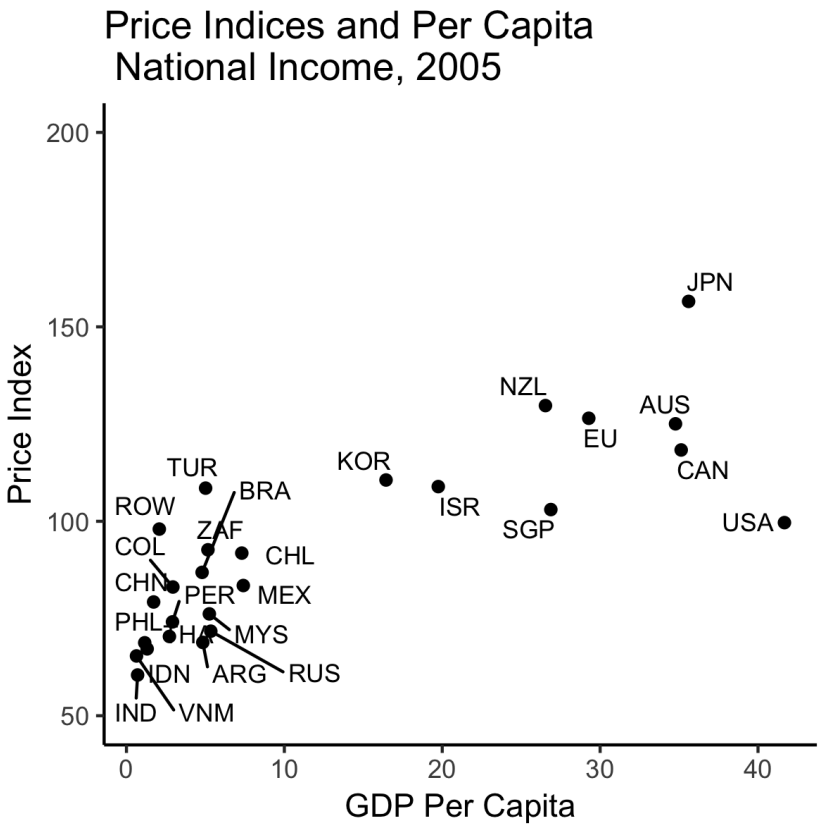
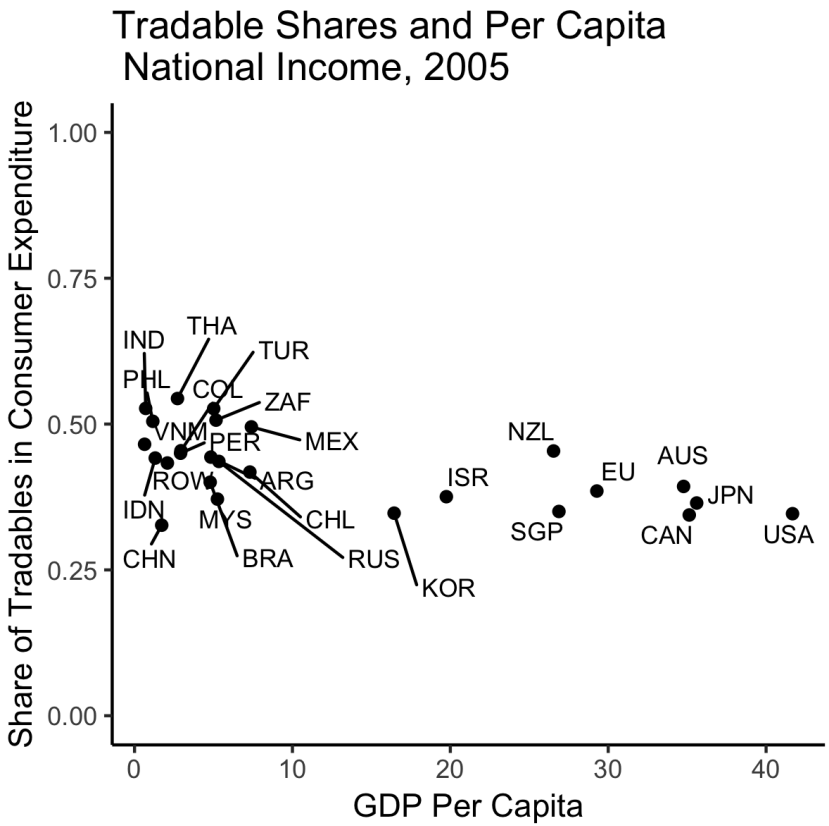
Prices (II)


