The Impact of NAFTA on Prices and Competition: Evidence from Mexican Manufacturing Plants

Ken Kikkawa[1] **Yuan Mei**[2] Pablo Robles[3]

[1]Sauder School of Business, UBC

[2]Singapore Management University

[3]The Brattle Group

January 3, 2021

Motivation

- How do firms respond to trade liberalizations?
  - More competition from abroad
  - Cheaper inputs from abroad
  - de Loecker et al. (2016) document increases in markups upon an unilateral trade liberalization
- Large fraction of tariff reductions occur through mutual reductions. E.g., FTAs
  - Firms may also change export prices to the partner country (de Blas and Russ, 2015; Arkolakis et al., 2017)
- Need for comprehensive empirical investigation on pro-/anti-competitive effects

This Paper

- Focuses on the effects of mutual tariff reductions that occurred through NAFTA on Mexican firms (1994-2008)
- Analyzes the effects on firms' prices through both competition and costs, by decomposing Mexican producer prices into marginal costs and markups

$$\log P = \log MC + \log \mu$$

  - Use confidential product-level dataset containing quantity and price data separately for exported and domestically sold products
  - Estimate markups at the plant-product-market level, following de Loecker et al. (2016)

This Paper

- With $\log P$, $\log MC$, and $\log \mu$ of domestic and exported products, analyze their responses to reductions in tariffs under NAFTA, τ
- τ is either:
  - Mexican output tariffs τ^{output} (Competition channel)
  - Intermediate input tariffs τ^{input} (Cost channel)
  - U.S. tariffs τ^{US} (Market access channel)
- Exploit variations within plant-product-market
- Consider both the average effects of tariff reductions and the dynamic effects over time

Main Findings

- Competition channel ($\downarrow$ Mexican output tariffs)
  - Marginal costs and prices of domestic products $\downarrow$, but changes in markups are insignificant
  - Evidence of pro-competitive effect

Main Findings

- Competition channel ($\downarrow$ Mexican output tariffs)
  - Marginal costs and prices of domestic products $\downarrow$, but changes in markups are insignificant
  - Evidence of pro-competitive effect
- Cost channel ($\downarrow$ intermediate input tariffs)
  - Domestic products: no significant effect
  - Exports: marginal cost $\downarrow$, markups $\uparrow$, resulting in zero effect on prices

Main Findings

- Competition channel (↓ Mexican output tariffs)
  - Marginal costs and prices of domestic products ↓, but changes in markups are insignificant
  - Evidence of pro-competitive effect
- Cost channel (↓ intermediate input tariffs)
  - Domestic products: no significant effect
  - Exports: marginal cost ↓, markups ↑, resulting in zero effect on prices
- Market access channel (↓ U.S. tariffs)
  - Exports: marginal cost ↓, markups ↑, resulting in slight increase in prices
  - Evidence of anti-competitive effect

Data

Confidential data from the Mexican Institute of Statistics and Geography (INEGI)

- Annual data for 1994-2008 ▸ EIM and EIA ▸ Tariff reductions
- Around $6,000$ manufacturing plants $\approx$ 80-85% of VA in manufacturing
- Quantity and sales value for $\approx 3,500$ 8-digit products ▸ Product example
- Products are disaggregated into domestic and exported ▸ NAFTA's share in exports
- Plant level data on investment, capital, labor, materials, etc ▸ Summary stats of plants ▸ Summary stats of products
- Panel with $\approx$ 180,000 plant-product-market-year observations

Decomposing P into MC and μ

$$\underbrace{\log P}_{\text{Observable}} = \underbrace{\log MC + \log \mu}_{\text{Unobservable}}$$

- Use the Mexican dataset
  - which includes quantity and price data separately for exported and domestic products
- Use a structural model of production
  - estimate plant-product-market level quantity production functions
  - use parameters to derive estimate of $\hat{\mu}$ from plants' FOCs for cost minimization
  - using P and $\hat{\mu}$, back out $\hat{MC}$

Structural Framework: Setup

- Follow de Loecker, Goldberg, Khandelwal and Pavcnik (2016)
- Consider the production function of product-market i produced by plant j in sector s at time t:

$$Q^s_{ijt} = F_{it}\left(M_{ijt}, L_{ijt}, K_{ijt}; \beta_s\right)\Omega_{jt}$$

  - Q_{ijt} is physical output, M_{ijt} is materials, L_{ijt} is labor, and K_{ijt} is capital
  - Ω_{jt} is plant j's productivity at time t
  - Estimate a translog production function ▸ Translog
- Assume firms minimize costs. FOC with respect to materials gives:

$$\mu_{ijt} = \theta^M_{ijt}\left(\alpha^M_{ijt}\right)^{-1}$$

  - $\theta^M_{ijt} = \frac{\partial Q_{ijt}}{\partial M_{ijt}} \frac{M_{ijt}}{Q_{ijt}}$ is the output elasticity of materials
  - $\alpha^M_{ijt} = \frac{W^M_{ijt} M_{ijt}}{P_{ijt} Q_{ijt}}$ is the expenditure share of materials in product-market i sales ▸ FOC

▸ Assumptions ▸ Product differences

Structural Framework: Three Challenges, 1

- Challenge: Unobserved input allocations by product $\Rightarrow$ cannot use multi-product plants
- Solution: Use single-product plants in the estimation of β_s
- But this may introduce selection bias. Control for the bias by:
  - use unbalanced panel of plants that are single-product at any point in time $\Rightarrow$ sample including plants that may become multiple products in other years ▸ Single product
  - use Heckman selection correction for the probability of remaining single-product plant

    ▸ Selection correction

Structural Framework: Three Challenges, 2

- Challenge: Unobserved plant-product-level input prices, only industry-level price indexes ▸ Bias

- Solution: Proxy for input prices using a function of output prices and market shares

- Intuition:
  - conditional on price, products with higher market shares have higher quality (Khandelwal, 2010)
  - high quality products use high quality inputs which have higher prices (Kugler and Verhoogen, 2012) ▸ Data

⇒ use data on prices and markets shares to derive measure of quality to proxy for unobserved input prices ▸ Data ▸ Input price control function

Structural Framework: Three Challenges, 3

- Challenge: Unobserved productivity ω_{jt} $\Rightarrow$ leads to simultaneity bias
- Solution: Use Olley and Pakes (1996), Levinsohn and Petrin (2003) proxy methods to control for ω_{jt} using demand for materials
- Intuition:
  - if material demand, $m_{jt} = m_t\left(\omega_{jt}, k_{jt}, l_{jt}, \mathrm{z_{jt}}\right)$, is increasing in ω_{jt},
  - we can invert demand to get

$$\omega_{jt} = h\left(\mathrm{x}_{jt}, \mathrm{z_{jt}}\right)$$

  where $\mathrm{x}_{jt} = (m_{jt}, k_{jt}, l_{jt})$ and $\mathrm{z}_{jt} = \left(p_{jt}, ms_{jt}, D_j, G_j, EXP_{jt}, \tau_{jt}^{output}, \tau_{jt}^{input}, \tau_{jt}^{US}\right)$

$\Rightarrow$ use second-order polynomials on x_{jt} and z_{jt} to approximate $h(\cdot)$

▸ Estimation

Structural Framework: Recovering Input Allocation

- Given the estimate of $\hat{\beta}_s$, we have all the elements required to get the markups and marginal costs for single product plants
- For multi-product plants (70% of plants), still need a way to recover estimates of input expenditures by product
- Assumptions:
  - productivity is at the plant-level
  - common input expenditure share across inputs within a product
- Use restrictions implied by production function to recover input expenditure shares

  ▸ Example

Impact of Tariffs

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

- Y^s_{ijt} : prices, markups, or marginal costs of product-market i of plant j in sector s at time t
- τ^{output}_{it}: Mexican output tariffs applied to product-market i
- τ^{input}_{jt}: weighted average of Mexican tariffs applied to intermediate inputs of plant j
- τ^{US}_{it}: US tariffs applied to Mexican product-market i
- ξ_{ij}: plant-product-market fixed effects
- ψ_{st}: sector-year fixed effects

Impact of Tariffs: Endogeneity

- Identification requires tariff cuts to be exogenous at the plant-product-market level
- Concern: tariffs schedules may be to protect certain products/industries
  - changes in tariffs correlated with omitted factor that influence prices ▸ Bias
- Evidence:
  - Pre-NAFTA tariff levels uncorrelated with phase-out periods (Kowalczyk and Davis, 1998) ▸ Evidence
  - Anecdotal evidence that Mexican negotiators had little discretion on tariff schedules during NAFTA negotiations (Cameron and Tomlin, 2002)

Impact of Tariffs on Domestic Products

$$\log Y^s_{ijt} \quad = \quad \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.13^{***}	0.15^{**}	-0.02
	(.04)	(.08)	(.09)
Input Tariffs	0.14	0.07	0.07
	(.54)	(.16)	(.16)
U.S. Tariffs	0.05	1.06^{***}	-1.01^{***}
	(.14)	(.32)	(.32)
Total Impact (%)	-3.43^{***}	-8.24^{***}	4.81^{**}
	(1.43)	(2.67)	(2.48)
Within R^2	0.073	0.01	0.02
N	145,887	145,887	145,887

- Focus on output and input tariffs for domestic products
  - US tariffs

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Impact of Tariffs on Domestic Products

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.13^{***}	0.15^{**}	-0.02
	(.04)	(.08)	(.09)
Input Tariffs			
U.S. Tariffs			
Total Impact (%)			
Within R^2	0.073	0.01	0.02
N	145,887	145,887	145,887

- Competition channel
- Estimated TFPQ show one pp decline in τ^{output} leads to 1.3% increase in TFPQ ▸ TFPQ
- Lack of significance on markup does not imply no pro-competitive effects

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Impact of Tariffs on Domestic Products

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs			
Input Tariffs	0.14	0.07	0.07
	(.54)	(.16)	(.16)
U.S. Tariffs			
Total Impact (%)			
Within R^2	0.073	0.01	0.02
N	$145,887$	$145,887$	$145,887$

- Majority of plants do not import
  - Importers

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Impact of Tariffs on Exported Products

