Profits, Scale Economies, and the Gains from Trade and Industrial Policy

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Indiana University

Industrial Policy is Back on the Scene[1]

[1] See Aiginger and Rodrik (2020) for a detailed account.

Industrial Targeting via *Trade Restrictions* is Proliferating

Made in China 2025

- 2015 Initiative to promote Chinese manufacturing via trade barriers and subsidies.

National Trade Council

- Created in *Dec 2016* to promote US manufacturing (later became OTMP).
- Proposed tariffs on goods imported from China to counter *"Made in China 2025"*.

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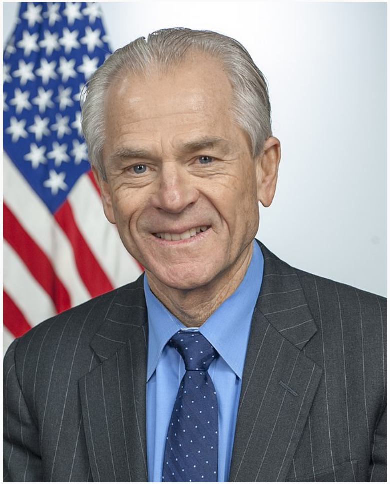

Old-but-Unresolved Policy Questions have Resurfaced

These developments have resurfaced some old-but-unresolved policy questions:

1. is trade policy an effective tool for correcting misallocation in domestic industries? (*e.g.*, for correcting underproduction in manufacturing)

2. if not, should governments correct misallocation, *unilaterally*, with industrial subsidies to select industries?

3. or should they coordinate their industrial policies via deep trade agreements?

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Our Answers to these Questions Exhibit Important Gaps

Standard *theories* that speak to Question 1-3 overlook key policy considerations:

- typically based on partial equilibrium, *2-good×2-country* models.
- overlook multilateral considerations & key industry linkages.

The *quantitative* route has proven equally-elusive:

- quantitative trade model have advanced remarkably over the past two decades...
- ...but we lack credible estimates for parameters that govern the gains from trade and industrial policy.

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This Paper: *Roadmap*

Step #1. Derive analytic formulas for *1st-best* and *2nd-best* trade policies in an important class of *multi-industry—multi-country* quantitative trade models where misallocation occurs due to scale economies or markup distortions.

Step #2 Estimate the parameters that govern the gains from policy in theses frameworks using micro-level data.

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This Paper: *Main Findings*

1. The gains from *terms-of-trade* manipulation are small!

2. Trade restrictions are an ineffective *second-best* measure for correcting misallocation in domestic industries.

3. Unilateral industrial policy is equally ineffective, as it triggers *immiserizing growth* in most countries.

4. What is the best remedy for misallocation in open economies? multilateral industrial policies that are coordinated via *deep* agreements.

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Conceptual Framework

Textbook Cases for Policy Intervention in an Open Economy

(1) Improving the terms-of-trade (ToT):

- It may be (unilaterally) optimal to tax and contract foreign trade.
- **Why?** the trade tax revenue collected from foreign producers/consumers can nullify the efficiency loss from trade restrictions

(2) Correcting misallocation in domestic industries:

- National output in *high-returns-to-scale* industries is sub-optimal $\sim$ misallocation
- Governments can restore efficiency by subsidizing high-returns-to-scale industries

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Theoretical Model

- We adopt a generalized Krugman model:
  - general equilibrium
  - admits arbitrarily many countries and industries
- Our theoretical framework has two prominent features
  - accommodates both the *ToT-improving* & *misallocation-correcting* cases for policy
  - is observationally equivalent to a multi-industry *Melitz-Pareto* model and a multi-industry *Eaton-Kortum* model with Marshallian externalities.

A Brief Overview of the Model

Demand and Preferences

- Industry k is served by many firms located in different countries.
- Nested-CES utility function over firm-level varieties.
  - σ_k ~ cross-national elasticity of substitution in industry k
  - γ_k ~ within-national elasticity of substitution b/w firm-level varieties

Supply and Firms

- labor is the sole factor of production
- firms compete under monopolistic competition + free (or restricted) entry

Two Key Elasticities for Policy Analysis

Trade Elasticity

- The trade elasticity in industry k is defined as

$$\text{trade elasticity} \sim \frac{\partial \ln \text{Bilateral trade value}}{\partial \ln \text{Bilateral trade barriers}} = \sigma_k - 1$$

- Lower $\sigma_k - 1 \longrightarrow$ greater scope for ToT manipulation

Scale Elasticity

- The scale elasticity in industry k is defined as

$$\text{scale elasticity} \sim \frac{\partial \ln \text{Variety-adjusted TFP}}{\partial \ln \text{Number of workers}} = \frac{1}{\gamma_k - 1}$$

