Markups as Shadow Tariffs:
How Market Power Skews Trade Reciprocity

Siying Ding
UIBE

Ahmad Lashkaripour
Indiana University

Volodymyr Lugovskyy
Indiana University

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Background and Motivation

Inevitable questions given the rise of *market power* & *trade integration*:

- Are the welfare losses from market power localized?
- Are the losses transmitted intentionally through trade connections?
- Are countries disproportionally exposed to the losses depending on their trade profile?

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This paper:

- New formula for the welfare cost of monopolistic markups under trade
- Combine formula and data to answer the above questions
- *Key insight*: if countries are sufficiently open, markups function as shadow tariffs

Roadmap

Step 1: We derive a semi-parametric formula for the *deadweight loss* of markups (μ) in open economies:

$$\text{DWL} = \text{MLD}\left(\frac{1}{\mu}\right) + \frac{1}{\epsilon}\cdot\Delta_{\mu}\left(\frac{\text{trade}}{\text{GDP}}\right) + \ln\left(\frac{\text{avg. expenditure-side markup}}{\text{avg. output-side markup}}\right)$$

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What's new? ***international profit-shifting*** effects

- markups generate *excess* profit (rent) payments between countries
- the burden of markups falls disproportionally on nations that specialize in low-markup goods and pay more excess profits to the RoW than they receive.

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Step 2: we estimate firm-level markups globally using *demand* and *cost-based* techniques + compile new data on global profit ownership

Step 3: we plug the estimated markups and data into our formulas to measure DWL among 65 major economies.

Preview of Findings

We estimate systematic *profit-shifting* from low-income to high-income countries:

- 44% increase in DWL of markups by for *low-income* countries.
- 15% reduction in the DWL of markups by for *high-income* countries.

Preview of Findings

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Policy Implication:

- International transfers through profit-shifting mimic an 8% shadow tariff charged by high-income countries on low-income trading partners
- these findings challenge the common view that high-income countries have made disproportionally greater tariff concessions under existing agreements (Chow et al., 2018)

Related Literature

(a) Theory of Trade Effects in Distorted Economies

1. **pro-competitive effects:**Melitz and Ottaviano (2008), Holmes et al. (2014), De Blas and Russ (2015), Edmond et al. (2015), Feenstra and Weinstein (2017), Arkolakis et al. (2019)
2. **inter-firm reallocation:** Epifani and Gancia (2011), Bai, Jin, and Lu (2019), Berthou et al. (2020), Dix-Carneiro et al. (2021), and Farrokhi et al. (2024)
3. **Unifying frameworks:** Atkin and Donaldson (2021), Baqaee and Farhi (2019), Edmond et al. (2023)

(b) Estimating market power in international settings: De Loecker et al. (2016); De Loecker and Eeckhout (2018); Díez et al. (2021); Coşar, Grieco, Li, and Tintelnot (2018); Keller and Yeaple (2020), Morlacco (2019), Alviarez, Fioretti, Kikkawa, and Morlacco (2023)

(c) Strategic trade policy & reciprocity: Brander and Spencer (1985); Eaton and Grossman (1986); Mrázová (2011); Ossa (2012); Bagwell and Staiger (2012); Head and Spencer (2017); Lashkaripour (2021); Firooz and Heins (2023); Lashkaripour and Lugovskyy (2023); Bown et al. (2023).

An Illustration of Markup Incidence in Open Economies

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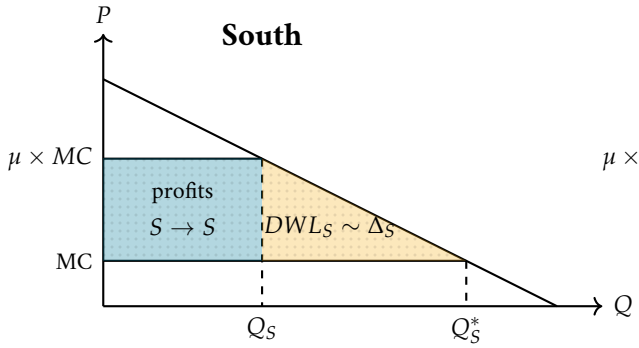
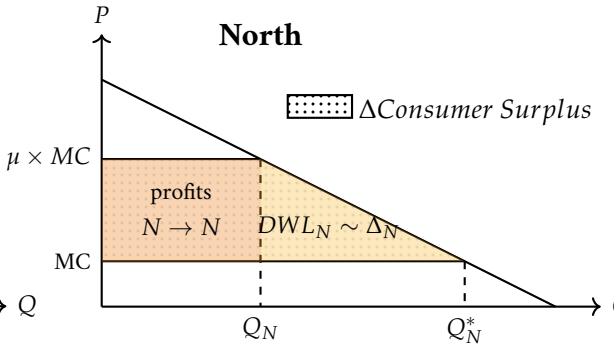
super stylized (just for illustration!)

Closed Economy (Textbook Case)





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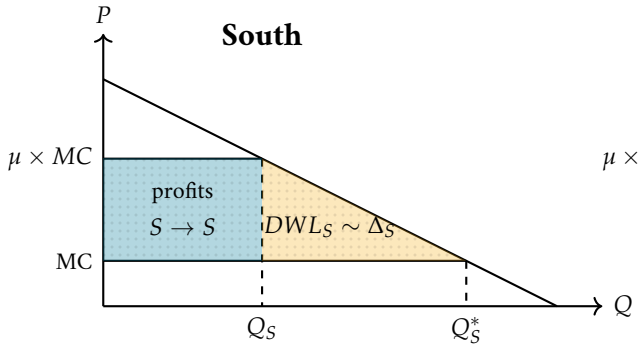

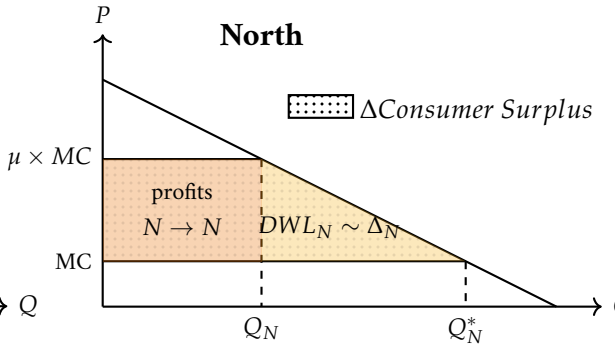

$$\mathcal{D}_i^{(closed)} = \Delta CS_i - \underbrace{\frac{\mu}{\mu - 1} PQ_i}_{\text{profits}} \equiv \Delta_i$$