Price Indices and Per Capita
National Income, 2005
Price Index
GDP Per Capita
200
150
100
50
0
10
20
30
40
JPN
NZL
AUS
EU
CAN
KOR
ISR
SGP
USA
TUR
BRA
ROW
ZAF
COL
CHL
CHN
PER
MEX
PHL
MYS
IDN
ARG
RUS
IND
VNM


Tradable Shares and Per Capita
National Income, 2005
Share of Tradables in Consumer Expenditure
GDP Per Capita
1.00
0.75
0.50
0.25
0.00
0
10
20
30
40
IND
THA
TUR
PHL
COL
ZAF
VNM
PER
MEX
NZL
ROW
ARG
ISR
EU
AUS
IDN
MYS
CHL
JPN
SGP
CAN
USA
CHN
BRA
RUS
KOR

Freight Costs (I)

$$\delta_{ij} : \boldsymbol{Z}_{ij} \rightarrow \hat{\delta}_{ij}$$

Data

- Transportation Mode Shares
  - United States, Japan, European Union, Brazil
- Freight Costs
  - United States Census Bureau
  - OECD Maritime Transport Costs
- Geographic Covariates ($\boldsymbol{Z}_{ij}$)
  - Sea Distance
  - Population-weighted great circle distance
  - Island indicators
  - Contiguity

Freight Cost Model

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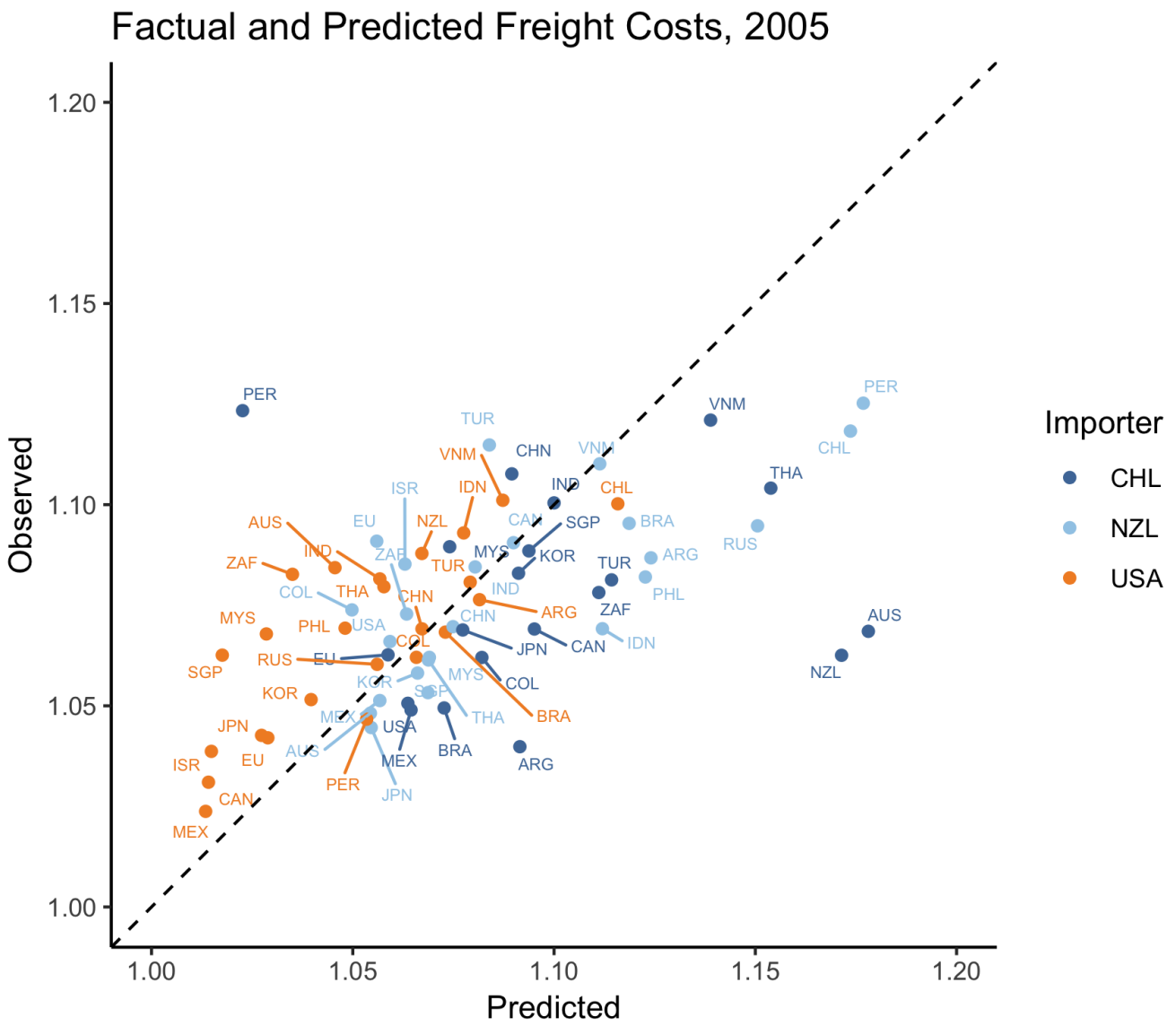
Freight Cost Model