- Higher $\text{Var}_k(\mu_k) \longrightarrow$ greater degree of misallocation

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First-Best Non-Cooperative Policy

Optimal Non-Cooperative Policy Problem

- Country i's optimal policy problem

import tariff

vector of equilibrium outcome

$$\max_{\mathbf{t}_i,\mathbf{x}_i,\mathbf{s}_i} W_i(\mathbf{t}_i, \mathbf{x}_i, \mathbf{s}_i; \mathbb{X}) \qquad s.t. \text{ Equilbrium conditons}$$

export subsidy

industrial subsidy

- **Note** the solution to the above problem does *not* internalize country i's ToT externality on the rest of the world $\longrightarrow$ it's sub-optimal from a global standpoint.

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- $\mathbf{t}_i$: import tariff
- $\mathbb{X}$: vector of equilibrium outcome
- $\mathbf{x}_i$: export subsidy
- $\mathbf{s}_i$: industrial subsidy

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Theorem 1: *First-Best*

The unilaterally optimal (first-best) policy consists of

1. industrial subsidies ($\mathbf{s}_i$) that promote high-μ (*high-returns-to-scale*) industries.
2. import tariffs ($\mathbf{t}_i$) $+$ export subsidies ($\mathbf{x}_i$) that contract exports in low-σ industries.

Corollary: first-best optimal tariffs and export subsidies are *misallocation-blind*.

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Second-Best Optimal Policy Problem

– Country i's 2nd-best optimal policy problem

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$$\max_{\mathbf{t}_i,\mathbf{x}_i,\mathbf{s}_i} \; W_i(\mathbf{t}_i, \mathbf{x}_i, \mathbf{s}_i; \mathbb{X}) \qquad s.t. \begin{cases} \text{Equilbrium conditons} \\ \mathbf{s}_i = \mathbf{0} \end{cases}$$

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– **Note:** The restriction that $\mathbf{s}_i = \mathbf{0}$ may reflect institutional barriers or political economy pressures.

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Theorem 2: *Second-Best*

– Optimal *2nd-best* trade policies can be specified as follows:

protect high-μ industries

$$t^*_{\text{2nd-best}} = t^*_{\text{1st-best}} \times t^*_{\text{misallocation-correcting}}$$

$$x^*_{\text{2nd-best}} = x^*_{\text{1st-best}} \times x^*_{\text{misallocation-correcting}}$$

contract exports in high-σ industries

subsidize exports in high-μ industries

Intuition

– $t^*_{\text{2nd-best}}$ and $x^*_{\text{2nd-best}}$ mimic *1st-best* (Pigouvian) industrial subsidies...

– ...but by the ***targeting principle***, they cannot replicate the *1st-best* outcome.

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Tension between ToT and Misallocation-Correcting Objectives

- Correcting misallocation requires promoting high-μ industries.
- ToT improvement requires contracting export sales in low-σ industries.

Proposition

- If $\text{Cov}_k(\mu_k, \sigma_k) < 0 \implies$ correcting misallocation with trade policy worsens the terms-of-trade and *vice versa*.
- This tension makes trade policy an ineffective *misallocation-correcting* measure, beyond what is implied by the targeting principle.

Avoiding Immiserizing Growth with Deep Agreements

- **Flip side:** If $\text{Cov}_k(\mu_k, \sigma_k) < 0 \implies$ using industrial subsidies, *unilaterally*, to correct misallocation causes *immiserizing growth*.
- **Why?** corrective industrial subsidies promote high-μ industries $\longrightarrow$ expand exports in low-σ industries by design $\longrightarrow$ worsen the ToT.
- The best remedy for misallocation in open economies:
  - Countries coordinate their industrial subsidies via *deep* trade agreements.
  - In this process, each country forgoes the (unilateral) ToT gains from policy but benefit for efficiency improvements in the RoW.

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Estimating the Key Policy Parameters

The Parameters that Govern the Gains from Policy

– The gains from optimal policy depend crucially on two sets of elasticities:

1. μ_k ~ industry-level scale elasticity
2. $\sigma_k - 1$ ~ industry-level trade elasticity

– We posses plenty of estimates for trade elasticities, but μ_k is often normalized:

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Estimation Strategy

- We propose a new methodology to jointly estimate ξ_k and ϵ_k.
- We estimate a ***firm-level*** nest-CES import demand function with ***transaction-level*** trade data (j, kt ~ origin j–industry k–year t):

$$\ln X_{j,kt}(\omega) = -(\sigma_k - 1)\ln \tilde{p}_{j,kt}(\omega) + (1 - \mu_k[\sigma_k - 1])\ln \lambda(\omega \mid j, kt) + \delta_{kt} + \varepsilon_{\omega jkt}$$

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firm-level price

within-national market share

- Data Source: Universe of Colombian import transactions during 2007-2013, covering 226,288 exporting firms from 251 different countries. Estimation Details

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Quantifying the Gains from Policy

Sketch of Optimization-Free Quantitative Strategy

- Our goal is to simulate the counterfactual equilibrium under optimal policy.