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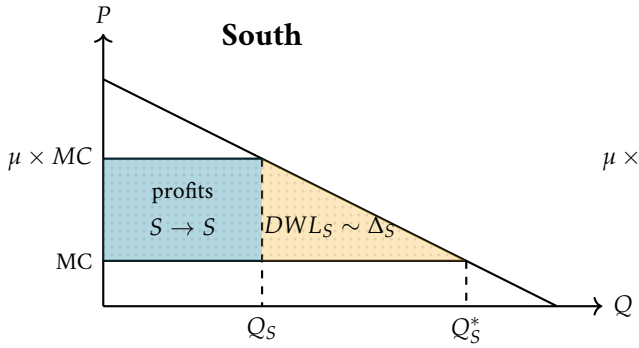

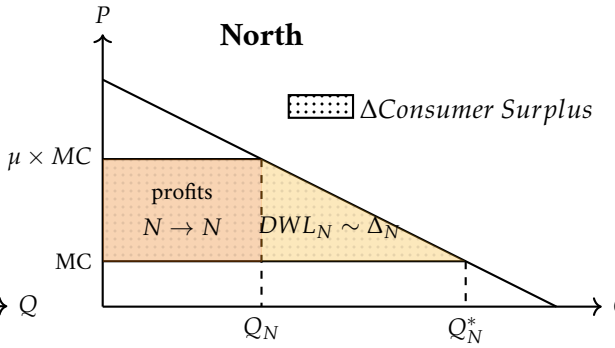

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loss to consumer surplus

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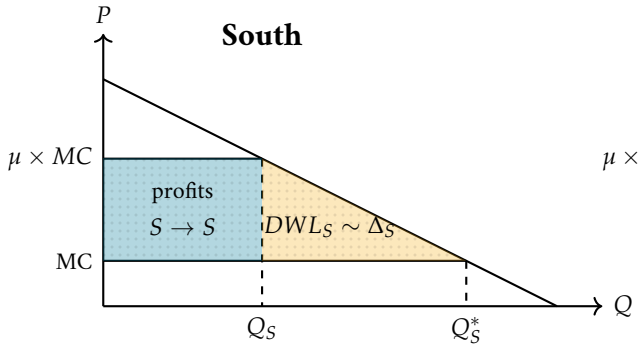

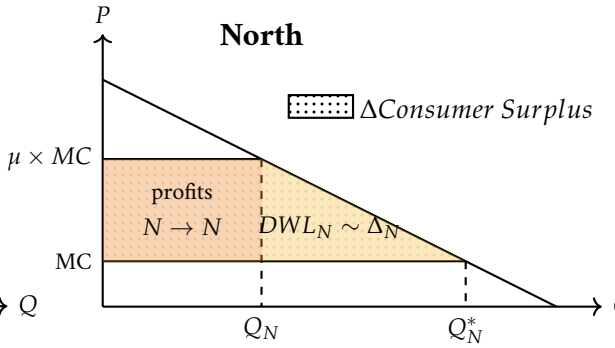

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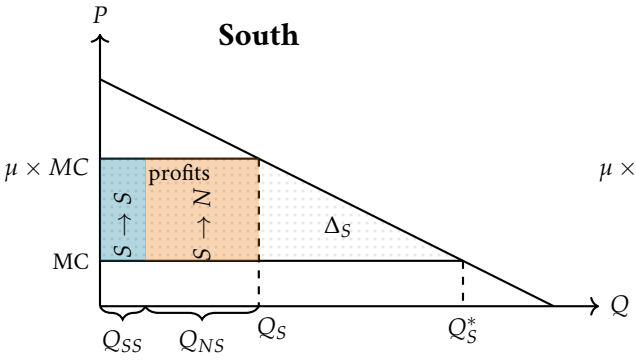
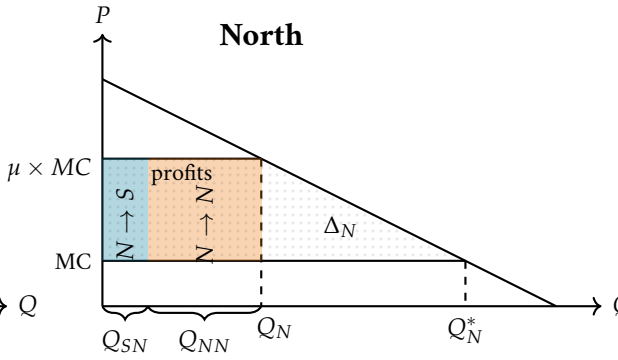
Harbinger triangle

loss to consumer surplus

The Open Economy Case





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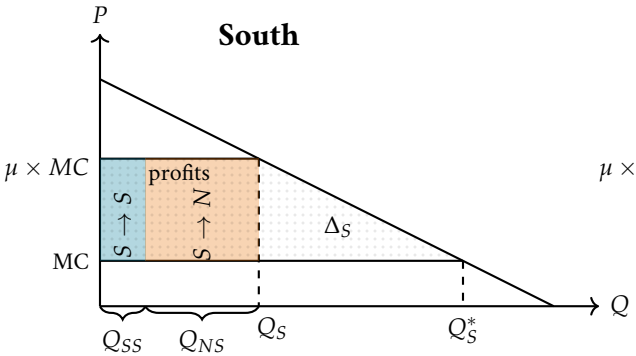

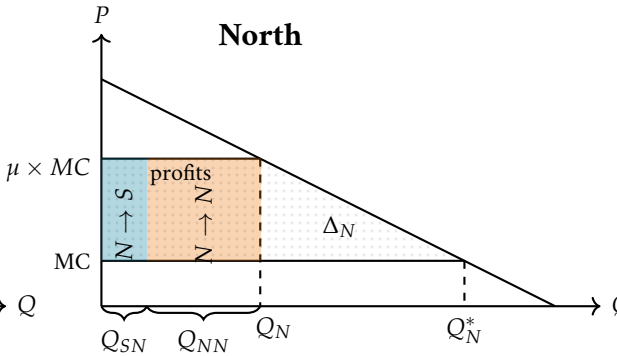

$$\mathcal{D}_S = \Delta_S + \underbrace{\frac{\mu - 1}{\mu} P \left(Q_{NS} - Q_{SN}\right)}_{\text{profit-shifting}} > \Delta_S$$