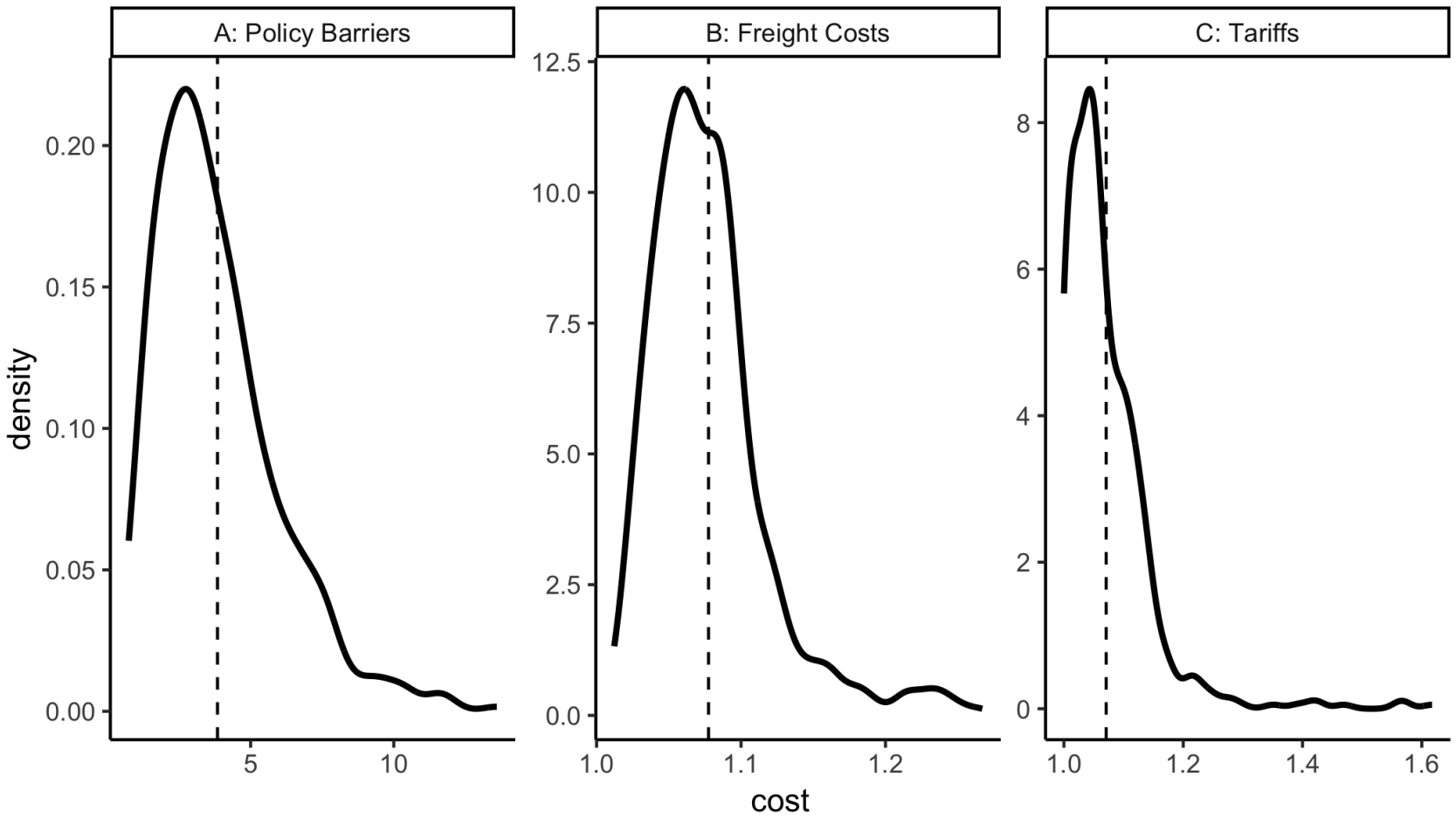
Freight Costs (II)