- A bullet point summary of our quantitative strategy:

  1. Use exact hat-algebra $\longrightarrow$ express optimal policy formulas in changes
  2. Use exact hat-algebra $\longrightarrow$ express equilibrium conditions in changes
  3. Solve the system of equations derived under Steps (1) and (2)

- Step (3) determines the change in *real GDP* in response to optimal policy as a function of the following *sufficient statistics*:

$$\mathcal{B}_v \equiv \{\lambda_{ni,k}, e_{n,k}, r_{ni,k}, \rho_{i,k}, w_n \bar{L}_n, Y_n\}_{ni,k} \qquad \mathcal{B}_e = \{\sigma_k - 1, \mu_k\}_k$$

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national accounts data

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estimable parameters

Data Sources

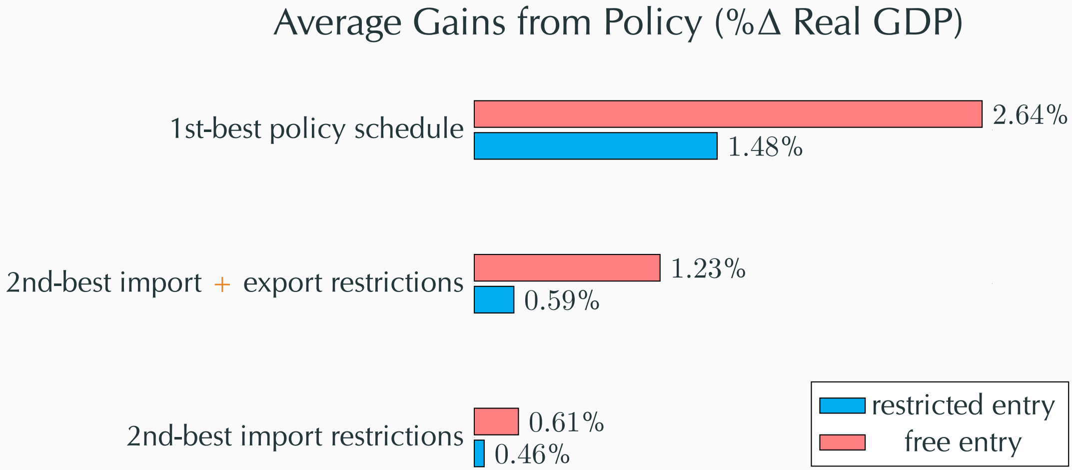
World Input-Output Database (2000-2014)

- production and expenditure by *origin*$\times$*destination*$\times$*industry*.
- 44 Countries + an aggregate of the rest of the world
- 56 Industries

UNCTAD-Trains Database:

- Average industry-level tariffs for all *44*$\times$*43* country pairs.

Gains from Non-Cooperative Optimal Policies



The Immiserizing Growth Effects of Industrial Policy

Welfare consequences of *corrective* industrial subsidies under **free entry**

- Unilateral adoption ⟶ **0.70%** decline in real GDP
- Coordinated via a deep agreement ⟶ **3.22%** rise in real GDP

Welfare consequences of *corrective* industrial subsidies under **restricted entry**

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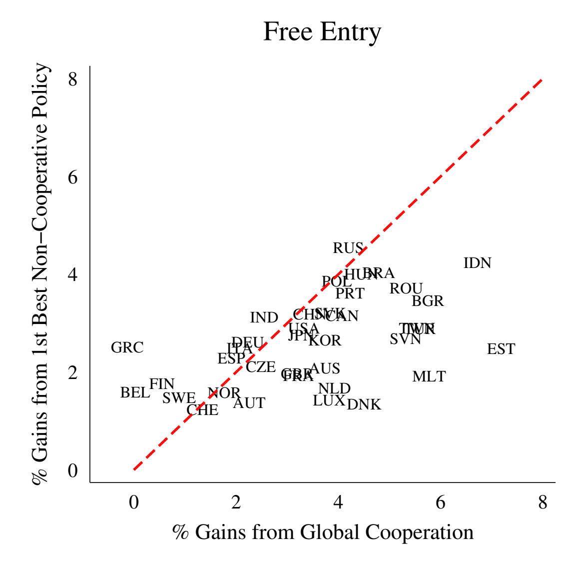