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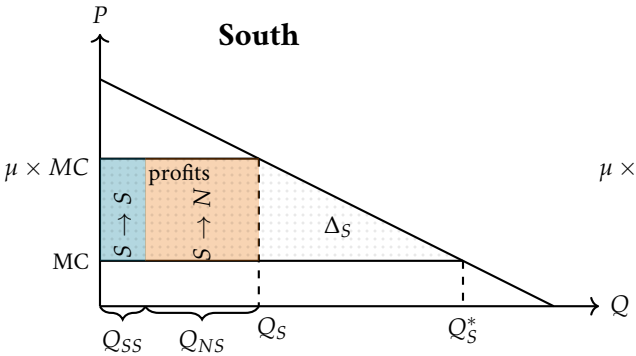
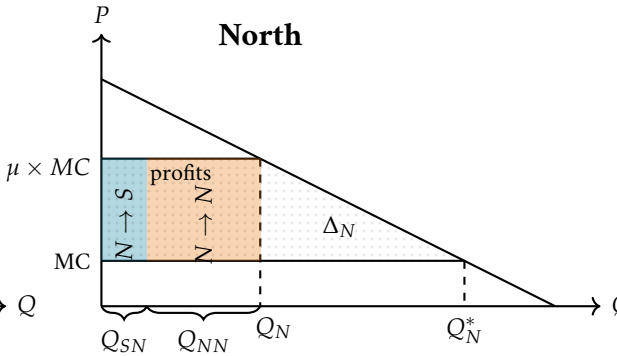
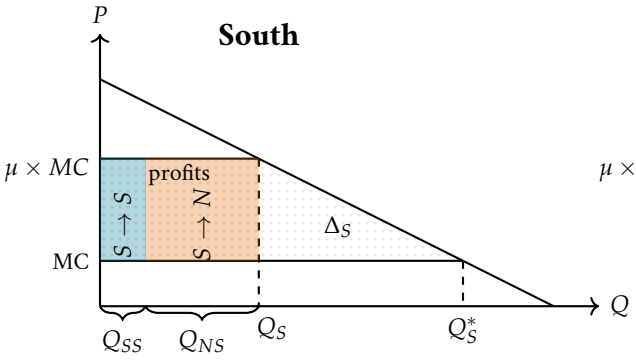
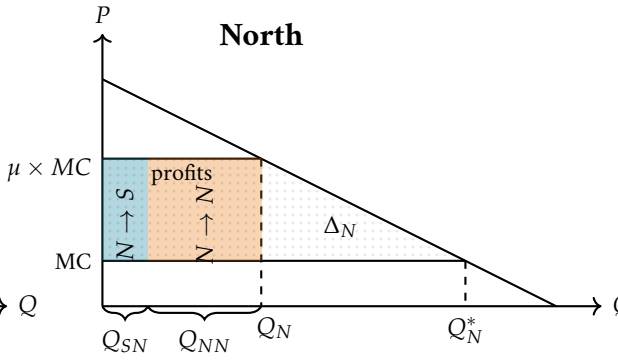




$$\mathcal{D}_N = \Delta_N - \underbrace{\frac{\mu - 1}{\mu} P \left(Q_{NS} - Q_{SN}\right)}_{\text{profit-shifting}} < \Delta_N$$

The Open Economy Case





- **Takeaway:** if North's exports have a higher markup content ⇾ trade reduces the DWL of markups in the North while increasing it in the South

suggestive evidence on North-South asymmetry in aggregate markups

Theoritical Framework

Economic Environment

- Multiple countries ($i, n = 1, ..., N$)
- Multiple industries ($k = 1, ..., K$)
- **Firms and Production**
  - fixed measure of firms in country i–industry k
  - each produces a differentiated variety under monopolistic competition
  - one factor of production, labor, immobile across countries
  - $L_i \equiv$ labor endowment, $w_i \equiv$ wage in country i
- **Consumers**
  - choose from a continuum of firm varieties $\omega \in \cup_k \Omega_k$
  - semi-parametric variable elasticity demand

Consumers: Demand and Preferences

- All consumers have same preferences:
  - *across industries*: separable + unitary elasticity of substitution
  - *within industries*: homothetic with aggregator demands system (semi-parametric)

- The share of expenditure on firm $\omega \in \Omega_k$ within industry k:

$$\lambda_k(p_\omega) = \frac{\frac{p_\omega}{P_k} D_k\left(\frac{p_\omega}{P_k}\right)}{\int_{\Omega_k} \frac{p_\omega}{P_k} D_k\left(\frac{p_\omega}{P_k}\right) d\omega}$$

  - $D_k(.)$ is decreasing with $D_k(x) = 0$ for all $x \geq a$
  - $P_k \equiv \mathcal{P}_k(\mathbf{p}_k)$ is a prices aggregator

Firms and Production

- Productivity drawn *i.i.d.* from a Pareto distribution with shape parameter θ
- Marginal cost under productivity φ:

$$c = \frac{1}{\varphi} \tau_{ni,k} w_n$$

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trade cost

wage

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- Profits and pricing decisions given cost c and aggregate shifter P_k

$$\pi(c; P_k) = \begin{cases} \max_p (p - c) D_k \left(\frac{p}{P_k}\right) Y_k & c < P_k \\ 0 & c \geq P_k \end{cases}$$

- **Note:** There are no fixed costs, but Melitz-style selection through the choke price

Firms and Production

- Profit-maximizing prices feature a variable markup over marginal cost: $p = \mu \times c$
- The markup of each firm is fully determined by $\nu \equiv P_k / c$

$$p_k(\nu) = \underbrace{m_k(\nu)}_{\mu} \times \underbrace{P_k / \nu}_{c}$$

where $m_k(.)$ is an increasing function that solves

$$m_k(\nu) = \frac{\varepsilon_k(\frac{m_k(\nu)}{\nu})}{\varepsilon_k(\frac{m_k(\nu)}{\nu}) - 1} \qquad \text{with} \qquad \varepsilon_k(x) \equiv \mid D_k'(x) \mid$$

