Tariffs on Input Trade Margins under Vertical Oligopoly: Theory and Evidence

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Outline of this talk

- Motivation
- Theory:
  - Vertical oligopoly with free entry
  - Extensive and intensive margins in input trade
- Evidence:
  - Data
  - Specification
  - Estimation results
- Summary

Motivation

- Recent years have witnessed faster growth of intermediate inputs in world trade volume:
  - Vertical specialization
  - Global value chains (GVCs)

- In analyzing fragmentation of production processes:
  - Most work $\Rightarrow$ Bilateral negotiation among particular buyer-seller relationships (e.g., Pol Antràs' work)
  - This paper $\Rightarrow$ Market-clearing condition among anonymous buyers and sellers

Motivation

- Contractual agreements vs. spot markets (Rauch, 1999; Nunn, 2007):
  - Differentiated goods $\Rightarrow$ Preexisting ties
  - Homogeneous goods $\Rightarrow$ Markets

- Less developed countries—especially China—tend to produce and trade homogeneous inputs in vertical specialization:
  - The similarity between Chinese and OECD exports is generally very low (Dean et al., 2011)
  - Chinese exports in GVCs are significantly less skill- and R&D-intensive (Dai et al., 2016)

Motivation

- Market-based transactions $\Rightarrow$ Strategic interdependence among large firms (Head and Spencer, 2017):
  - Only a few large firms participate in international trade
  - Markets are becoming more concentrated toward these firms over time
  - Market structure is more characterized by oligopoly

- Most papers in the GVC literature consider perfectly competitive firms (e.g., Antràs and de Gortari, 2020; Johnson and Moxnes, 2023)

Motivation

Table: Ten most concentrated industries in China, 1998

Most concentrated			
CIC	Industry description	HHI	Upstreamness
4039	Applied TV equipment and other audio-video equipment	0.681	2.584
4127	Nucleon and nuclear radiation measuring apparatus manuf.	0.609	3.060
3313	Nickel cobalt smelting	0.573	4.877
4159	Other stationary and office machine manufacturing	0.527	3.060
3759	Navigation mark and other floating equipment manuf.	0.517	2.617
4124	Meter apparatus for forming, forestry and fishing manuf.	0.516	3.666
2433	Electronic musical instrument	0.479	2.781
3723	Trolley manufacturing	0.457	2.953
2413	Teaching specimen and mode	0.441	2.781
4152	Slide projector and overhead projector manuf.	0.396	3.060
		0.519	3.144

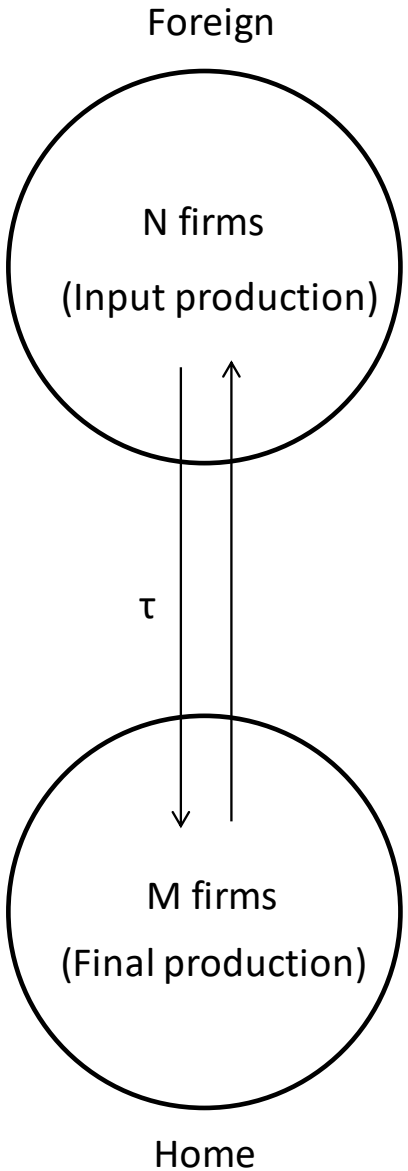
Source: China's annual survey of industrial firms and authors' calculations

Motivation

- Research question:
  - What is the effect of tariffs on the input trade margins when vertically related markets are oligopolistic?
  - Extensive margin $\Rightarrow$ The number of trading firms
  - Intensive margin $\Rightarrow$ Average trade value per firm