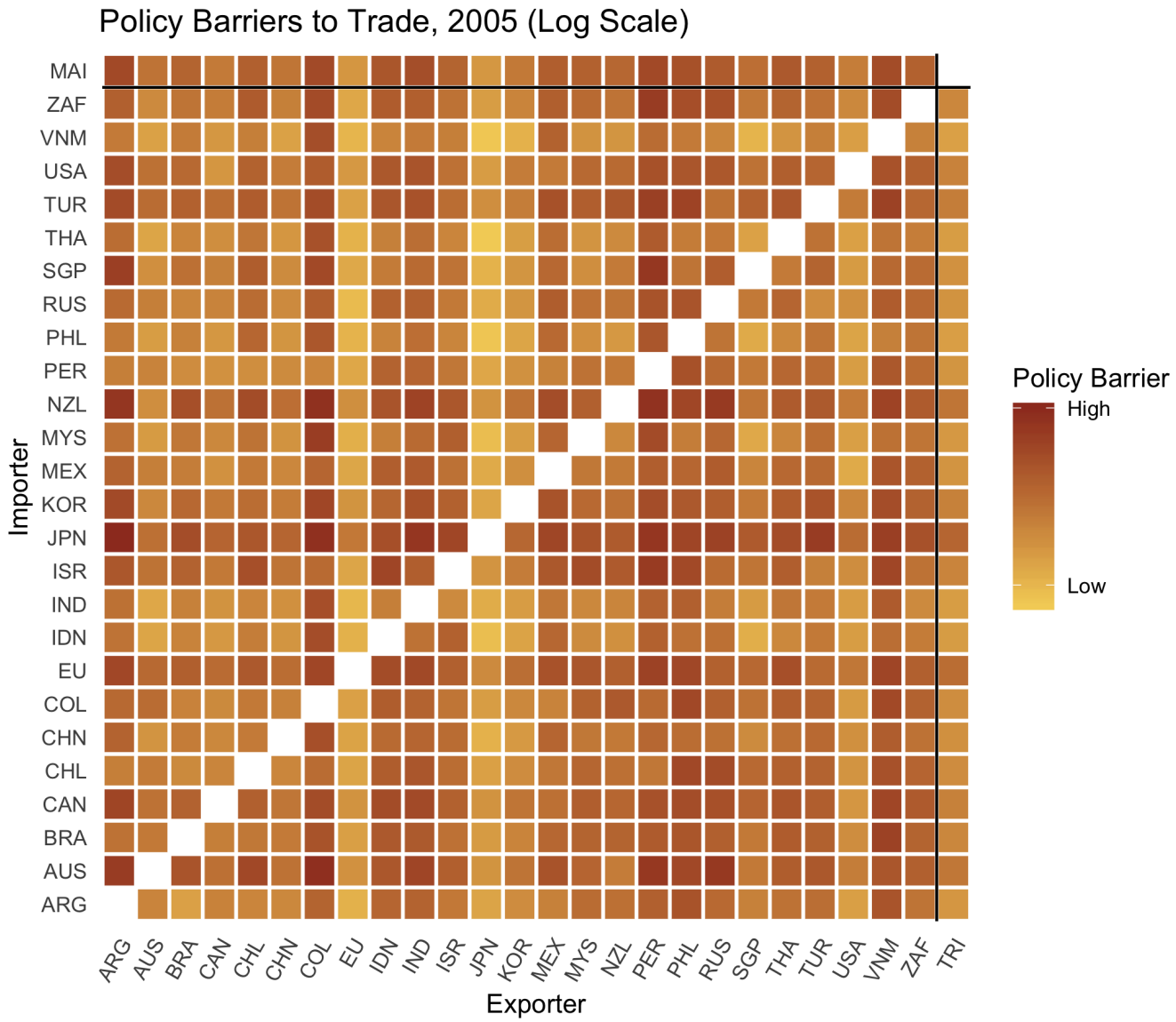
Results

Magnitude of Policy Barriers

- **Free?** Average policy barrier equivalent to 284 percent import tariff ($\tau = 3.84$)
- **Fair?** Within-country standard deviation of τ_{ij} is 1.72