Key Equilibrium Outcomes

- There's a 1:1 correspondence b/w a firm's markup (μ) with its price and market share

$$p_k(\mu) = \frac{\mu}{m_k^{-1}(\mu)} P_k \qquad \lambda_k(\mu) = \frac{\frac{\mu}{m_k^{-1}(\mu)} D_k\left(\frac{\mu}{m_k^{-1}(\mu)}\right) \left(m_k^{-1}(\mu)\right)^{-\theta-1}}{\int_1^\infty \frac{\mu}{m_k^{-1}(\mu)} D_k\left(\frac{\mu}{m_k^{-1}(\mu)}\right) \left(m_k^{-1}(\mu)\right)^{-\theta-1} d\mu}$$

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- Aggregate expenditure and output shares:
  - expenditure share on goods with markup μ: $e_i(\mu) = \sum_k \lambda_k(\mu) e_{i,k}$
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- Aggregate bilateral trade shares:

$$\lambda_{ni,k} = \frac{\chi_{i,k}(\tau_{ni,k} w_n)^{-\theta}}{\sum_\ell \chi_{\ell,k}(\tau_{\ell i,k} w_\ell)^{-\theta}} \qquad \text{(origin } n\text{–destination } i\text{–industry } k\text{)}$$

General Equilibrium

- Consumers maximize utility
  - Welfare: $W_i = v_i(Y_i, \mathbf{p}_i)$ where $\mathbf{p}_i$ is the vector of prices in market i
- Firms maximize profits
  - variable and heterogeneous markups
  - Melitz-style selection
- Goods and labor markets clear:
  - profits are rebated to households in the firms's country of origin
  - national-level expenditure equals sales (wage income + profits): $Y_i = \sum_n \lambda_{in,k} e_{n,k} Y_n$
  - labor markets clear in each country: $w_i L_i = \left[\int_\mu \frac{1}{\mu} y_i(\mu) d\mu\right] Y_i$

The Deadweight Loss of Markups

Notation: *Arithmetic and Harmonic Mean*

Let $F(.)$ be some generic function:

$$[\text{arithmetic mean}] \qquad \mathbb{E}_{\omega}[F(\mu)] = \int_{\mu} F(\mu)\,\omega(\mu)\,d\mu$$

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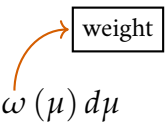

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[arithmetic mean] $$\mathbb{E}_{\omega}[F(\mu)] = \int_{\mu} F(\mu)\,\omega(\mu)\,d\mu$$

weight

[harmonic mean] $$\widetilde{\mathbb{E}}_{\omega}[F(\mu)] = \left(\int_{\mu} F(\mu)^{-1}\,\omega(\mu)\,d\mu\right)^{-1}$$

The Deadweight Loss of Markups: *Closed Economy*

Definition: the deadweight loss from markups in country i is define as

$$\mathcal{D}_i \equiv \Delta_\mu \ln W_i = \ln W_i(1) - \ln W_i(\mu)$$

- $W_i(\mu)$ denotes factual welfare under markups
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The Deadweight Loss of Markups: *Open Economy*

Proposition 2: The DWL from markups in open economy i is

$$\mathscr{D}_i = \text{MLD}_{e_i}\left(\frac{1}{\mu}\right) - \frac{1}{\theta}\Delta_\mu \ln \tilde{\lambda}_{ii} + \ln\left(\widetilde{\mathbb{E}}_{e_i}[\mu] / \widetilde{\mathbb{E}}_{y_i}[\mu]\right)$$

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- The profit-shifting term represents international transfers via excess profit payments:

$$\ln \frac{\widetilde{\mathbb{E}}_{e_i}[\mu]}{\widetilde{\mathbb{E}}_{y_i}[\mu]} \sim \ln \frac{\text{avg expenditure-side markup}}{\text{avg output-side markup}}$$

- These are *zero-sum* transfers from countries specializing in low-markup activities to those specializing in high-markup activities

Trade-Induced Change in the DWL of Markups

- The pure impact of trade on the DWL of markups is

$$\Delta_\tau \mathscr{D}_i \equiv \mathscr{D}_i(\tau) - \mathscr{D}_i(\infty)$$

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- The pure impact of trade on the DWL of markups is

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- Δ_τ markup dispersion $= 0$
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- profit-shifting is the man force (zero-sum)

A Theory of Markups as Shadow Tariffs

Duality between Tariffs & Markups

- Markups introduce a local DWL but also transfer excess surplus from foreign to home
  - akin to the textbook effect of import tariffs

- To formalize this, specify welfare as an explicit function of tariffs ($\mathbf{t}$) and markups ($\boldsymbol{\mu}$):

$$W_i = \mathbb{W}_i\left(\mathbf{t}, \boldsymbol{\mu}\right), \qquad \text{where} \qquad \begin{cases} \mathbf{t} = \{t_1, ..., t_N\} \\ \boldsymbol{\mu} = \{\mu_1, ..., \mu_K\} \end{cases}$$

where t_i is the uniform tariff applied by i on all trading partners

Unpacking the Duality in Welfare Effects

- Welfare effects of markups:

$$\Delta_\mu \ln W_i = \underbrace{\ln \frac{\widetilde{\mathbb{E}}_{y_i}[\mu]}{\widetilde{\mathbb{E}}_{e_i}[\mu]}}_{\text{international transfer}} + \underbrace{\text{MLD}_{e_i}\left(\frac{1}{\mu}\right) - \frac{1}{\theta}\Delta_\mu \ln \tilde{\lambda}_{ii}}_{\text{local effeciency loss}}$$

- Welfare effects of tariffs:

$$\Delta_t \ln W_i = \underbrace{-\ln\left[1 - \frac{(1-\lambda'_{ii})t_i}{1+t_i}\right]}_{\text{international transfer}} - \underbrace{\frac{1}{\theta}\Delta_t \ln \tilde{\lambda}_{ii}}_{\text{local effeciency loss}}$$

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- Tariffs/markup yield unilateral welfare gains if *international transfer* $>$ *local efficiency loss*
  - ... but these gains are inefficient and come at the expense of partners.