- Main findings:
  - Tariff reductions increase both margins in the vertically related sectors
  - The intensive margin rises relatively more than the extensive margin
  - Theoretically-consistent evidence in China's input imports

Theory



$$\pi_{Fi} \equiv \left(g\left(x_i + \sum_{j \neq i}^{N} x_j, M, \tau\right) - ct\right) x_i$$

Input price → D = S

$$r = g(X, M, \tau)$$

$$\pi_{Hi} \equiv \left(P\left(q_i + \sum_{j \neq i}^{M} q_j\right) - r\tau\right) q_i$$

Theory

- Equilibrium conditions:
  - First-order condition

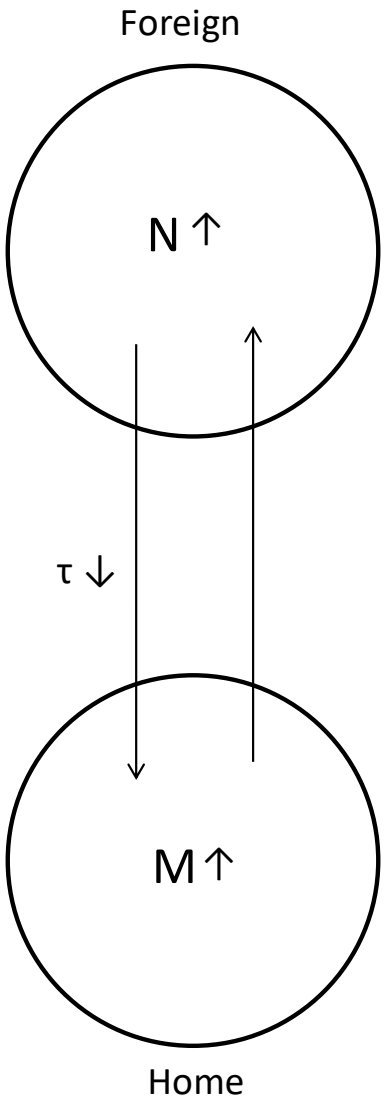
$$MP(Q) + QP'(Q) = Mr \quad \Longrightarrow \quad Q$$
$$Ng(X, M, \tau) + Xg_X(X, M, \tau) = Nct \quad \Longrightarrow \quad X$$

  - Free-entry condition

$$\frac{(P - r\tau)Q}{M} = K_H \quad \Longrightarrow \quad M$$
$$\frac{(r - ct)X}{N} = K_F \quad \Longrightarrow \quad N$$

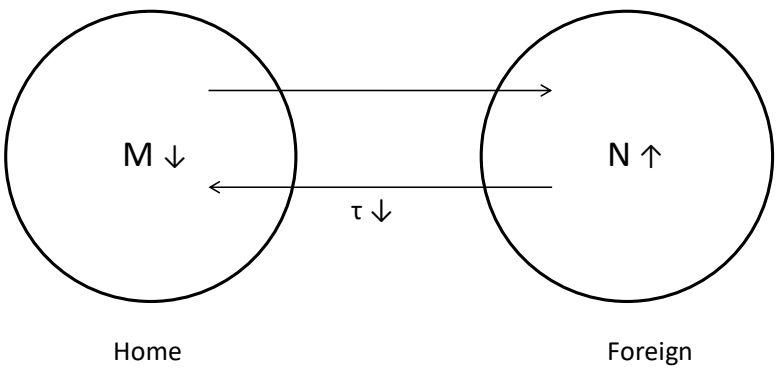
- Input trade margins:
  - Extensive margin $\Rightarrow M, N$
  - Intensive margin $\Rightarrow q = \frac{Q}{M}, x = \frac{X}{N}$

Theory



- Vertical specialization ⇒ Co-movement
- Tariff reductions induce some firms to enter the Home market, as traded goods are complements

Theory



- Horizontal specialization (Brander-Krugman) $\Rightarrow$ De-location
- Tariff reductions induce some firms to exit the Home market, as traded goods are substitutes

Theory

Proposition

(i) *Tariffs have the following effect on input imports of Home firms* $Q = Mq$*:*

$$\underbrace{\frac{d \ln Q}{d \ln \tau}}_{\text{Total margin}} = \underbrace{\frac{d \ln M}{d \ln \tau}}_{\text{Extensive margin}} + \underbrace{\frac{d \ln q}{d \ln \tau}}_{\text{Intensive margin}} < 0$$

where $\frac{d \ln M}{d \ln \tau} < 0$ and $\frac{d \ln q}{d \ln \tau} \gtrless 0$