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.04	0.52^{*}	-0.48^{*}
	(.08)	(.29)	(.28)
Input Tariffs	0.07	1.45^{***}	-1.38^{***}
	(.20)	(.33)	(.35)
U.S. Tariffs	-0.50^{*}	1.34^{**}	-1.84^{***}
	(0.30)	(.67)	(.66)
Total Impact (%)	1.98	-27.93^{***}	29.92^{***}
	(2.50)	(6.40)	(6.34)
Within R^2	0.035	0.034	0.032
N	28,738	28,738	28,738

- Focus on US tariffs for exported products
  - Output tariffs
  - Input tariffs

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Impact of Tariffs on Exported Products

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs			
Input Tariffs			
U.S. Tariffs	-0.50^{*}	1.34^{**}	-1.84^{***}
	(0.30)	(.67)	(.66)
Total Impact (%)			
Within R^2	0.035	0.034	0.032
N	28,738	28,738	28,738

- Increased market access raises productivities of plants ▸ TFPQ
  - Incentive to upgrade and export to the US market ▸ product introduction
  - Economies of scale ▸ IRS

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Impact of Tariffs on Exported Products

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs			
Input Tariffs			
U.S. Tariffs	-0.50^{*}	1.34^{**}	-1.84^{***}
	(0.30)	(.67)	(.66)
Total Impact (%)			
Within R^2	0.035	0.034	0.032
N	28,738	28,738	28,738

- Markups increase
  - incomplete pass-through
  - better market access

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Pro/Anti-competitive Effects

- Presence of variable markups suggest that the previous specification is not capturing the effects of tariff declines on competition ▸ Pass-through regression

- In order to capture pro/anti-competitive effects, need to control for marginal costs

- Estimate

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + g\left(\log \hat{MC}_{ijt}\right) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

  where $g\left(\log \hat{MC}_{ijt}\right)$ is a third-order polynomial

- Instrument for measurement error in the polynomial using lagged polynomial and input tariffs

Pro-competitive Effects: Domestic

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	(1)	(2)
Output Tariffs	0.11***	0.12***
	(.04)	(.04)
U.S. Tariffs	−0.06	0.00
	(.14)	(.13)
Instruments	No	Yes
First Stage F	-	44.08
Within R^2	0.82	0.83
N	145,887	124,971

The dependent variable in Columns 1-2 is the log of the markup. Both specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level.

Anti-competitive Effects: Exported

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	(1)	(2)
Output Tariffs	0.02	-0.01
	(.08)	(.08)
U.S. Tariffs	-0.54^*	-0.55^*
	(.33)	(.33)
Instruments	No	Yes
First Stage F	-	7.66
Within R^2	0.88	0.88
N	28,738	23,207

The dependent variable in Columns 1-2 is the log of the markup. Both specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level.

Conclusions

Contributions:

- Used microdata containing quantity and price data separately for exported and domestic products
  - conducted comprehensive analysis on the effect of multilateral tariff reductions on prices
  - recovered all competition channel, cost channel, and market access channel
- Prices and markups on exported goods behave differently from domestic goods
  - Exporters responded to declines in US tariffs by raising their markups, resulting in increases in export prices

Thank you

References

Ackerberg, Daniel A., Kevin Caves, and Garth Frazer, "Identification Properties of Recent Production Function Estimators," *Econometrica*, November 2015, *83* (6), 2411–2451.

Amiti, Mary and Jozef Konings, "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review*, 2007, *97* (5), 1611–1638.

Arkolakis, Costas, Arnaud Costinot, Dave Donaldson, and Andrés Rodríguez-Clare, "The Elusive Pro-Competitive Effects of Trade," *Working paper*, 2017.

Atkeson, Andrew and Ariel Burstein, "Pricing-to-Market, Trade Costs, and International Relative Prices," *American Economic Review*, December 2008, *98* (5), 1998–2031.

Berry, Steven, James Levinsohn, and Ariel Pakes, "Automobile Prices in Market Equilibrium," *Econometrica*, July 1995, *63* (4), 841–890.

Brander, James and Paul Krugman, "A reciprocal dumping model of international trade," *Journal of International Economics*, 1983, *15*, 313–321.

Brandt, Loren, Johannes Van Biesebroeck, Luhang Wang, and Yifan Zhang, "WTO Accession and Performance of Chinese Manufacturing Firms," *American Economic Review*, 2017, *107* (9), 2784–2820.

Bustos, Paula, "Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinian Firms," *American Economic Review*, 2011, *101* (1), 304–40.

Cameron, Maxwell A. and Brian W. Tomlin, *The Making of NAFTA: How the Deal Was Done*, Cornell University Press, 2002.

de Blas, Beatriz and Katheryn N. Russ, "Understanding Markups in the Open Economy," *American Economic Journal: Macroeconomics*, 2015, *7* (2), 157–180.

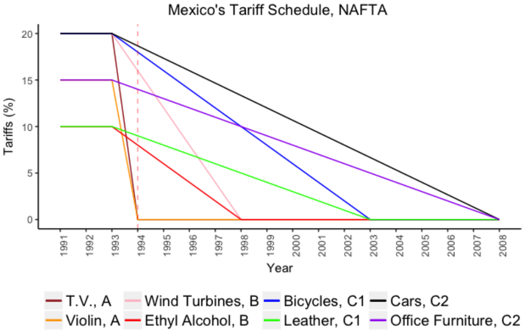
de Loecker, Jan and Frederic Warzynski, "Markups and Firm-Level Export Status," *American Economic Review*, October 2012, *102* (6), 2437–2471.

___ **, Pinelopi K. Goldberg, Amit Khandelwal, and Nina Pavcnik**, "Prices, Markups, and Trade Reform," *Econometrica*, March 2016, *84* (2), 445–510.

NAFTA

- Under NAFTA, countries agreed to phase out most of their tariffs during 1994-2008
  - Trade with NAFTA

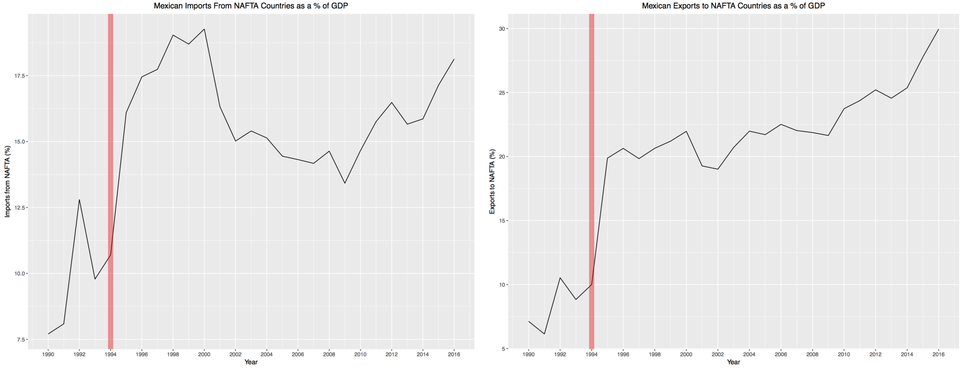
- Products separated into groups according to their phase-out date
  - Summary stats of tariffs



- Back

Mexico's trade with NAFTA

Figure: Mexico's Imports and Export from NAFTA Countries (%GDP)



▸ Back

Tariffs

	1993			2008			Difference 2008-1993	
	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Output Tariffs	14.8	15.0	4.3	0.2	0.0	1.0	-14.6	−15.0
Input Tariffs	9.6	9.2	2.2	0.1	0.0	0.0	−9.3	−9.2
U.S. Tariffs	5.2	4.3	4.5	0.1	0.0	0.5	−5.1	−4.3

▸ Back

EIM and EIA

- Monthly industrial survey (EIM)
  - Monthly data on plant-level quantities and sales value of products (CMAP94 8-digit level) for domestically sold goods and exported goods
  - More than 85% of exports go to the US in the sample period
  - Aggregate monthly data to annual level
- Annual industrial survey (EIA)
  - Annual data on plant-level standard balance sheet items ▸ Capital ▸ Deflators
- A plant is classified to one of 206 6-digit CMAP94 codes

▸ Back

Constructing capital stock

- Construct capital stock following the perpetual inventory method, using the book value reported in 1994 as the initial value
- Capital of type z from plant j during period t, K_{jt}^{z} evolves:

$$K_{jt}^{z} = (1 - \delta_z) K_{jt-1}^{z} + I_{jt-1}^{z}$$

where δ_z is the depreciation rate, and I_{jt-1}^{z} is investment at time $t-1$

- Four types of capital with depreciation rates being the mid-point of the depreciation band from Iacovone (2008):

Type of Fixed Assets	Fiscal Depreciation Band	Applied Depreciation Rate
Machinery and Equipment	5-15%	10%
Buildings	3-8%	5.5%
Transportation Equipment	15-25%	20%
Office Equipment and Others	7-35%	21%

Notes: This table includes the fiscal depreciation bands from the Mexican Ministry of Finance.