Equivalence Result: Duality between Tariffs & Markups

Proposition 3: If countries are sufficiently open and the trade elasticity θ is sufficiently small, there exists a uniform tariff schedule, $\tilde{\mathbf{t}}$, that replicates the welfare effects of the markups schedule, $\boldsymbol{\mu}$:

$$\mathbb{W}_i(\mathbf{t} + \tilde{\mathbf{t}}, \mathbf{1}) = \mathbb{W}_i \underbrace{(\mathbf{t}, \boldsymbol{\mu})}_{\text{status quo}}; \qquad (\forall i)$$

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- **Key takeaway:**
  - markups function as decentralized *shadow* tariffs
  - sufficiently open countries may find it in their self-interest *not* to regulate markups

Extensions and Sufficient Statistics for Measurement

- We re-derive our formula under three extensions:
    1. global profit ownership
    2. input-output linkages
    3. fixed overhead costs

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- The sufficient statistics for measuring the DWL of markups across all cases:
  1. sales-weighted average markup per industry: $\widetilde{\mathbb{E}}_{\rho_k}[\mu]$
  2. aggregate expenditure/output shares by industry: $e_{i,k}$, $y_{i,k}$
  3. aggregate input-output shares: $\alpha_{i,kg}$
  4. global profit ownership shares: π_{ni}

Data and Estimation

Summary of Data Sources

- **Aggregate shares:** OECD Inter-Country Input-Output Tables, covering 64 major countries and 36 industries during 2005-2015.

- We compile new data on global profit ownership using Orbis

- **Firm-level markups:** We estimate markups using two techniques
  - **cost-based:** we apply *De Loecker-Warzynski's* estimation technique to Worldscope data, covering 71,546 firms in 134 countries
  - **demand-based:** we estimate a linear approximation of BLP using high-frequency transaction-level import data from Colombia, covering 226,288 firms from 251 countries

Demand-Based Markup Estimation

- Our goal is to estimate a Mixed MultiNomial Logit (MMNL) demand model, which approximates our semi-parametric demand function as closely as possible.
- The standard approach to MMNL demand estimation is BLP:
  - the market share of variety ω is specified as

$$\lambda_{kt}(\omega) = \mathbb{E}_{\boldsymbol{\epsilon}}\left[\frac{\exp\left(\left(\overline{\boldsymbol{\beta}}_{kt} + \boldsymbol{\epsilon}\right) \cdot \mathbf{X}_{kt}(\omega) + \xi_{kt}(\omega)\right)}{1 + \sum_{\tilde{\omega}} \exp\left(\left(\overline{\boldsymbol{\beta}}_{kt} + \boldsymbol{\epsilon}\right) \cdot \mathbf{X}_{kt}(\tilde{\omega}) + \xi_{kt}(\tilde{\omega})\right)}\right],$$

    where $\mathbf{X}$ denotes *observed* product characteristics, $\overline{\boldsymbol{\beta}}$ is the mean coefficient, $\boldsymbol{\epsilon}$ is a random coefficient, and ξ encompasses *unobserved* product characteristics
  - BLP recover $\boldsymbol{\xi}$ by inverting the market share equation and enforcing the moment condition $\mathbb{E}[\Delta\boldsymbol{\xi} \mid \mathbf{z}] = 0$, for a choice of price instruments, $\mathbf{z}$.

Demand-Based Markup Estimation

- Performing the standard BLP estimation *at scale* faces two complications:
  1. inverting the nonlinear system of market share equations is computationally taxing
  2. credible identification requires information on observed product characteristics other than price, which are unavailable at the scale we conduct our estimation.

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- We overcome these challenges in two ways:
  1. use Salanie and Wolak's (2019) approximation to recover $\boldsymbol{\xi}$ without inversion:

variance matrix

$$\boldsymbol{\epsilon} \sim N\left(0, \boldsymbol{\Sigma}_{kt}\right)$$

$$\xi_{kt}\left(\omega\right) = \ln\left(\lambda_{kt}\left(\omega\right)/\lambda_{kt,0}\right) - \overline{\boldsymbol{\beta}}_{kt} \cdot \mathbf{X}_{kt}\left(\omega\right) - \tilde{\boldsymbol{\Sigma}}_{kt} \cdot \mathbf{K}_{kt}\left(\omega\right) + O\left(\| \boldsymbol{\Sigma}_{kt} \|^2\right)$$

artificial regressor: $K_{kt}\left(\omega\right) \equiv X_{kt}\left(\omega\right)\left[\frac{1}{2}X_{kt}\left(\omega\right) - \sum_{\omega'} \lambda_{kt}\left(\omega'\right) X_{kt}\left(\omega'\right)\right]$

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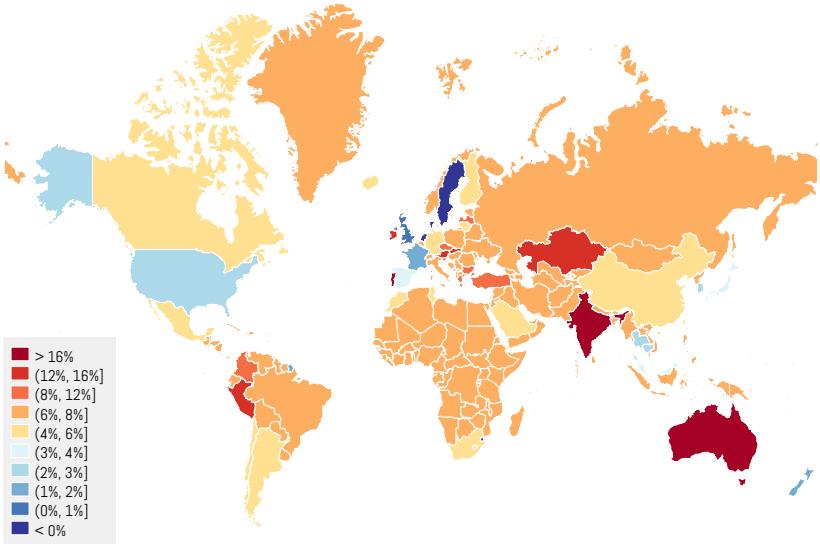
  2. leverage high-frequency data and the shift-share IV proposed by Lashkaripour & Lugovskyy (2023) to guide identification with limited information on observed product characteristics.