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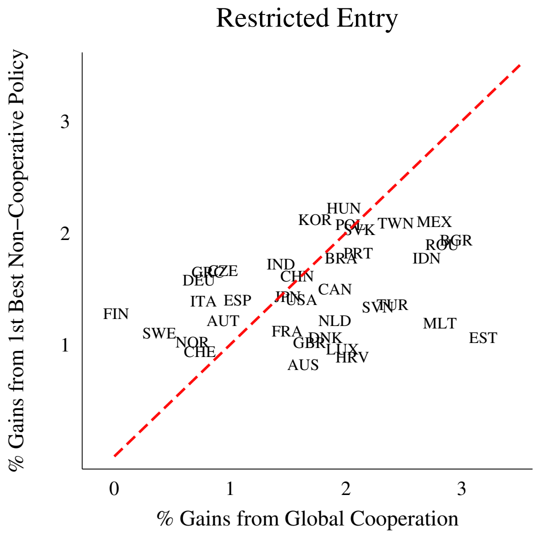

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Thank you

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- **Identification Challenge:** $\Delta \ln p$ and $\Delta \ln \lambda$ maybe correlated with $\Delta\varepsilon$.
- **Identification Strategy:** use degree of exposure to *monthly* exchange rate shocks as an instrument for $\Delta \ln \tilde{p}$ and $\Delta \ln \lambda$. Return

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– **Identification Strategy:** use degree of exposure to *monthly* exchange rate shocks as an instrument for $\Delta \ln \tilde{p}$ and $\Delta \ln \lambda$. Return

Main Instrument

- Compile an external database on monthly exchange rates.
- Interact the change in monthly exchange rates w/ prior export behavior to construct a *variety-specific* shift-share IV:

$$z_{j,kt}(\omega) = \sum_{m=1}^{12} \left([\text{share of month } m \text{ sales in } t-1] \times \Delta \ln E_{j,t}(m) \right)$$

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Sector	ISIC4 codes	Estimated Parameter $\sigma_k - 1$	$\frac{\sigma_k - 1}{\gamma_k - 1}$	μ_k	Obs.	Weak Ident. Test
Agriculture & Mining	100-1499	6.212	0.875	0.141	11,962	2.51
		(2.112)	(0.142)	(0.167)		
Food	1500-1699	3.333	0.883	0.265	20.042	6.00
		(0.815)	(0.050)	(0.131)		
Textiles, Leather & Footwear	1700-1999	3.413	0.703	0.207	126,483	63.63
		(0.276)	(0.020)	(0.022)		
Wood	2000-2099	3.329	0.899	0.270	5,962	1.76
		(1.331)	(0.181)	(0.497)		
Paper	2100-2299	2.046	0.813	0.397	37,815	2.65
		(0.960)	(0.216)	(0.215)		
Petroleum	2300-2399	0.397	0.698	1.758	4,035	2.03
		(0.342)	(0.081)	(1.584)		
Chemicals	2400-2499	4.320	0.915	0.212	134,413	42.11
		(0.376)	(0.027)	(0.069)		

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		$\sigma_k - 1$	$\frac{\sigma_k - 1}{\gamma_k - 1}$	μ_k		
Rubber & Plastic	2500-2599	3.599	0.582	0.162	107,713	7.22
		(0.802)	(0.041)	(0.039)		
Minerals	2600-2699	4.561	0.847	0.186	28,197	3.19
		(1.347)	(0.096)	(0.129)		
Basic & Fabricated Metals	2700-2899	2.959	0.559	0.189	155,032	16.35
		(0.468)	(0.024)	(0.032)		
Machinery	2900-3099	8.682	0.870	0.100	266,628	8.54
		(1.765)	(0.080)	(0.065)		
Electrical & Optical Equipment	3100-3399	1.392	0.631	0.453	260,207	17.98
		(0.300)	(0.015)	(0.099)		
Transport Equipment	3400-3599	2.173	0.289	0.133	86,853	5.09
		(0.589)	(0.028)	(0.036)		
N.E.C. & Recycling	3600-3800	6.704	0.951	0.142	70,974	8.51
		(1.133)	(0.100)	(0.289)		

Summary of Estimates

- High-μ sectors:
  1. Electrical & Optical Equipment
  2. Petroleum
- Low-μ sectors:
  1. Agriculture & Mining
  2. Wood

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