Deflators

- For domestic material inputs, use price deflators for domestic intermediate goods provided at 4-digit NAICS level
- For imported intermediates, follow Iacovone (2008) and use the US intermediate inputs price deflator for exported, non-agricultural supplies and materials (excluding fuels and building materials), adjusted for exchange rate fluctuations

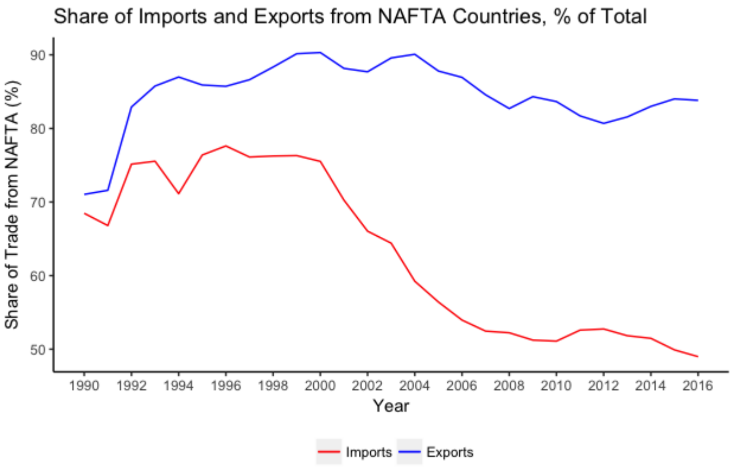
▸ Back

Example of Products

Industry Code	Product Code	Description
36		**Non-Metallic Mineral Products Sector**
3612		**Clay Materials for Construction Sub Sector**
361203		**Bricks and Tiles from Non-Refractory Clay Industry**
	36120301	Blocks
	36120302	Lattice Bricks
	36120303	Regular Bricks
	36120304	Breeze Block
	36120305	Coated Bricks
	36120306	Natural Bricks
	36120311	Tiles
	36120312	Coated Tiles
	36120313	Natural Tiles
	36120321	Spanish Tiles
	36120322	French Tiles

▸ Back

Share of NAFTA in Trade



Back

Summary Statistics of Plants

Sector	# of Plants			Average, Thousands of Dollars				
	Total	Exporter	Single	Employee†	Sales	VA/Employee	Materials	Capital
Food and Beverages	814	224	151	378.9	35,823.9	164.7	16,230.4	7,363.1
Textile Manufacturing	235	118	85	248.9	13,339.1	56.3	5,568.6	4,116.2
Apparel Manufacturing	410	135	143	148.9	4,864.8	25.5	2,217.0	771.4
Wood and Furniture	150	42	43	133.6	4,681.2	15.2	2,457.6	1,136.5
Paper Industries	318	81	165	210.5	16,761.4	45.5	6,907.1	5,543.5
Chemical Industries	707	339	167	244.0	24,221.0	48.6	10,123.2	6,940.8
Non-Metallic Minerals	292	79	125	212.1	19,815.1	67.6	2,938.7	9,455.3
Metallic Manufacturing	354	183	123	242.7	32,703.9	36.6	18,443.7	8,752.3
Machinery & Equipment	325	192	96	467.0	78,896.3	26.3	44,954.4	15,835.7

Notes: Table includes the average number of plants per sector across all of the years in the sample. Units in columns 5-8 are in 1994 US dollars converted from Mexican pesos using the average 1994 exchange rate. †Number of employees.

▸ Back to Data ▸ Back to Unobserved input allocations

Summary Statistics of Products

Sector	# of Products			Avg. # of Products Per Plant		
	Total	Domestic	Exported	Total	Domestic	Exported †
Food and Beverages	2,963	2,622	340	3.66	3.23	1.55
Textile Manufacturing	548	417	131	2.36	1.78	1.13
Apparel Manufacturing	1,240	1,091	149	3.00	2.64	1.13
Wood and Furniture Industries	610	547	63	4.13	3.70	1.57
Paper Industries	850	752	98	2.62	2.33	1.16
Chemical Industries	2,908	2,348	561	4.11	3.31	1.66
Non-Metallic Mineral Products	839	708	130	2.86	2.40	1.67
Metallic Manufacturing	1,105	809	296	3.17	2.30	1.66
Machinery & Equipment Manufacturing	890	666	225	2.76	2.06	1.17

Notes: Table shows the average number of plant-product pairs and products per plant per sector for all the years in the sample. †Average number of exported products for exporter plants.

▸ Back

Mexican tariffs, 1991-1994

- Tariff data for Mexico before 1995 is only available for year 1991
- Use same tariffs until 1993 as tariff schedules in Mexico did not change from 1991 to 1993 (Faber, 2014)
- For 1994, exploit the fact that under NAFTA, tariffs on goods coming from the US were either set to zero in 1994 or declined by a constant yearly magnitude from 1993 to 1995
  - if 15% in 1993 and 5% in 1995, then 10% in 1994
  - if 15% in 1993 and 0% in 1995, then 0% in 1994

▸ Back

Correlations of tariffs

Table: Correlation Matrix of Tariffs

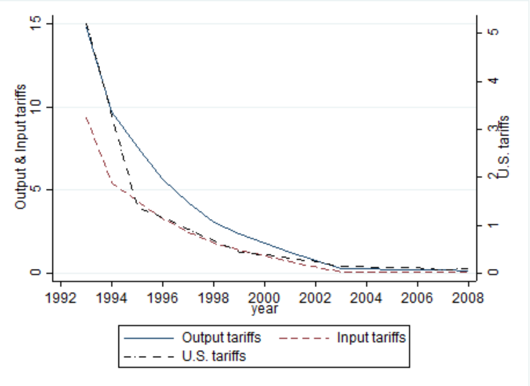
	Output Tariffs	Input Tariffs	U.S. Tariffs
Output Tariffs	1.00		
Input Tariffs	0.77	1.00	
U.S. Tariffs	0.60	0.58	1.00

Notes: The table shows the correlation matrix for our three measures of tariffs, output tariffs, tariffs on intermediate inputs, and U.S. tariffs on Mexican products for the years 1994-2008.

Back

Average tariffs over time

Figure: Average τ^{output}, τ^{input}, and τ^{US}



Back

Production function

- Production function of product-market i, by plant j, in sector s, at time t:

$$
\begin{aligned}
f_{it}(m_{ijt}, l_{ijt}, k_{ijt}; \beta_s) = & \beta_{sm} m_{ijt} + \beta_{smm} m_{ijt}^2 + \beta_{sl} l_{ijt} + \beta_{sll} l_{ijt}^2 \\
& + \beta_{sk} k_{ijt} + \beta_{skk} k_{ijt}^2 + \beta_{sml} m_{ijt} l_{ijt} + \beta_{smk} m_{ijt} k_{ijt} \\
& + \beta_{smlk} m_{ijt} l_{ijt} k_{ijt}
\end{aligned}
$$

▸ Back

Assumptions

1. Production function is product-market specific
2. $F_{it}(\cdot)$ is continuous and twice diff. w.r.t. at least one variable input (use M_{ijt})
3. Hicks-neutral productivity Ω_{jt} is log additive and plant specific
4. Expenditures of all variable and fixed inputs are attributable to products
5. Plants minimize short-run costs taking output quantity and input prices as given

▸ Back

Old vs New Beetle

2003 Models	Old Beetle	New Beetle
Market	Domestic	Exported
Price	$7,500 USD	$17,500 USD
Window	Manual	Automatic
Seat Materials	Lower quality foam and coconut fibers.	High quality polyurethane foam.

Both are produced in at the same VW factory in the Mexican State of Puebla.

Source: Verhoogen (2008). ▸ Back

FOC w.r.t. materials

- Assume firms minimize costs. Lagrangian of the cost minimization problem of a product-market i from plant j at time t:

$$\begin{aligned}\mathcal{L}\left(M_{ijt}, L_{ijt}, K_{ijt}, \lambda_{ijt}\right) =& W_{ijt}^{M} M_{ijt} + W_{ijt}^{L} L_{ijt} + W_{ijt}^{K} K_{ijt} \\ &+ \lambda_{ijt}\left[Q_{ijt} - Q_{ijt}\left(M_{ijt}, L_{ijt}, K_{ijt}, \Omega_{jt}\right)\right]\end{aligned}$$

- FOC with respect to materials

$$\frac{\partial \mathcal{L}_{ijt}}{\partial M_{ijt}} : W_{ijt}^{M} - \lambda_{ijt} \frac{\partial Q_{ijt}}{\partial M_{ijt}} = 0$$

  where λ_{ijt} is the marginal cost

- Since $\lambda_{ijt} = \frac{P_{ijt}}{\mu_{ijt}}$, we can derive an expression for the markup from FOC as

$$\mu_{ijt} = \theta_{ijt}^{M} \left(\alpha_{ijt}^{M}\right)^{-1}$$

Back

Selection bias

- Assume number of products increases with productivity (Mayer et al., 2014)
- Let the state vector of plant j at time t be

$$\mathrm{s}_{jt} = \left(N_{jt}, K_{jt}, \Omega_{jt}, G_j, EXP_{jt}, \tau_{jt}^{output}, \tau_{jt}^{input}, \tau_{jt}^{US} \right)$$

  where N_{jt} is the number of products
- Denote by $\bar{\omega}_{jt}(\mathrm{s}_{jt})$ the productivity cutoff associated with the introduction of a second product as a function of state variables. Then:

$$\begin{aligned} Pr\,(SingleProd) &= Pr\left(\omega_{jt} \leq \bar{\omega}_{jt}(\mathrm{s}_{jt})\,|\bar{\omega}_{jt}(\mathrm{s}_{jt}), \omega_{jt-1}\right) \\ &= \kappa_{t-1}\left(\bar{\omega}_{jt}(\mathrm{s}_{jt}), \omega_{jt-1}\right) \\ &= \kappa_{t-1}\left(\mathrm{x}_{jt-1}, \mathrm{z}_{jt-1}\right) \\ &\equiv SP_{jt} \end{aligned}$$

  where $\mathrm{x}_{jt} = (m_{jt}, k_{jt}, l_{jt})$ and $\mathrm{z}_{jt} = \left(p_{jt}, ms_{jt}, D_j, G_j, EXP_{jt}, \tau_{jt}^{output}, \tau_{jt}^{input}, \tau_{jt}^{US}\right)$
- Estimate this probability using fitted values from a probit estimation

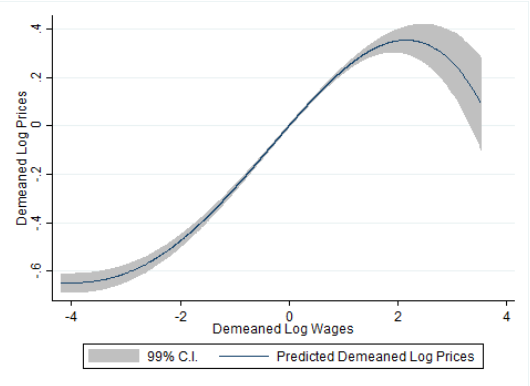
▸ Back

Example of bias

- Suppose two Mexican producers of bicycles use materials as their only input
- First producer makes its bicycles using cheap domestic materials, and the second uses more expensive imported materials
- First produces twice as many bicycles by spending only half of what the second spends, but second may have higher revenues due to higher quality bicycles
- If one runs OLS on quantity of bicycles on material expenditures deflated by a common industry-level price index, then output elasticity w.r.t. materials becomes negative

▸ Back

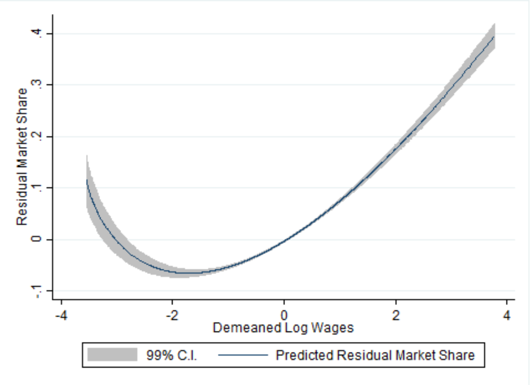
Output Price and Average Wages



The figure shows the best-fitted polynomials of the logarithm of of prices demeaned by product-market fixed effects (y-axis) and the demeaned logarithm of the average wages (x-axis). Average wages were constructed by dividing total wage bill by total number of employees. The shaded area indicates a 99% confidence interval.