Markup Estimation Results

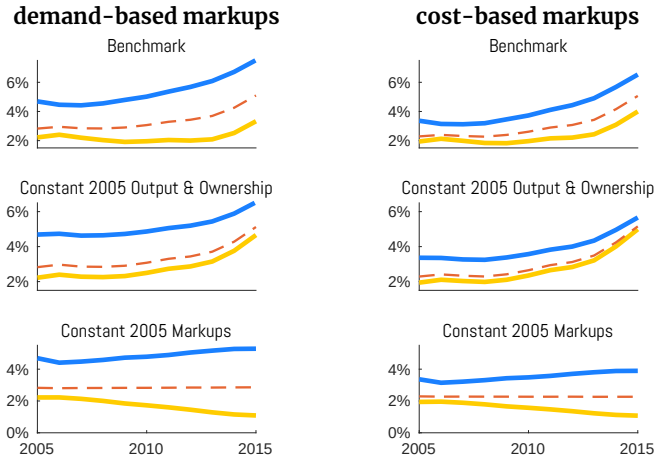
within-industry heterogeneity

Quantitative Results

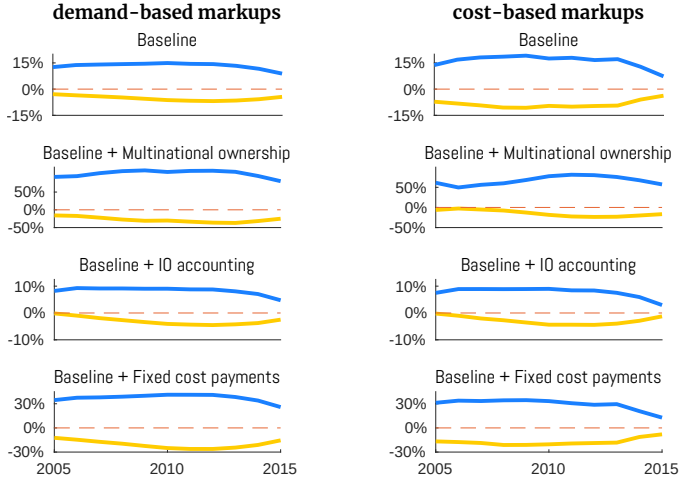
The DWL of Markups = markup dispersion + International profit-shifting



The Deadweight Loss of Markups has Risen Over Time



Trade-Induced Change in the DWL of Markups ($\Delta_\tau \mathcal{D}$)



decomposition

Discussion of Findings

(a) Trade has caused systematic profit-shifting from low- to high-income countries $\longrightarrow$ the burden of markups falls disproportionately on low-income countries

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(b) *Demand-* and *cost-based* markup estimates yield similar aggregate predictions

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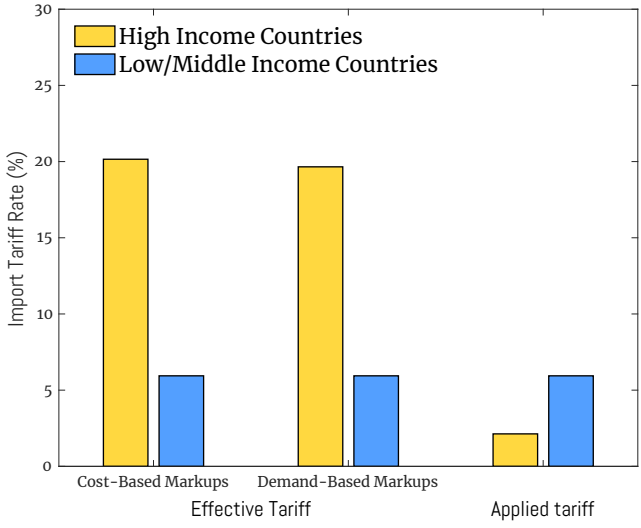
(b) *Demand-* and *cost-based* markup estimates yield similar aggregate predictions

- This is encouraging news for the methodological debate regarding markup estimation.

(c) Some high-income nations like the Netherlands benefit from markup distortions, due to strong and positive profit-shifting effects!

Tariff Reciprocity after Accounting for Shadow Tariffs



Policy Remedies for Profit-Sifting Externalities

- Firm-level markup operate as *decentralized shadow tariffs* that inflict international externalities
  $\longrightarrow$ require internationally-coordinated policy remedies

- Two policies potential policy solutions:

  1. preferential tariff concessions by high-income countries under the WTO's GSP mechanism

  2. destination tax on profits under Lever 1 of the Global Minimum Tax Agreement

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  2. destination tax on profits under Lever 1 of the Global Minimum Tax Agreement (partially effective)

	no global tax	$\tau^{global} = 15\%$	$\tau^{global} = 30\%$	$\tau^{global} = 45\%$
$\Delta\mathcal{D}$ **(low-income)**	43.9%	39.0%	33.7%	27.9%
$\Delta\mathcal{D}$ **(high-income)**	-14.8%	-12.3%	-9.9%	-7.7%

Conclusions

Main Finding: systematic *profit-shifting* from low-income to high-income countries:

- Trade has raised the DWL of markups by 44% for *low-income* countries.
- Trade has lowered the DWL of markups by 15% for *high-income* countries.
- Finding is robust across different models and markup estimation techniques.

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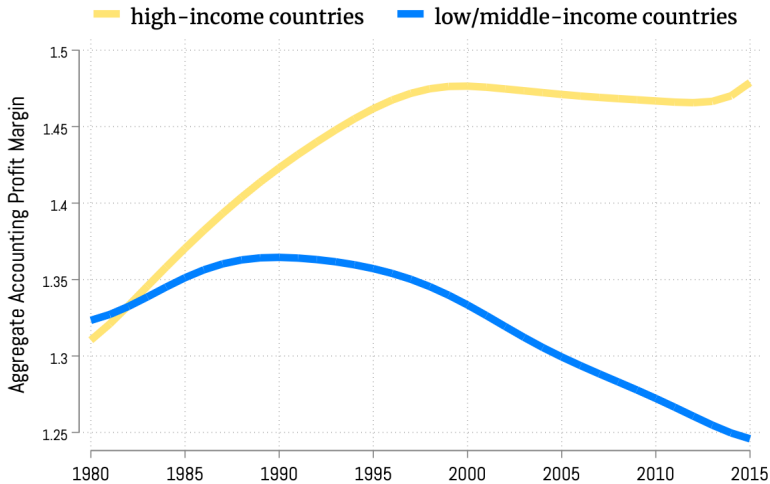
- Finding is robust across different models and markup estimation techniques.

Policy Implication:

- firm-level markups act as *shadow tariffs* that disrupt tariff reciprocity
- preferential tariff liberalization by high-income countries has partially restored reciprocity, though not completely

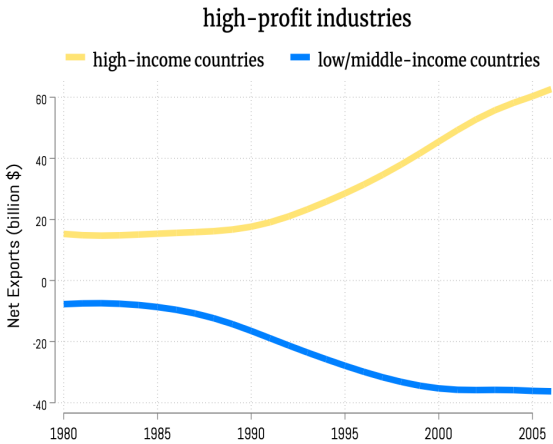
Thank you.