Distribution of Policy Barriers



Trade Restrictiveness and Market Access (I)

Trade Restrictiveness Index

$$\mathrm{TRI}_i = \frac{1}{\sum_{j \neq i} E_j} \sum_{j \neq i} \tau_{ij} E_j \tag{13}$$

Market Access Index

$$\mathrm{MAI}_j = \frac{1}{\sum_{i \neq j} E_i} \sum_{i \neq j} \tau_{ij} E_i \tag{14}$$

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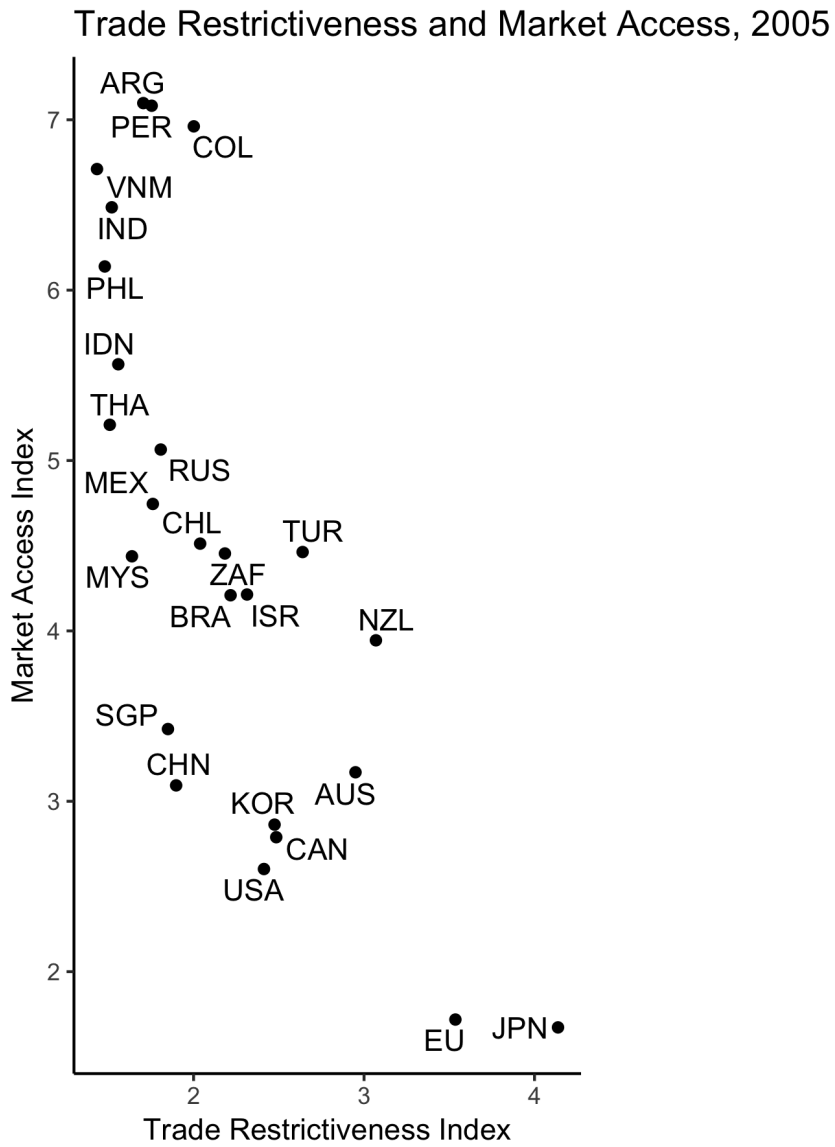
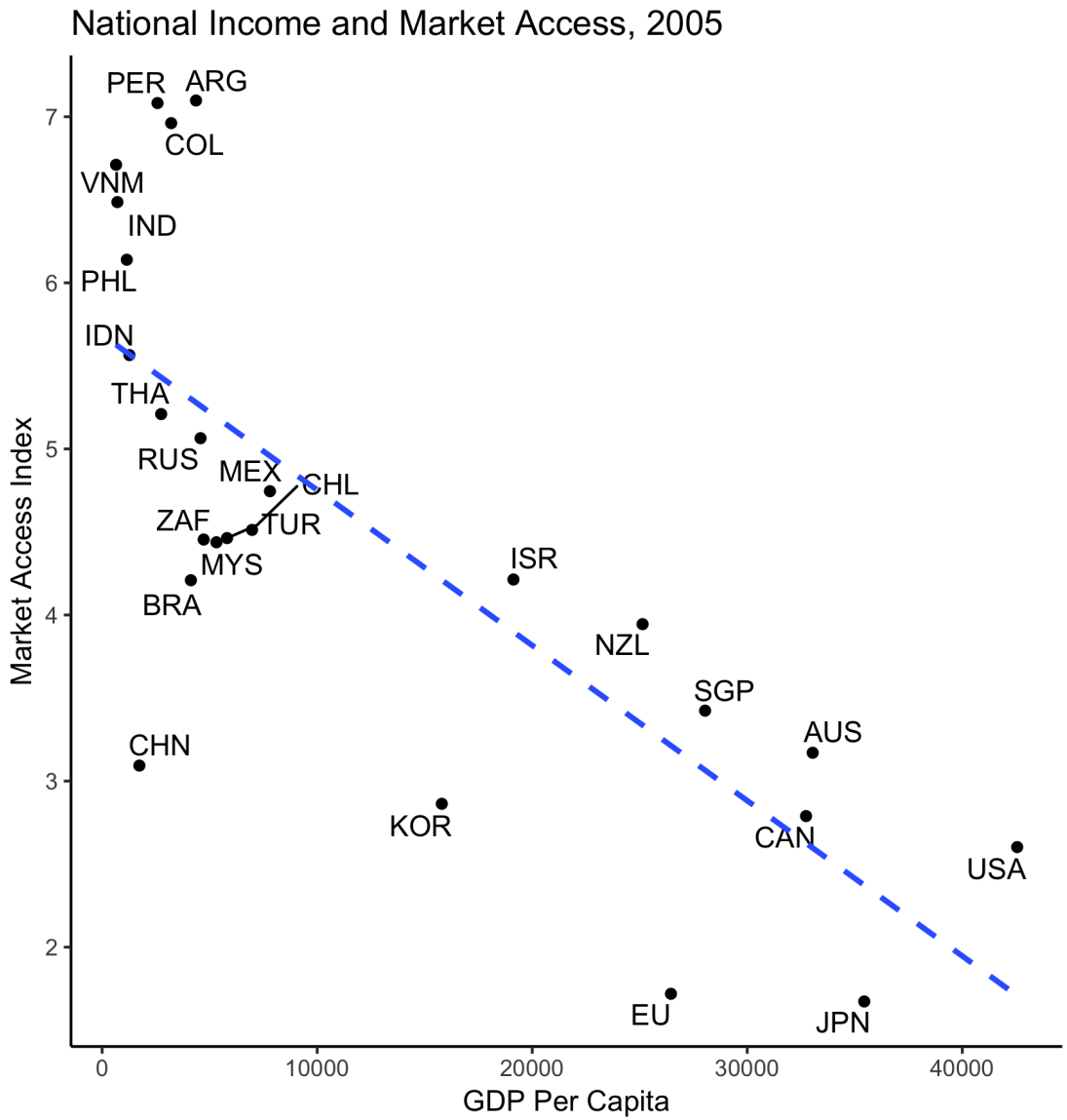
Trade Restrictiveness and Market Access (II)



