

Advanced International Trade: Lesson 6

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Lesson 6

Lesson 6: Trade liberalization, prices and mark-ups

- De Loecker, P. Goldberg, A. Khandelwal and N. Pavcnik, "Prices, Markups and Trade Reform", *Econometrica*, 84(2), 445-510, 2016
- **Aim:** Disentangle the effects of input and output trade liberalization on firms' prices and markups
- **Contribution:**
- Develop a framework to estimate markups from production data with multi-product firms
- First paper to find a causal effect of output and input-trade liberalization on prices, marginal costs and variable markups within firms.

Motivation: trade liberalization and firm performance

- Output trade liberalization has positive effects on **aggregate productivity** driven by a selection effect and reallocation of firms as less productive firms exit and the remaining firms expand (e.g., Melitz (2003) and Pavcnik (2002))
- Input-trade liberalization allows firms **to take advantage of cheaper or previously unavailable imported inputs** (e.g., Goldberg et al. (2010a), Amiti and Konings (2007), Halpern et al. (2011)).
- Trade reforms have also been shown **to reduce markups** (e.g., Levinsohn (1993) and Harrison (1994)).

Motivation: trade liberalization and firm performance

- Based on this evidence, trade reforms should exert downward pressure on firm prices.
- However, we have little direct evidence on how prices respond to liberalization
- since product prices that firms set in the domestic market are rarely observed during trade reforms.
- → De Loecker et al. (2016) study the link between trade liberalization, prices, markups and marginal costs.

Contributions

- (1) **Develop a unified framework to estimate markups and marginal costs** of multi-product firms across a broad set of manufacturing industries.
- (2) **Methodology to estimate production functions** required to estimate markups. They rely on a quantity-based production function dealing with allocation of inputs across products within multi-product firms.
- (3) **Account for output- and input-trade liberalization channels (competition and imported inputs)** to understand the overall impact of trade reforms on prices and markups

Main results

- **Pro-competitive effects** of output tariff reductions: lowers firms' output prices,
- However, the price declines are small relative to the declines in marginal costs,
- **Input-tariff cuts**: allow mainly Indian firms to reduce their marginal costs.
- **Reasons of this incomplete cost pass-through to prices**

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Main results

- **Reasons of this incomplete cost pass-through to prices** firms offset their reductions in marginal costs by raising markups.
- Substantial heterogeneity and variability in markups across firms and time
- Changes in marginal costs are not perfectly reflected in changes in prices because of variable markups **incomplete pass-through**
- **Welfare gains implications:** producers benefited relative to consumers, at least immediately after the reforms.

Identification strategy

- **Step 1:** Estimation of markups, marginal costs
- **Step 2:** Disentangle the effects of output and input tariffs on prices, marginal costs and markups based on India's trade liberalization.

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Step 1

- Estimation of markups from production data with multi-product firms based on Hall (1988) and De Loecker and Warzynski (2012).
- Flexible methodology does not require assumptions on:
- The market structure
- Demand curves faced by firms,
- Nor assumptions on how firms allocate their inputs across products

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Step 1

- Estimation of markups from production data with multi-product firms.
- Methodology:
 - (1) Exploit quantity and price information to disentangle markups from quantity-based TFP,
 - (2) Compute marginal costs by dividing observed prices by the estimated markups.

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Step 1

- Differences between revenue-based TFP and quantity-based TFP

Step 1

- Differences between revenue-based TFP and quantity-based TFP:
- (1) **Revenue-based TFP**: uses firms' sales to estimate the production function, \rightarrow TFP is the residual of this estimation capturing increases in quantity or in prices (markups).
- (2) **Quantity-based TFP**: uses firms' quantity to estimate the production function \rightarrow TFP is the residual of this estimation capturing increases in physical quantity related to efficiency improvements within the firm.
- Most of the works do not have data on prices and used revenue based TFP

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Step 1

- In order to infer markups they assume that **firms minimize cost**
- **Markups μ are the deviation between the elasticity of output with respect to a variable input and that input's share of total revenue**
- $\mu_{fjt} = \theta(P_{fjt} * Q_{fjt} / W_{fjt} * V_{fjt})$
- W = a vector of variable input prices for firm f , product j in year t and V = a vector of variable input
- **The elasticity of output with respect to variable input $V(\theta)$ comes from estimates of production functions** across many industries using physical quantity data.
- **Marginal costs:**
- $mc_{fjt} = P_{fjt} / \mu_{fjt}$

Step 1

- Identification issue of multi-product firms: in production function estimation.