(ii) *For constant-elasticity demand* $P(Q) = AQ^{-1/\sigma}$ *where* $\sigma > 1$*:*

$$\frac{d \ln M}{d \ln \tau} > \frac{d \ln q}{d \ln \tau} \implies \left| \frac{d \ln M}{d \ln \tau} \right| < \left| \frac{d \ln q}{d \ln \tau} \right|$$

(iii) *The same results apply to input exports of Foreign firms* $X = Nx$

Theory

- Why do we have to care about the difference in two margins?:
  - Because it is directly related to who gains from trade liberalization

- If tariff reductions mainly increase:
  - Extensive margin $\Rightarrow$ Trade liberalization benefits mostly new entrants by allowing for additional foreign access
  - Intensive margin $\Rightarrow$ Trade liberalization benefits mostly incumbent firms by reaping the scale of production

Evidence

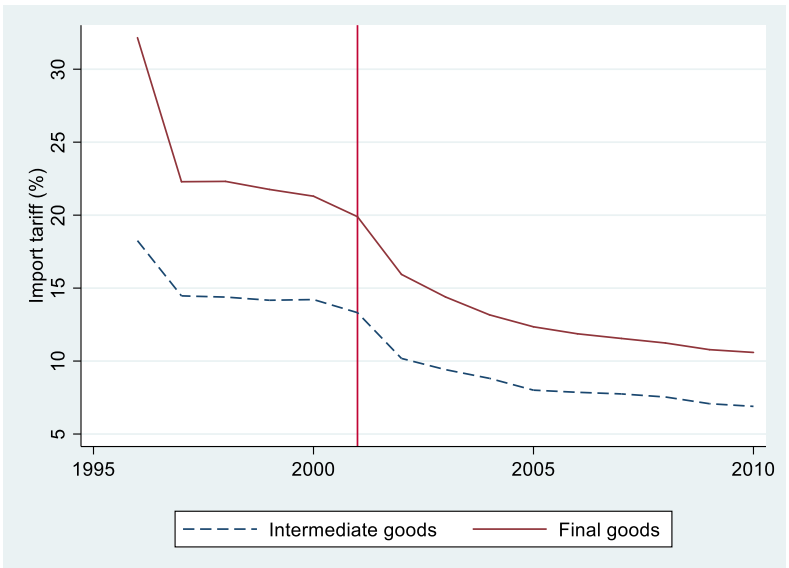
- China's imports:
  - 2000-2008 collected by China Customs
  - Firm-product-destination-year level dataset
  - 6-digit HS classification (over 5,000 HS-6 products)
  - Import volume (Q_{pct}), the number of importers (M_{pct}), average imports (q_{pct}) for product p imported from country c in year t

- Types of imports, 2007:

Ordinary intermediate input 3,031	Processing intermediate input 2,860
Ordinary final good 1,825	Processing final good 1,361