Market Access Barriers

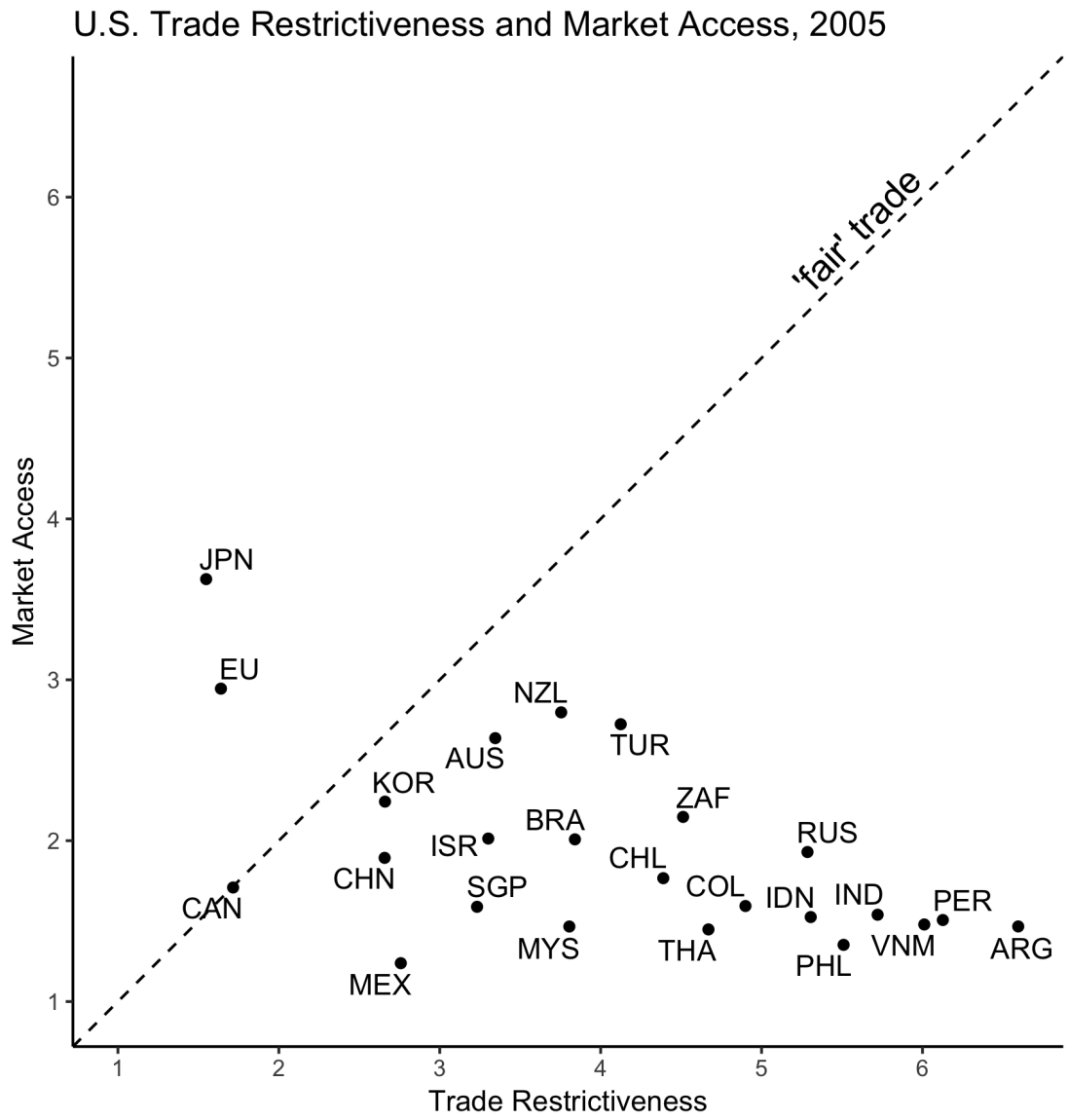


Correlates of Policy Barriers

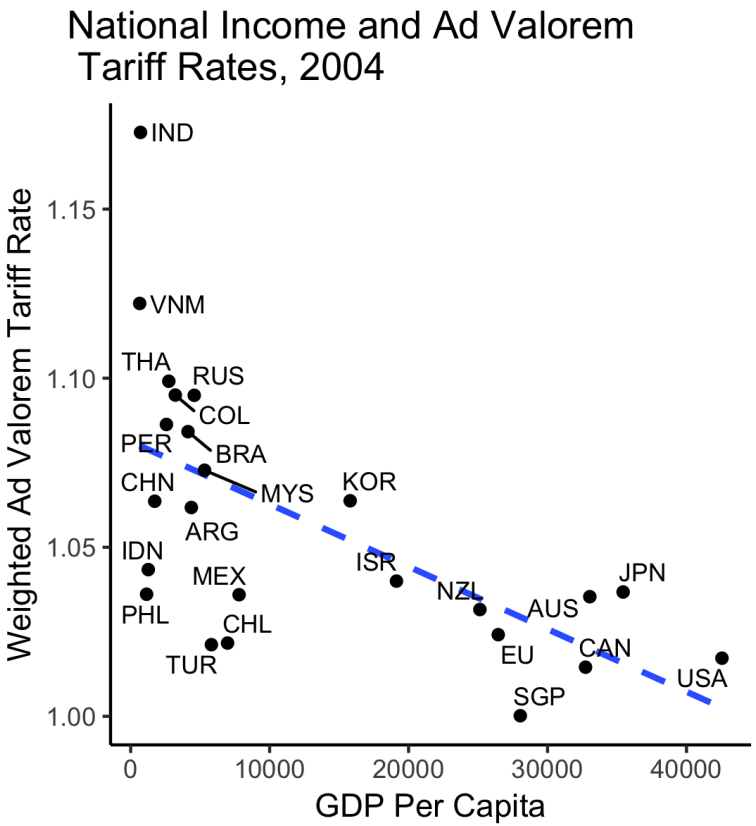
	Dependent variable:
	Structural Policy Barrier
Tariffs	2.886***
	(0.875)
PTAs	−0.706***
	(0.133)
Core NTM	−0.285
	(0.440)
Health/Safety NTM	−0.160
	(0.351)
Other NTM	−0.241
	(0.691)
Importer Fixed Effects	✓
Exporter Fixed Effects	✓
Observations	506
R^2	0.781
Note:	*p<0.1; **p<0.05; ***p<0.01