▸ Back

Market Share and Average Wages



The figure plots the the best-fitted polynomial of residuals from a regression of product market shares on prices and product dummies (y-axis) and the log of average wages demeaned by product-market fixed effects (x-axis) for the full 1994-2008 sample. Average wages were constructed by dividing total wage bill by total number employees. The shaded area indicates a 99% confidence interval.

▸ Back

Input Price Control Function

- Vector of unobserved input price deviation of the log of plant j's input prices from the log of the industry specific input price indices

$$w_{jt} = w_t \left(p_{jt}, ms_{jt}, D_i, G_j, EXP_{jt}; \delta_s \right)$$

- p_{jt} is log price (single product), ms_{jt} is the market share, D_i is the product dummy, G_j is the plant's location (state), EXP_{jt} is the export status, and δ_s is the sector-specific parameter to estimate

▸ Back

Estimation (I)

- Follow Ackerberg et al. (2015), de Loecker et al. (2016)
- Production function taking into account unobserved input prices and simultaneity bias: ‣ ∧

$$q_{jt} = \underbrace{f\left(\mathrm{x}_{jt};\beta_s\right) + \Lambda\left(\left(p_{jt}, ms_{jt}, D_j, G_j, EXP_{jt}\right)\times\left(1;\mathrm{x}_{jt}\right);\beta_s,\delta_s\right) + h_t\left(\mathrm{x}_{jt},\mathrm{z}_{jt}\right)}_{\phi_{jt}\left(\mathrm{x}_{jt},\mathrm{z}_{jt}\right)} + \epsilon_{jt}$$

- Assume that productivity follows a first-order Markov process:

$$\omega_{jt} = g\left(\omega_{jt-1}, \tau^{output}_{jt-1}, \tau^{input}_{jt-1}, \tau^{US}_{jt-1}, EXP_{jt-1}, SP_{jt}, R\&D_{jt-1}\right) + \xi_{jt}$$

  where SP_{jt} is the fitted probability of remaining single-product, ξ_{jt} is the innovation in the productivity shock

- Form second-order polynomial on x_{jt} and z_{jt} to proxy for $\phi_{jt}\left(\cdot\right)$, purge ϵ_{jt} and obtain $\hat{q}_{jt} = \hat{\phi}_{jt}$
- Productivity $\omega_{jt} = h_t\left(\mathrm{x}_{jt},\mathrm{z}_{jt}\right)$ can then be expressed as

$$\omega_{jt}\left(\beta_s,\delta_s\right) = \hat{\phi}_{jt} - f\left(\mathrm{x}_{jt};\beta_s\right) - \Lambda\left(\left(p_{jt}, ms_{jt}, D_j, G_j, EXP_{jt}\right)\times\left(1;\mathrm{x}_{jt}\right);\beta_s,\delta_s\right)$$

Estimation (II)

- Approximate $\Lambda(\cdot)$ using second-order polynomial on the elements of $w_{jt}(\cdot)$ and their interactions with input expenditures
- Then the innovation ξ_{jt} is

$$\begin{aligned}\xi_{jt}(\beta_s, \delta_s) = & \omega_{jt}(\beta_s, \delta_s) \\ & - E\left[\omega_{jt}(\beta_s, \delta_s) \mid \omega_{jt-1}(\beta_s, \delta_s), \tau_{jt-1}^{output}, \tau_{jt-1}^{input}, \tau_{jt-1}^{US}, EXP_{jt-1}, SP_{jt}, R\&D_{jt-1}\right]\end{aligned}$$

- Estimate β_s and δ_s via GMM, with

$$E\left[\xi_{jt}(\beta_s, \delta_s) \mathrm{I}_{jt}\right] = 0$$

where instrument matrix I_{jt} include lagged materials, current capital, current labor, their higher-order interactions, lagged market shares, lagged tariffs, lagged prices, lagged export status

▸ Back

Estimation (III)

- Assumption:
  - labor and capital do not respond to contemporaneous innovation on productivity
  - materials do respond to contemporaneous productivity shocks
  - input and output prices are contemporaneously correlated with productivity innovations
- Estimation done at the 2-digit sector level

▸ Back

Interaction term in Λ function?

- The "real" production function is $q = f(x; \beta) + \omega$, where x is the unobserved input quantity
- But we observe x^{obs}, which are deflated input values. Hence
$$x = x^{obs} - w(z; \delta)$$
- The production function can be written as
$$\begin{aligned} q &= f\left(x^{obs} - w(z; \delta); \beta\right) + \omega \\ &= f\left(x^{obs}; \beta\right) + f\left(x^{obs} - w(z; \delta); \beta\right) - f\left(x^{obs}; \beta\right) + \omega \end{aligned}$$
- With **translog** $f(\cdot)$, one can write
$$f\left(x^{obs} - w(z; \delta); \beta\right) - f\left(x^{obs}; \beta\right) = \Lambda\left(z \times \left(1; x^{obs}\right); \beta, \delta\right)$$
- Hence
$$q = f\left(x^{obs}; \beta\right) + \Lambda\left(z \times \left(1; x^{obs}\right); \beta, \delta\right) + \omega$$

Back to Estimation (I)

Example: Recovering Input Allocation

- Consider a plant producing two products Q_1 and Q_2.

$$
\begin{aligned}
Q_i &= L_i^{\beta_1} K_i^{\beta_2} M_i^{\beta_3} \Omega \ \forall i \\
&= (exp(\rho_i)L)^{\beta_1} (exp(\rho_i)K)^{\beta_2} (exp(\rho_i)M)^{\beta_3} \Omega \ \forall i
\end{aligned}
$$

where $exp(\rho_i)$ is the share of input expenditures used on product i

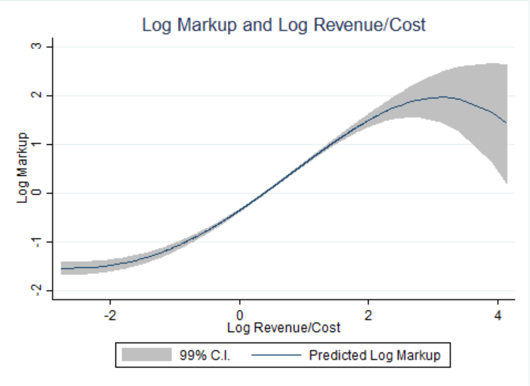
- We have

$$
\begin{aligned}
q_1 - (\beta_1 l + \beta_2 k + \beta_3 m) &= (\beta_1 + \beta_2 + \beta_3)\rho_1 + \omega \\
q_2 - (\beta_1 l + \beta_2 k + \beta_3 m) &= (\beta_1 + \beta_2 + \beta_3)\rho_2 + \omega \\
1 &= exp(\rho_1) + exp(\rho_2)
\end{aligned}
$$

- Given estimates of β's and plant-level inputs, LHS is data/estimates and RHS depends on unknowns ρ_1, ρ_2, and ω
- Solve for each multi-product plant-year, around 46,000 system of non-linear equations

▸ Back

Markups & Revenue/Costs



Notes: The figure shows the predicted fractional polynomial of the logarithm of the estimated markups (y-axis) and the log of the ratio of accounting revenue over costs (x-axis).

▸ Back

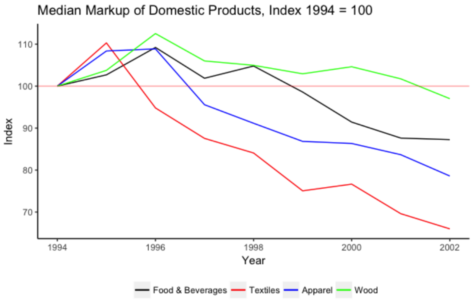
Median Markups by Sector and Destination

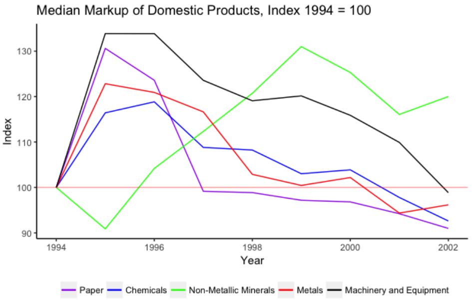
Median Markup by Destination		
Sector	**Domestic**	**Exported**
Food and Beverages	1.12	1.11
Textile Manufacturing	1.11	1.32
Apparel Manufacturing	1.27	1.19
Wood and Furniture Industries	1.06	0.90
Paper Industries	1.47	1.93
Chemical Industries	1.29	1.03
Non-Metallic Mineral Products	1.96	1.79
Metallic Manufacturing	1.14	1.03
Machinery and Equipment Manufacturing	1.27	1.45
Total	1.24	1.19

Notes: The table shows the median estimates of markups by destination for all the years in the sample (1994-2008). Outliers below the 1st percentile and above 99th percentile within each sector are trimmed.