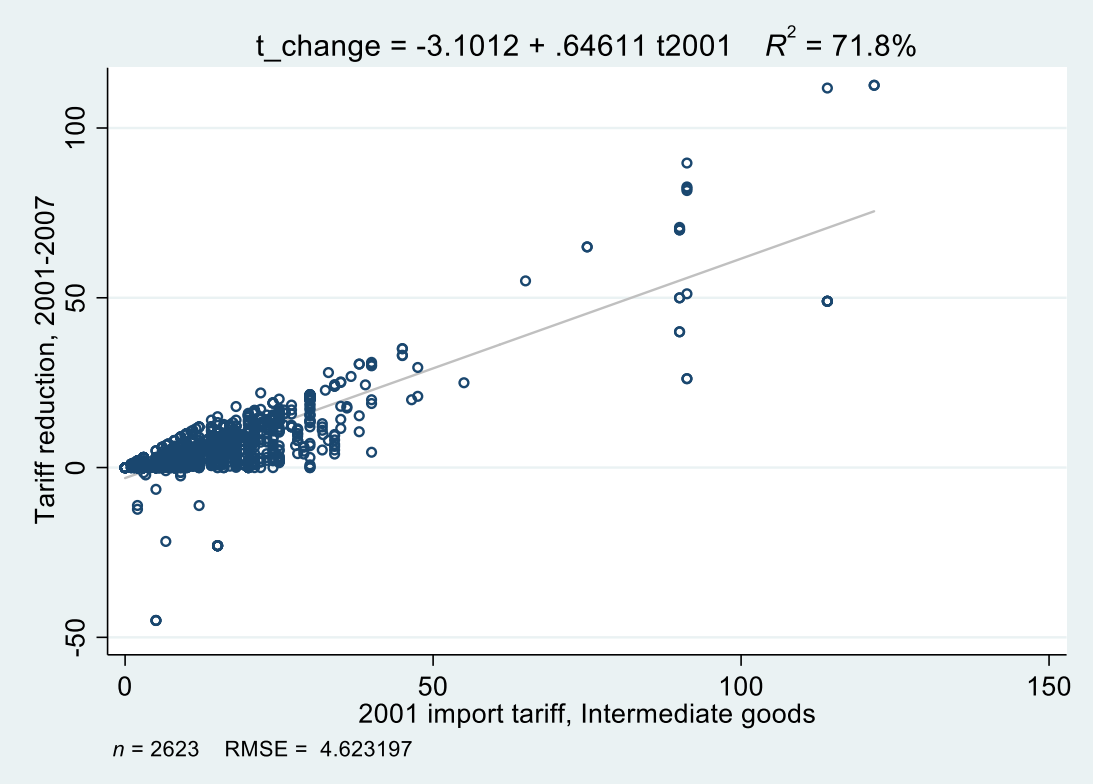
Evidence

- China's import tariffs:
  - Trade Analysis Information System (TRAINS) dataset
  - Ad-valorem applied tariffs
  - 6-digit HS classification
  - 159 countries of both WTO and non-WTO members



China's import tariffs, 1996–2010

Evidence



China's tariff reductions by initial tariff levels

Evidence

- Fixed effects model:

$$\ln y_{pct} = \beta_0 + \beta \ln \tau_{pct-1} + \theta_{pt} + \gamma_{ct} + \alpha_{cp} + \epsilon_{pct}$$

  where $y_{pct} \in \{Q_{pct}, M_{pct}, q_{pct}\}$

- NB:
  - *Not* a usual gravity equation
  - Equivalent to the "within" regression by Buono and Lalanne (2012)

- Theoretical predictions:
  - $\beta < 0$ for all margins
  - $|\beta|$ is greater for q_{pct} than M_{pct}

Evidence

- DID estimation:

$$\ln y_{pct} = \beta \ln \tau_{pc2001} * Post_{2002} + \theta_p + \gamma_{ct} + \alpha_{cp} + \epsilon_{pct}$$

  where $Post_{2002} = 1$ if $t \geq 2002$

- NB:
  - Treatment group $\Rightarrow$ More protected products with larger tariff reductions
  - Control group $\Rightarrow$ Less protected products with smaller tariff reductions

Evidence

Table: Effect of tariffs on intermediate goods imports

	(1)	(2)	(3)
	$\ln Q_{pct}$	$\ln M_{pct}$	$\ln q_{pct}$
Panel A. Linear Regression			
$\ln \tau_{pct-1}$	-3.508^{***}	-0.468^{**}	-3.040^{***}
	(1.056)	(0.208)	(0.936)
No. of obs	306,805	306,805	306,805
Adj. R^2	0.825	0.925	0.768
Panel B. DID Specification			
$\ln \tau_{pc2001} * Post_{2002}$	-1.105^{***}	-0.265^{***}	-0.841^{***}
	(0.305)	(0.089)	(0.233)
No. of obs	408,971	408,971	408,971
Adj. R^2	0.776	0.894	0.710

Note: ***, **, and * indicate significance at the 1%, 5% and 10% level, respectively

Evidence

- Discussions:
  - Previous work finds that tariff reductions only induce incumbent firms to increase their shipments (e.g., Buono and Lalanne, 2012)
  - Why does trade liberalization significantly increase the extensive margin in our study?

- Three possibilities:
  - China's tariff reductions are sufficiently large
  - Intermediate goods trade is different from final goods trade
  - China is a developing country (e.g., Dai et al., 2016)

Summary

- Key contributions:
  - Examine the effect of tariffs on the input trade margins when vertically related sectors are oligopolistic
  - Provide a better understanding of the mechanism through which import tariffs can affect the input trade margins from the long-run perspectives