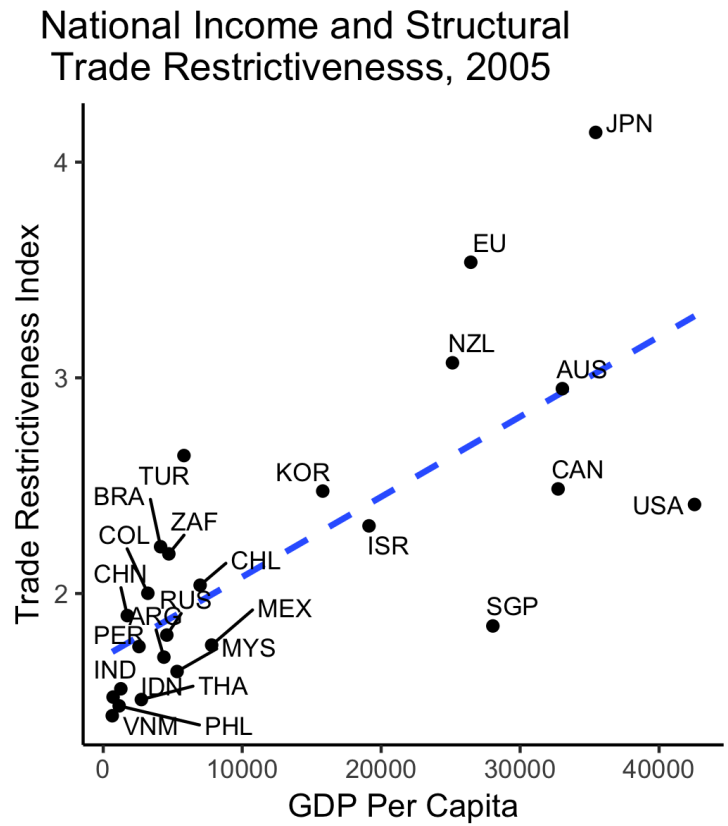

TAKE THAT, CHINA!
THIS IS CANADA
TRADE WAR

U.S. Barriers and Market Access



Measurement Matters





Conclusion

State Capacity and Protectionism

- Tariffs as "second-best" solution to revenue-raising problem facing low-capacity governments
  - Acemoglu (2005), Rodrik (2008), and Queralt (2015)
- Developing (more autocratic) world not necessarily more "welfare-concious" than developed counterparts
  - Milner and Kubota (2005), Gawande, Krishna, and Olarreaga (2009); Gawande, Krishna, and Olarreaga (2015)

Development and Trade Discrimination

- Growth causally linked to market access conditions abroad (Romalis 2007)
- Lack of market access by developing countries may hinder development prospects
  - Redding and Venables (2004), Romalis (2007), Waugh (2010)

International trading system neither free nor fair – and developing world bears brunt of inequality

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Table of Contents

Freight Cost Model

- Products $m \in \{1, ..., M\}$
- Transportation modes $k \in \{1, ..., K\}$
- ζ_{ij}^{mk} share of product m transported by mode k

Mode and Cost Functions

$$g : \{\boldsymbol{Z}_{ij}, d^m\} \rightarrow \delta_{ij}^{mk}$$

$$h : \{\boldsymbol{Z}_{ij}, d^m\} \rightarrow \zeta_{ij}^{mk}$$

Aggregate Freight Costs

$$\hat{\delta}_{ij}\left(\boldsymbol{Z}_{ij}, \boldsymbol{d}_{ij}\right) = \frac{1}{X_{ij}} \sum_{m=1}^{M} x_{ij}^{m} \sum_{k=1}^{K} g\left(\boldsymbol{Z}_{ij}, d^m\right) h\left(\boldsymbol{Z}_{ij}, d^m\right)$$

Back