▸ Back ▸ Over time, Domestic ▸ Over time, Exported

Median Domestic Markups

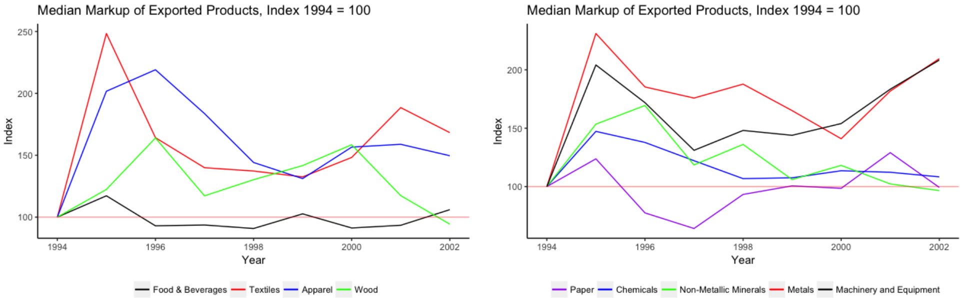




Notes: The figure shows the median estimates of markups for domestic products by sector through time. Outliers below the 1st percentile and above 99th percentile within each sector are trimmed.

- Back to median markups
- Back to median markups by destination

Median Exported Markups



Notes: The figure shows the median estimates of markups for exported products by sector through time. Outliers below the 1st percentile and above 99th percentile within each sector are trimmed.

▸ Back to median markups ▸ Back to median markups by destination

Markup Single Product Plants

Median Markup, Single Product Plants	
Sector	**Markup**
Food and Beverages	1.20
Textile Manufacturing	1.30
Apparel Manufacturing	1.26
Wood and Furniture Industries	0.87
Paper Industries	1.26
Chemical Industries	1.19
Non-Metallic Mineral Products	2.08
Metallic Manufacturing	1.32
Machinery and Equipment Manufacturing	1.21
Total	1.27

Notes: The table shows the median estimates of markups for all the products of single product plants and all the years in the sample (1994-2008). Outliers below the 1st percentile and above 99th percentile within each sector are trimmed.

Back

Plant Level Markups

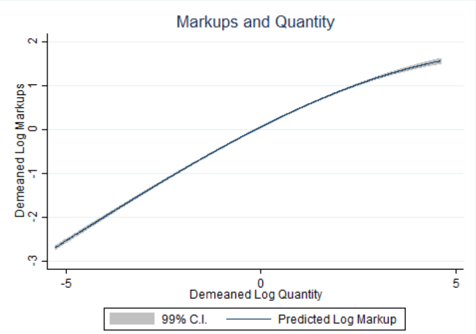
Median Plant Level Markup			
Sector	**All**	**Domestic**	**Exporters**
Food and Beverages	1.84	1.75	2.22
Textile Manufacturing	1.54	1.33	1.78
Apparel Manufacturing	1.87	1.89	1.81
Wood and Furniture Industries	1.67	1.59	2.09
Paper Industries	1.62	1.53	1.91
Chemical Industries	1.97	2.02	1.91
Non-Metallic Mineral Products	2.86	2.64	3.50
Metallic Manufacturing	1.93	1.71	2.20
Machinery and Equipment Manufacturing	2.06	1.71	2.40
Total	1.91	1.81	2.12

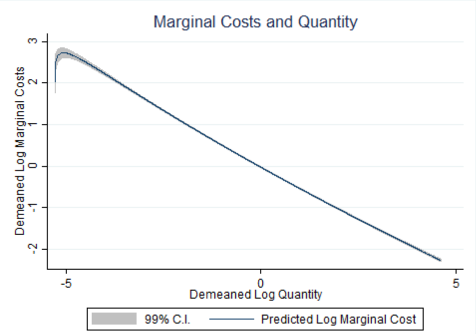
Notes: The table shows the median plant level markup for all plants and all years in the sample (1994-2008). Plant level markups were constructed by revenue weighting the product level markup estimates for each plant. Outliers below the 1st percentile and above 99th percentile within each sector are trimmed.

▸ Back

Markups, Marginal Costs and Quantities

- Most sectors are characterized by IRS
- Variables demeaned by product-market fixed effects.



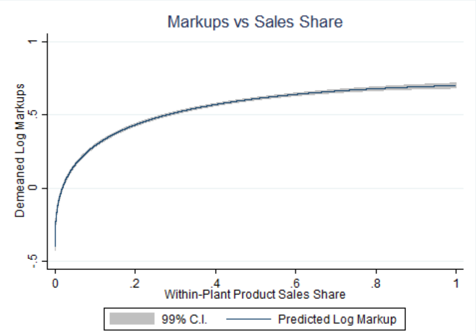


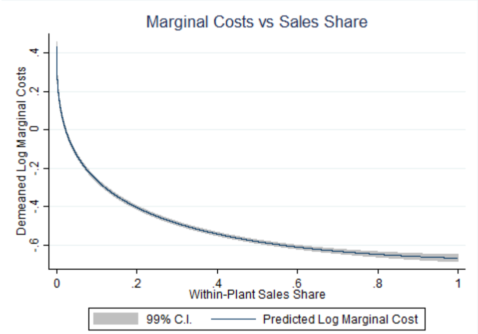
Notes: The figures show the best-fitted polynomials of the log of markups and marginal costs demeaned by product-market fixed effects (y-axis) and the demeaned log of quantity produced (x-axis). Outliers below the 1st percentile and above 99th percentile within each sector are trimmed.

▸ Back to median markups ▸ Back to US tariffs on domestic ▸ Back to US tariff on exported

Markups, Marginal Costs and Within Sales Shares

- Mayer et al. (2014): product high revenue share have lower MC and higher markups
- Markups and marginal costs demeaned by product-market fixed effects.





Notes: The figures show the best-fitted polynomials of the log of markups and marginal costs demeaned by product-market fixed effects (y-axis) and the within-plant product sales share (x-axis). Outliers below the 1st percentile and above 99th percentile within each sector are trimmed.

Back

Median Elasticities by Sector

Sector	Materials (1)	Capital (2)	Labor (3)	RTS (4)	Obs. (5)
Food and Beverages	0.86	0.06	0.19	1.12	1,781
Textile Manufacturing	0.62	0.02	0.28	0.97	992
Apparel Manufacturing	0.86	0.05	0.11	1.00	1,691
Wood and Furniture Industries	0.73	0.12	0.08	0.91	490
Paper Industries	0.95	0.01	0.30	1.21	1,968
Chemical Industries	0.65	0.09	0.27	1.03	1,995
Non-Metallic Mineral Products	0.58	0.08	0.42	1.05	1,519
Metallic Manufacturing	0.67	0.18	0.23	1.09	1,493
Machinery & Equipment Manufacturing	0.74	0.12	0.10	0.90	1,073

Column 4 reports the median returns to scale (RTS) which is the sum of the labor, capital and materials elasticities. Column 5 reports the total number of observations used in the estimation of the production function for each sector.

▸ Average ▸ Implied vs actual ▸ Estimates w/o corrections ▸ Back

Average Elasticities by Sector

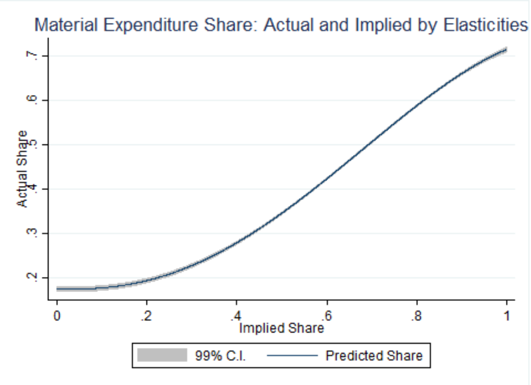
Sector	Materials (1)	Capital (2)	Labor (3)	RTS (4)
Food and Beverages	0.85	0.06	0.19	1.10
	(0.17)	(0.05)	(0.11)	(0.22)
Textile Manufacturing	0.59	0.01	0.22	0.81
	(0.12)	(0.20)	(0.27)	(0.45)
Apparel Manufacturing	0.87	0.05	0.11	1.03
	(0.15)	(0.05)	(0.06)	(0.16)
Wood and Furniture Industries	0.69	0.10	0.06	0.86
	(0.34)	(0.11)	(0.39)	(0.29)
Paper Industries	1.04	0.05	0.38	1.47
	(0.35)	(0.14)	(0.24)	(0.68)
Chemical Industries	0.70	0.11	0.31	1.12
	(0.26)	(0.23)	(0.25)	(0.36)
Non-Metallic Mineral Products	0.55	0.08	0.42	1.06
	(0.30)	(0.11)	(0.31)	(0.20)
Metallic Manufacturing	0.66	0.17	0.20	1.03
	(0.11)	(0.07)	(0.15)	(0.28)
Machinery and Equipment Manufacturing	0.77	0.05	0.17	0.99
	(0.21)	(0.24)	(0.48)	(0.67)

Notes: The table presents estimates of the output elasticities of the production function for all the products, domestic and exported, and all the years in the sample (1994-2008). Columns 1-3 report the average elasticities and standard deviations (in parenthesis) within each sector. Column 4 reports the average returns to scale (RTS) which is the sum of the labor, capital and materials elasticities.

▸ Back

Theory Implied Expenditure Share vs Actual

Theory implied input expenditure share of materials: $\frac{\hat{\epsilon}_M}{\hat{\epsilon}_M+\hat{\epsilon}_L+\hat{\epsilon}_K}$

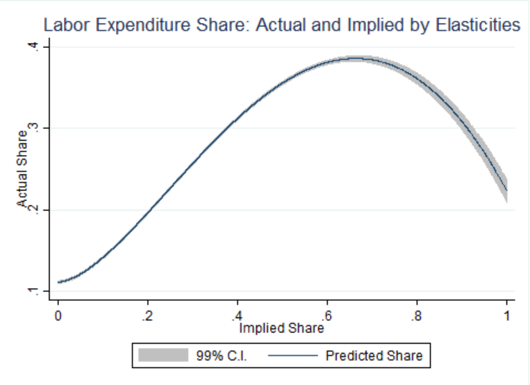


Notes: The figure shows the predicted fractional polynomial of the share of material expenditures out of total expenditures in labor, capital and materials (y-axis) and the materials expenditure share implied by the estimated elasticities (x-axis).