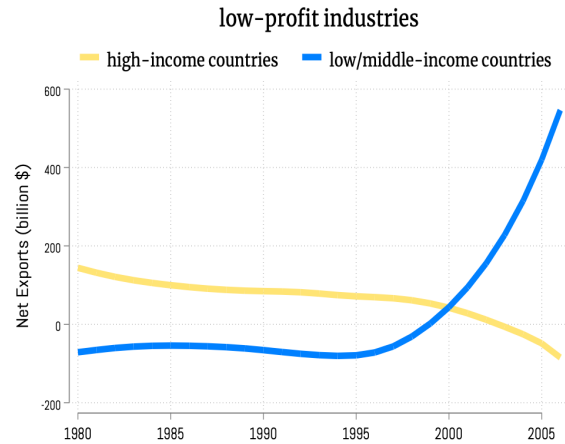
Fact 1: Aggregate accounting profit margins have diverged between high- and low-income countries despite their rates of fixed capital formation and R&D growth remaining synchronized.



Source: UNIDO-INDSTAT covering 196 countries and 23 ISIC rev.3. industries

Fact 2: The North-South divergence in aggregate profit margins coincides with high-income economies, like the US, becoming increasingly specialized in high-profit industries.





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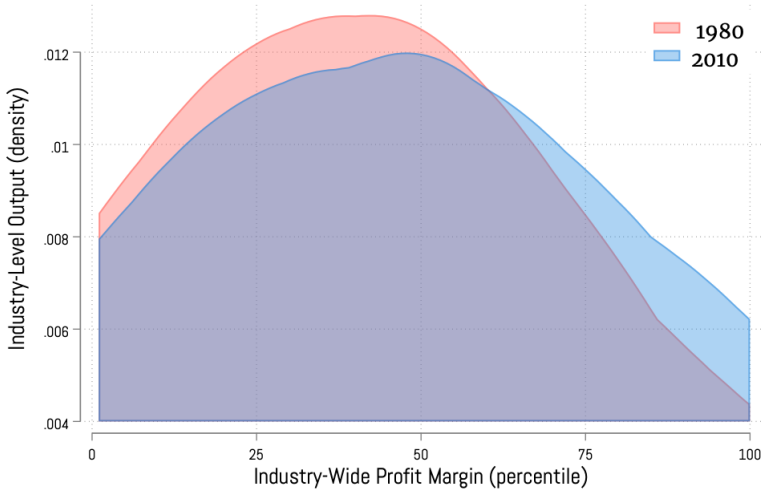
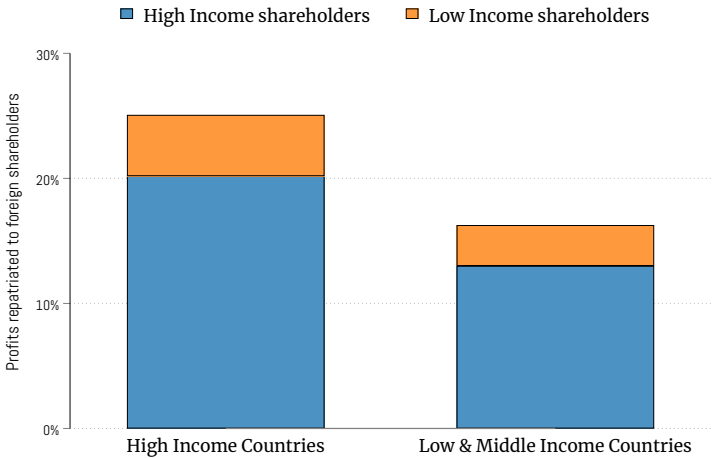
Granular Example: Trade openness coincides with US specialization in high-profit Industries

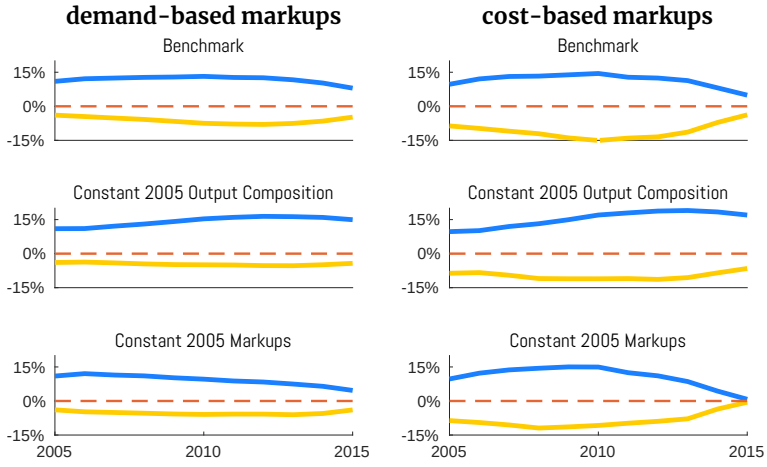


Source: Compustat data on publicly-trade North American firms

Fact 3: A minor fraction of profits are repatriated to foreign shareholders, but most repatriated profits payments accrue to high-income countries.