Back

Theory Implied Expenditure Share vs Actual

Theory implied input expenditure share of labor: $\frac{\hat{\epsilon}_L}{\hat{\epsilon}_M+\hat{\epsilon}_L+\hat{\epsilon}_K}$

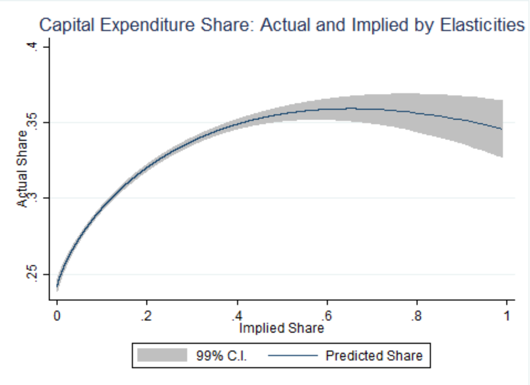


Notes: The figure shows the predicted regression line of the share of labor expenditures out of total expenditures in labor, capital and materials (y-axis) and the labor expenditures share implied by the estimated elasticities (x-axis).

Back

Theory Implied Expenditure Share vs Actual

Theory implied input expenditure share of capital: $\frac{\hat{\epsilon}_K}{\hat{\epsilon}_M+\hat{\epsilon}_L+\hat{\epsilon}_K}$



Notes: The figure shows the predicted regression line of the share of capital expenditures out of total expenditures in labor, capital and materials (y-axis) and the capital expenditures share implied by the estimated elasticities (x-axis).

Back

Median Elasticities by Sector, No Selection Correction

	No Selection Correction			
Sector	Materials	Capital	Labor	RTS
	(1)	(2)	(3)	(4)
Food and Beverages	0.88	0.03	0.16	1.09
Textile Manufacturing	0.69	-0.01	0.21	1.01
Apparel Manufacturing	0.87	0.05	0.10	1.01
Wood and Furniture Industries	0.68	0.08	0.07	0.79
Paper Industries	0.96	0.01	0.31	1.22
Chemical Industries	0.64	0.11	0.27	1.01
Non-Metallic Mineral Products	0.54	0.09	0.43	1.02
Metallic Manufacturing	0.68	0.15	0.22	1.06
Machinery & Equipment	0.59	0.08	0.16	0.76

Notes: The table presents estimates of the output elasticities of the production function for all the products and all the years in the sample (1994-2008). Columns 1-3 report the median elasticities within each sector for the estimation without including a selection correction for the probability of remaining single product. Column 4 reports the median returns to scale (RTS) which is the sum of the labor, capital and materials elasticities.

Back

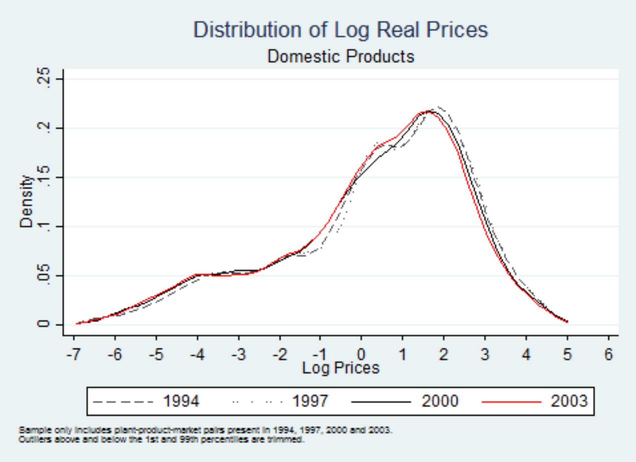
Median Elasticities by Sector, No Input Price Correction

	No Input Price Correction			
Sector	Materials	Capital	Labor	RTS
	(1)	(2)	(3)	(4)
Food and Beverages	0.69	-0.12	0.52	1.25
Textile Manufacturing	0.56	0.12	0.28	0.74
Apparel Manufacturing	0.52	-0.01	0.12	0.55
Wood and Furniture Industries	-0.26	-0.01	-0.39	-0.07
Paper Industries	0.23	-0.30	1.04	0.96
Chemical Industries	0.35	0.38	0.81	1.49
Non-Metallic Mineral Products	0.50	0.04	0.48	1.09
Metallic Manufacturing	0.80	0.40	0.11	1.24
Machinery & Equipment	0.80	-0.64	-0.30	0.02

Notes: The table presents estimates of the output elasticities of the production function for all the products and all the years in the sample (1994-2008). Columns 1-3 report the median elasticities within each sector for the estimation without including the input price control function Column 4 reports the median returns to scale (RTS) which is the sum of the labor, capital and materials elasticities.

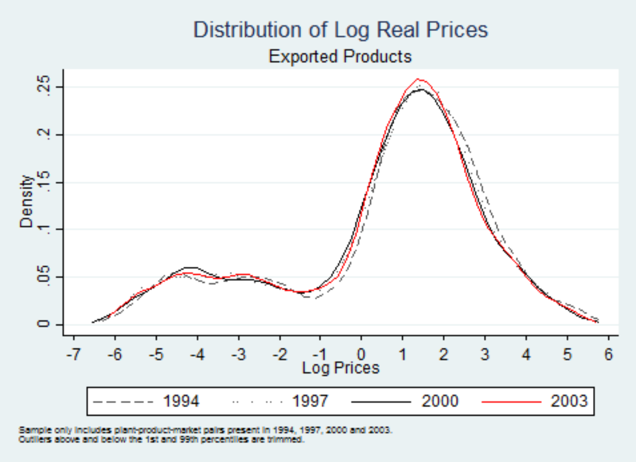
Back

Distribution, Domestic P



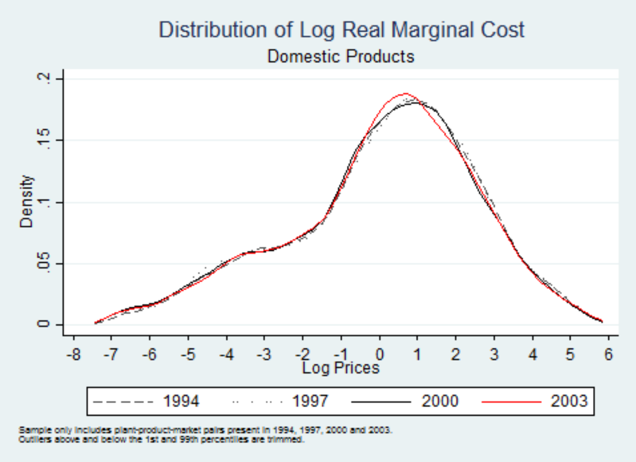
Back

Distribution, Exported P



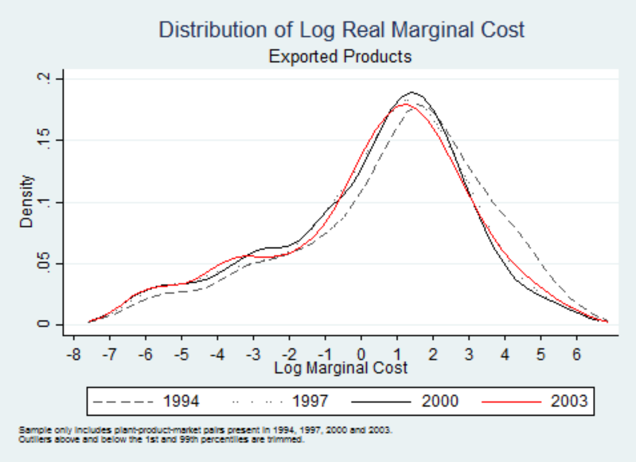
▸ Back

Distribution, Domestic *MC*



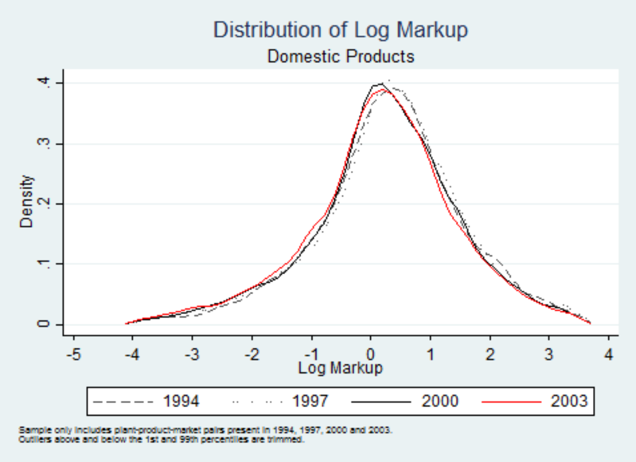
▸ Back

Distribution, Exported *MC*



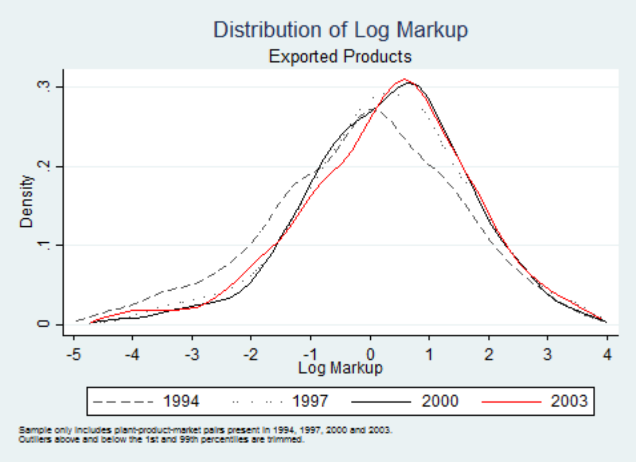
▸ Back

Distribution, Domestic μ



▸ Back

Distribution, Exported μ



▸ Back

Bias from protectionism

- Let $\kappa_{ijt} \in [0,1]$ denote protectionism, where higher κ_{ijt} corresponds to more protectionism

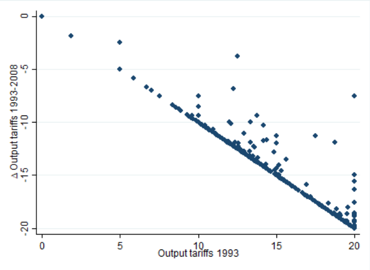
- For example, consider

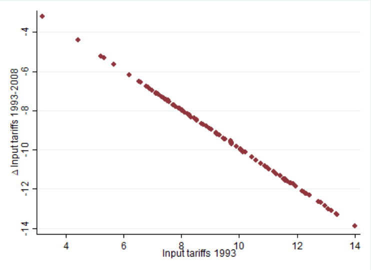
$$\begin{aligned}
\log P_{ijt} &= \alpha + \beta \tau_{it}^{output} + \epsilon_{ijt} \\
\epsilon_{ijt} &= \kappa_{ijt} + u_{ijt} \\
0 &= E\left[u_{ijt}\right] \\
0 &= E\left[\tau_{it}^{output} u_{ijt}\right]
\end{aligned}$$

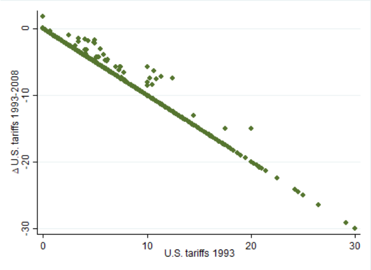
- If protected industries have higher tariffs, $Cov\left(\kappa_{ijt}, \tau_{it}^{output}\right) > 0$, then $\hat{\beta}$ would be overestimated as

$$\begin{aligned}
\hat{\beta} &= \frac{Cov\left(\log P_{ijt}, \tau_{it}^{output}\right)}{Var\left(\tau_{it}^{output}\right)} \\
&= \beta + \frac{Cov\left(\kappa_{ijt}, \tau_{it}^{output}\right)}{Var\left(\tau_{it}^{output}\right)}
\end{aligned}$$

Tariff Declines







Impact of Tariffs on Domestic Products

$$\log Y_{ijt}^{s} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{jt}^{input} + \beta_3 \tau_{it}^{US} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs			
Input Tariffs			
U.S. Tariffs	0.05	1.06***	−1.01***
	(.14)	(.32)	(.32)
Total Impact (%)			
Within R^2	0.073	0.01	0.02
N	145,887	145,887	145,887

- Increased market access raises productivities of plants ▸ TFPQ
  - Incentive to upgrade and export to the US market ▸ product introduction
  - Economies of scale ▸ IRS

▸ Back

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Impact of Tariffs on Product Introduction

$$Pr\left(\text{Intro}_{jt}=1\right)=\Phi\Big(\alpha+\beta_1\tau_{jt}^{output}+\beta_2\tau_{jt}^{input}+\beta_3\tau_{jt}^{US}$$
$$+\text{EXP}_{jt}\times\left[\beta_4\tau_{jt}^{output}+\beta_5\tau_{jt}^{input}+\beta_6\tau_{jt}^{US}\right]+\gamma X_{jt}\Big)$$

	Contemporaneous			Lagged		
	(1)	(2)	(3)	(4)	(5)	(6)
τ_{jt}^{output}	0.000	0.000	-0.001^{*}	0.001	0.001	-0.001
	(.001)	(.001)	(.001)	(.001)	(.001)	(.001)
τ_{jt}^{input}	0.029^{***}	0.029^{***}	0.023^{**}	0.028^{***}	0.027^{***}	0.021^{***}
	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)
τ_{jt}^{US}	0.007	0.007	0.009^{*}	0.004	0.003	0.006
	(.005)	(.005)	(.005)	(.004)	(.004)	(.004)
$\tau_{jt}^{output}\times EXP_{jt}$	-0.003^{*}	-0.003	-0.004^{***}	-0.005^{***}	-0.005^{***}	-0.006^{***}
	(.002)	(.002)	(.002)	(.002)	(.002)	(.002)
$\tau_{jt}^{input}\times EXP_{jt}$	-0.008^{**}	-0.008^{**}	-0.006	-0.008^{*}	-0.008^{*}	-0.005
	(.004)	(.004)	(.004)	(.004)	(.004)	(.004)
$\tau_{jt}^{US}\times EXP_{jt}$	-0.024^{***}	-0.021^{***}	-0.018^{**}	-0.015^{**}	-0.012^{*}	-0.010^{*}
	(.008)	(.008)	(.008)	(.007)	(.007)	(.006)
Plant Controls	✓	✓	✓	✓	✓	✓
Year FE	✓	✓		✓	✓	
State FE		✓	✓		✓	✓
Sector-Year FE			✓			✓
Pseudo R^2	0.069	0.071	0.077	0.027	0.030	0.036
N	54,091	54,091	54,091	48,571	48,571	48,571

Notes: Columns 1-6 gives the results of the probit specification. Columns 1-3 include the specification with the independent variables in their contemporaneous values, and Column 4-6 shows the results with the independent variables lagged one year. All specifications include labor, capital, and material expenditures as well as import and export status as plant-level controls. The coefficients on controls are omitted for brevity. Regressions include plant-level for the years 1994-2008.
Significance: a (1%), b (5%), and c (10%), respectively.

▸ Back to US tariff on domestic ▸ Back to US tariff on exported ▸ Average product churning

Product Churning

	All Products				Domestic				Exported			
	Add	Drop	Net	Total	Add	Drop	Net	Total	Add	Drop	Net	Total
Food and Beverages	.100	.088	.012	.188	.094	.086	.008	.180	.146	.102	.044	.248
Textile Manufacturing	.109	.096	.013	.205	.099	.094	.004	.193	.142	.101	.041	.243
Apparel Manufacturing	.122	.105	.017	.227	.114	.103	.011	.217	.172	.123	.049	.295
Wood and Furniture	.123	.101	.022	.224	.116	.099	.016	.215	.192	.139	.053	.331
Paper Industries	.111	.097	.014	.207	.105	.096	.009	.201	.162	.112	.049	.274
Chemical Industries	.103	.091	.012	.195	.094	.089	.005	.183	.141	.102	.040	.243
Non-Metallic Minerals	.105	.092	.013	.197	.102	.091	.011	.193	.132	.098	.034	.230
Metallic Manufacturing	.107	.091	.016	.198	.101	.091	.010	.191	.124	.090	.034	.214
Machinery & Equipment	.113	.088	.025	.201	.106	.086	.020	.192	.133	.093	.041	.226

Notes: Add refers to the number of products introduced at t divided by the total number of products at t. *Drop* refers to products ceasing to be produced at t divided by the total number of products at t. *Net* refers to Add–Drop. *Total* refers to Add+Drop.

Back

Impact of Tariffs on TFPQ

- Based on López-Córdova (2003), run

$$\omega_{jt} = \alpha + \beta_1 \tau_{jt}^{output} + \beta_2 \tau_{jt}^{input} + \beta_3 \tau_{jt}^{US} + \gamma X_{jt} + \varepsilon_{jt}$$

	(1)	(2)	(3)	(4)	(5)
τ_{jt}^{output}	-1.272^{***}	-1.225^{***}	-1.255^{***}	-1.363^{***}	-0.200^{***}
	(.224)	(.218)	(.221)	(.245)	(.056)
τ_{jt}^{input}	-2.307^{***}	-2.453^{***}	-2.197^{***}	-1.868^{*}	-2.024^{***}
	(.467)	(.466)	(.781)	(1.001)	(.166)
τ_{jt}^{US}	-4.009^{***}	-3.802^{***}	-3.383^{***}	-1.824^{*}	-0.550^{**}
	(.769)	(.762)	(.852)	(1.073)	(.264)
Plant Controls	✓	✓	✓	✓	✓
State FE		✓	✓	✓	
Year FE			✓		
Sector-Year FE				✓	✓
Plant FE					✓
R^2	0.072	0.083	0.084	0.107	0.088
N	37,498	37,498	37,498	37,498	37,498

Notes: The dependent variable in Columns 1- 5 is the logarithm of a plant's productivity. The specifications in Columns 1-5 vary only on the set of fixed effects included in the estimation. The R^2 reported in Column 5 corresponds to the within R^2. All specifications include import and export status, total industry sales excluding the plant's sales and the HHI index of concentration as plant-level controls. The coefficients on controls are omitted for brevity. Regressions include plant-level for the years 1994-2008. Standard errors are clustered at the plant level.
Significance: a (1%), b (5%), and c (10%), respectively.

▸ Back to Output tariff on domestic ▸ Back to US tariff on domestic ▸ Back to US tariff on exported

Impact of Tariffs on Domestic Products: Same Sample

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.13^{***}	0.16^{*}	-0.04
	(.04)	(.10)	(.08)
Input Tariffs	0.12^{*}	0.06	0.06
	(.07)	(.11)	(.11)
U.S. Tariffs	0.09	0.93^{**}	-0.84^{**}
	(.16)	(.41)	(.38)
Within R^2	0.08	0.01	0.02
N	125,710	125,710	125,710

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of domestic products that are produced in all years (1994-2008). Standard errors are clustered at the product level.

▸ Back to robustness

Impact of Tariffs on Exported Products: Same Sample

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.10^{*}	0.19	-0.08
	(.05)	(.24)	(.21)
Input Tariffs	0.05	2.18^{***}	-2.13^{***}
	(.19)	(.44)	(.16)
U.S. Tariffs	-0.92^{**}	1.48^{*}	-2.40^{***}
	(.48)	(.80)	(.79)
Within R^2	0.05	0.01	0.04
N	16,703	16,703	16,703

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of exported products that are produced in all years (1994-2008). Standard errors are clustered at the product level.

▸ Back to robustness

Impact of Tariffs on Domestic Products: Import Status

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + Import \times [\gamma_1 \tau^{output}_{it} + \gamma_2 \tau^{input}_{jt} + \gamma_3 \tau^{US}_{it}] + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.13*	0.11	0.02
	(.07)	(.16)	(.16)
Input Tariffs	0.11*	−.13	0.24
	(.06)	(.19)	(.18)
U.S. Tariffs	0.13	1.07***	−0.93***
	(.16)	(.37)	(.37)
Import*Output Tariffs	−0.01	0.08	−0.09
	(.06)	(.16)	(.16)
Import*Input Tariffs	0.02	0.35***	−0.33**
	(.04)	(.13)	(.14)
Import*U.S. Tariffs	−0.17	0.07	−0.24
	(.14)	(.38)	(.38)
Within R^2	0.07	0.01	0.02
N	145,887	145,887	145,887

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level.