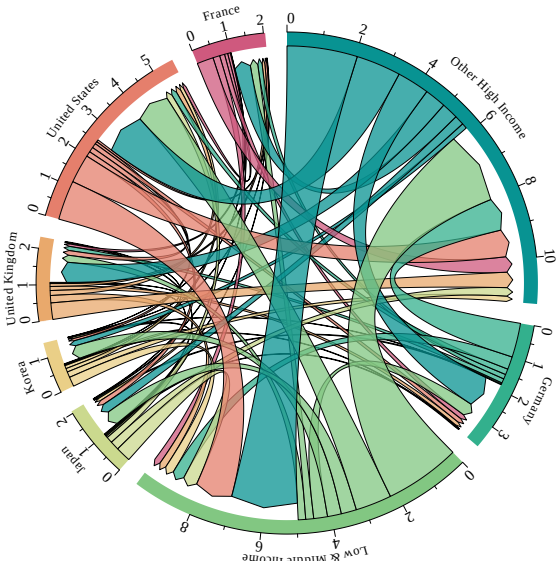
Source: Orbis databse return


demand-based markups
cost-based markups
Benchmark
Benchmark
Constant 2005 Output Composition
Constant 2005 Output Composition
Constant 2005 Markups
Constant 2005 Markups
15%
0%
-15%
2005
2010
2015
Low/Middle Income Countries
High Income Countries

return

The Anatomy of International profit-Shifting

return



Determinants of RCA in High-Markup Industries

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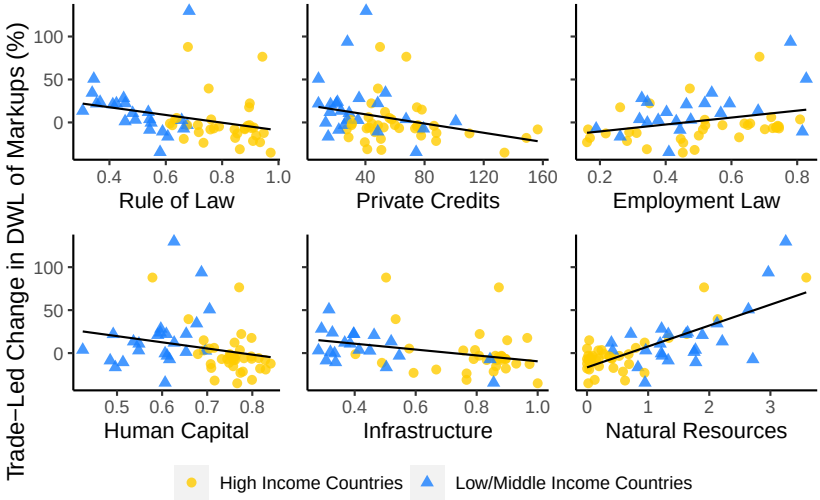
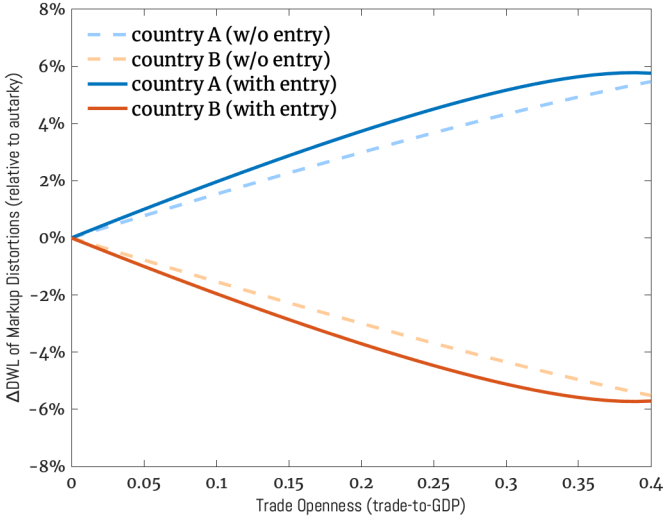


Internationally zero-sum welfare effects under free entry



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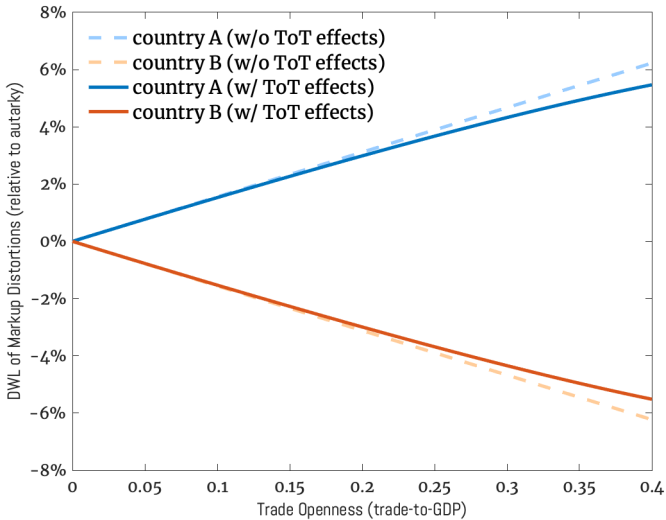
Profit-shifting net of Factoral Terms of Trade Effects



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The Gains from Trade

The gains from trade relative to autarky

$$GT_i = 1 - \exp\left(\Delta \mathcal{D}_i\right) \times \prod_k \lambda_{ii,k}^{e_{i,k}/\theta_k},$$

- Mechanical implication: gains from trade are more unequal

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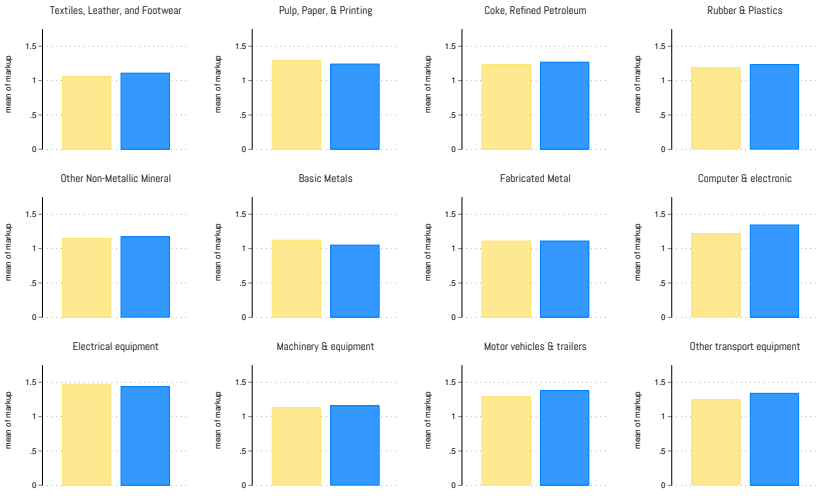
- Mechanical implication: gains from trade are more unequal

- However, the overall effect is more nuanced:
  - There is evidence that θ and average markups are negative correlated across industries
  - more imports in low-θ (high-markup) industries $\longrightarrow$ larger ACR gains
  - more imports in low-θ (high-markup) industries $\longrightarrow$ negative profit-shifting effects return

Within-Industry Heterogeneity in Estimated Markups



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