▸ Back to Input tariffs on domestic ▸ Back to robustness

Impact of Tariffs on Domestic Products: Export Status

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + Export \times [\gamma_1 \tau^{output}_{it} + \gamma_2 \tau^{input}_{jt} + \gamma_3 \tau^{US}_{it}] + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

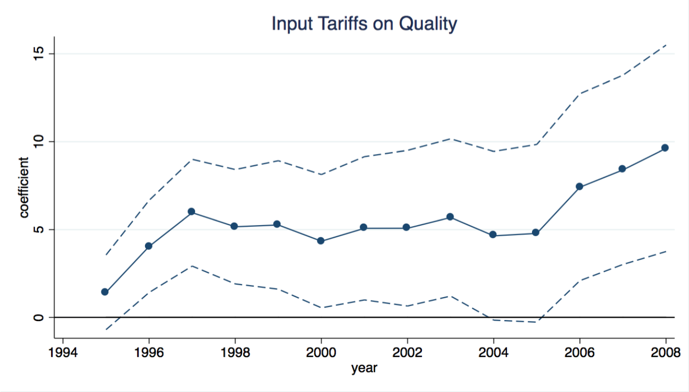
	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.16***	0.08*	0.08
	(.05)	(.04)	(.12)
Input Tariffs	0.09*	−0.06	0.16
	(.05)	(.18)	(.18)
U.S. Tariffs	0.03	0.94***	−0.91***
	(.14)	(.34)	(.35)
Export*Output Tariffs	−0.07	0.22	−0.29*
	(.05)	(.16)	(.16)
Export*Input Tariffs	0.11**	0.52***	−0.42***
	(.05)	(.17)	(.17)
Export*U.S. Tariffs	0.13	0.40	−0.27
	(.15)	(.42)	(.42)
Within R^2	0.07	0.01	0.02
N	145,887	145,887	145,887

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level.

▸ Back

Input Tariffs on Dom. Product Quality, Over Time

- Quality proxy: residuals from a regression of product market shares on prices, product FE, and year FE (Khandelwal, 2010)



▸ Back

Impact of Tariffs on Exported Products

$$\log Y^s_{ijt} = \alpha + \beta_1 \tau^{output}_{it} + \beta_2 \tau^{input}_{jt} + \beta_3 \tau^{US}_{it} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs	0.04	0.52*	−0.48*
	(.08)	(.29)	(.28)
Input Tariffs			
U.S. Tariffs			
Total Impact (%)			
Within R^2	0.035	0.034	0.032
N	28,738	28,738	28,738

- 96% of the exported products are also sold in the domestic market
- No pro-competitive effect on markups, which rose to offset gain in marginal cost

Back

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Impact of Tariffs on Exported Products

$$\log Y_{ijt}^{s} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{jt}^{input} + \beta_3 \tau_{it}^{US} + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	$\log P_{ijt}$	$\log \hat{MC}_{ijt}$	$\log \hat{\mu}_{ijt}$
Output Tariffs			
Input Tariffs	0.07	1.45***	−1.38***
	(.20)	(.33)	(.35)
U.S. Tariffs			
Total Impact (%)			
Within R^2	0.035	0.034	0.032
N	28,738	28,738	28,738

- Exporters also import
- Effects in de Loecker et al. (2016) coming from exported products

Back

Dependent variables in Columns 1-3 are the logs of prices, marginal costs, and markups, respectively. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level. We calculate the total impact of tariff declines by taking the average percentage point decrease in tariffs for the 1993-2008 period, -14.6, -9.3 and -5.1 for output, input and U.S. tariffs respectively, and multiplying them by their associated coefficients.

Incomplete Pass through

- Pass-through regression yields coefficient below one:

$$logP_{ijt} = \alpha + \beta^{PT} logMC_{ijt} + \xi_{ij} + \varphi_{st} + \epsilon_{ijt}$$

	Domestic			Exported		
	(1)	(2)	(3)	(4)	(5)	(6)
$logMC_{ijt}$	0.064^a	0.098^a	0.115^a	0.018^a	0.043^a	0.050^c
	(.004)	(.0097)	(.011)	(.007)	(.0145)	(.028)
Within R^2	0.021	0.079	0.078	0.023	0.034	0.083
Instruments	-	τ_{jt}^{input},$log\hat{m}c_{ijt-1}$	τ_{jt}^{input},$log\hat{m}c_{ijt-2}$	-	τ_{jt}^{input},$log\hat{m}c_{ijt-1}$	τ_{jt}^{input},$log\hat{m}c_{ijt-2}$
N	148,873	127,341	111,189	29,334	23,680	19,997
F		1,608	482		779	147

Notes: The dependent variable is the log of prices. Columns 1 and 4 show the OLS specification. Column 2 and 5 instrument marginal costs using lagged value and intermediate input tariffs. Column 3 and 6 instrument marginal costs with 2-year lag and intermediate input tariffs. Regressions include plant–product fixed effects and year-fixed effects using data for the entire sample (1994–2008). Standard errors are clustered at the product level.
Significance: a (1%), b (5%), and c (10%), respectively.

▸ Back

Pro/Anti-competitive effects: Domestic

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	Homogenous		Non-Homogenous	
	(1)	(2)	(3)	(4)
Output Tariffs	0.78*	0.96*	0.07*	0.07*
	(.40)	(.56)	(.04)	(.04)
U.S. Tariffs	0.49	1.24	-0.03	−0.00
	(1.19)	(1.28)	(.14)	(.14)
Instruments	No	Yes	No	Yes
First Stage F	-	12.33	-	40.63
Within R^2	0.86	0.86	0.81	0.83
N	8,721	7,591	136,228	116,600

The dependent variable in Columns 1-4 is the log of the markup. All specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2 and 4, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level.

▸ Back

Pro/Anti-competitive effects: Exported

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	Homogenous		Non-Homogenous	
	(1)	(2)	(3)	(4)
Output Tariffs	0.83	0.61	−0.02	−0.03
	(.80)	(.77)	(.07)	(.08)
U.S. Tariffs	1.05	0.56	-0.67*	−0.64*
	(.70)	(.78)	(.36)	(.35)
Instruments	No	Yes	No	Yes
First Stage F	-	8.27	-	47.36
Within R^2	0.88	0.86	0.88	0.88
N	1,333	1,045	27,405	22,162

The dependent variable in Columns 1-4 is the log of the markup. All specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2 and 4, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level.

▸ Back

Pro/Anti-competitive effects: Domestic

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	Large		Small	
	(1)	(2)	(3)	(4)
Output Tariffs	0.12***	0.13***	0.12	0.15
	(.04)	(.04)	(.09)	(.10)
U.S. Tariffs	−0.14	−0.10	0.26	0.27
	(.16)	(.16)	(.25)	(.22)
Instruments	No	Yes	No	Yes
First Stage F	-	50.82	-	22.35
Within R^2	0.85	0.85	0.84	0.85
N	73,612	64,455	75,261	61,929

The dependent variable in Columns 1-4 is the log of the markup. All specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2 and 4, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Large plants are those with more than 150 employees. Standard errors are clustered at the product level.

▸ Back

Pro/Anti-competitive effects: Exported

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	Large		Small	
	(1)	(2)	(3)	(4)
Output Tariffs	-0.05	-0.07	0.15	0.17
	(.05)	(.06)	(.15)	(.14)
U.S. Tariffs	-0.39	-0.40	-2.34^{***}	-2.19^{***}
	(.32)	(.41)	(.09)	(.08)
Instruments	No	Yes	No	Yes
First Stage F	-	10.20	-	8.98
Within R^2	0.89	0.85	0.86	0.86
N	21,734	17,902	7,600	5,572

The dependent variable in Columns 1-4 is the log of the markup. All specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2 and 4, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Large plants are those with more than 150 employees. Standard errors are clustered at the product level.

▸ Back

Pro/Anti-competitive effects: Domestic

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + High\_Tariff_0 \times [\gamma_1 \tau_{it}^{output} + \gamma_2 \tau_{it}^{US}] + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	(1)	(2)
Output Tariffs	0.08**	0.11**
	(.04)	(.04)
U.S. Tariffs	−0.06	−0.01
	(.14)	(.04)
High*Output Tariffs	0.10*	0.07
	(.06)	(.05)
High*U.S. Tariffs	0.24	0.32
	(.21)	(.23)
Instruments	No	Yes
First Stage F	-	39.70
Within R^2	0.84	0.85
N	148,873	127,341

The dependent variable in Columns 1 and 2 is the log of the markup. Both specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of domestic products and all years (1994-2008). Standard errors are clustered at the product level.

Back

Pro/Anti-competitive effects: Exported

$$\log \hat{\mu}_{ijt} = \alpha + \beta_1 \tau_{it}^{output} + \beta_2 \tau_{it}^{US} + High\_Tariff_0 \times [\gamma_1 \tau_{it}^{output} + \gamma_2 \tau_{it}^{US}] + g(\log \hat{MC}_{ijt}) + \xi_{ij} + \psi_{st} + \varepsilon_{ijt}$$

	(1)	(2)
Output Tariffs	-0.00	-0.03
	(.06)	(.06)
U.S. Tariffs	-0.68^{*}	-0.60
	(.40)	(.44)
High*Output Tariffs	0.86	0.23
	(.53)	(.55)
High*U.S. Tariffs	-0.05	0.04
	(.86)	(1.04)
Instruments	No	Yes
First Stage F	-	9.42
Within R^2	0.89	0.88
N	23,738	23,207

The dependent variable in Columns 1 and 2 is the log of the markup. Both specifications include third-order polynomials on log marginal costs (coefficients not reported). In Column 2, we instrument the marginal cost polynomial using its lag and intermediate input tariffs. The regressions exclude outliers in the top and bottom 1\% of the markup distribution within each sector. Regressions include plant-product-market fixed effects and sector-year fixed effects using data for the sample of exported products and all years (1994-2008). Standard errors are clustered at the product level.

▸ Back