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Step 1

- Issue of allocation of variable inputs (wages, intermediate goods, capital) across products for multi-product firms.
- To deal with multi-product firms: they use single-product firms at the production function estimation stage
- so it does not require assumptions on how firms allocate inputs across products, not observable
- Main assumption: the physical relationship between inputs and outputs is the same for single- and multi-product firms that manufacture the same product.
- E.G.: single-product firm uses the same technology to produce rickshaws as a multi-product firm that produces rickshaws and cars.

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Data

- Indian firm-product level data from Prowess data that is collected by the Centre for Monitoring the Indian Economy (CMIE).
- Information on quantities and values of products sell by Indian firms in the domestic market
- Prices: unit value.
- Prowess contains mainly medium large Indian firms.

Lesson 6: Main Results

Table 6: Markups, by Sector

Sector	Markups	
	Mean	Median
15 Food products and beverages	1.78	1.15
17 Textiles, Apparel	1.57	1.33
21 Paper and paper products	1.22	1.21
24 Chemicals	2.25	1.36
25 Rubber and Plastic	4.52	1.37
26 Non-metallic mineral products	4.57	2.27
27 Basic metals	2.54	1.20
28 Fabricated metal products	3.70	1.36
29 Machinery and equipment	2.48	1.34
31 Electrical machinery, communications	5.66	1.43
34 Motor vehicles, trailers	4.64	1.39
Average	2.70	1.34

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- Incomplete pass-through
- Estimate the following pass-through regression:
- $\ln P_{fjt} = \lambda \ln mc_{fjt} + a_{fj} + \epsilon_{fjt}$
- a_{fj} is a firm-product fixed effect.
- Expected sign and value of λ if markups are constant
- Endogeneity issue

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- If markups are constant, then we would expect to find that $\lambda = 1$ and $\epsilon_{ijt} = 0$
- If markups are variable, marginal costs and the error will be negatively correlated and the pass-through coefficient $\lambda < 1$
- **Endogeneity issue:** Measurement error in marginal costs results in a downward bias in the pass-through coefficient
- **Instrumental variables for marginal costs:**
- Input tariffs and lagged marginal cost.

Lesson 6: Main Results

Table 7: Pass-Through of Costs to Prices

	Log Price _{ijt}		
	(1)	(2)	(3)
Log Marginal Cost _{ijt}	0.337 ***	0.305 ***	0.406 †
	0.041	0.084	0.247
Observations	21,246	16,012	12,334
Within R-squared	0.27	0.19	0.09
Firm-Product FEs	yes	yes	yes
Instruments	-	yes	yes
First-Stage F-test	-	98	5

Notes: The dependent variable is (log) price. Column 1 is an OLS regression on log marginal costs. Column 2 instruments marginal costs with input tariffs and lag marginal costs. Column 3 instruments marginal costs with input tariffs and two-period lag marginal costs. The regressions exclude outliers in the top and bottom 3rd percent of the markup distribution. All

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Step 2

- Estimate the within effect of output and input tariff cuts on prices, marginal costs, and markups:

- $$p_{fjt} = \lambda_{fj} + \lambda_{st} + \lambda_1 output\tau + \lambda_2 input\tau + \epsilon_{fjt}$$

- The estimation includes:
- λ_{fj} firm-product fixed effects → capture the within effect of trade liberalization
- λ_{st} industry-year fixed effects → control for unobservable shocks varying over time across industries (inflation and other reforms that took place in India)
- Estimation is done using as dependent variables: prices, markups and marginal costs.

Lesson 6: Main Results

Table 8: Prices and Output Tariffs, Annual Regressions

	Log Prices _{ijt}	
	(1)	(2)
Output Tariff _{it}	0.136 **	0.167 ***
	0.056	0.054
Within R-squared	0.00	0.02
Observations	21,246	21,246
Firm-Product FEs	yes	yes
Year FEs	yes	no
Sector-Year FEs	no	yes
Overall Impact of Trade Liberalization	-8.4 **	-10.4 ***
	3.4	3.3

Notes: The dependent variable is a firm-product's (log) price. Column 1 includes year fixed effects and Column 2 includes sector-year fixed effects. The regressions exclude outliers in the top and bottom 3rd percent of the markup distribution. All regressions include firm-product fixed effects and use data from 1989-1997. Standard errors are clustered at the industry level. The final row uses the average 62% decline in output tariffs from 1989-1997 to compute the mean and standard error of the impact of trade liberalization on prices. That is, for each column the mean impact is equal to the $-0.62 \times 100 \times \{\text{coefficient on output tariffs}\}$. Significance: * 10 percent, ** 5 percent, *** 1 percent.

Lesson 6: Main Results

Table 9: Prices, Costs and Markups and Tariffs

	Log Prices _{fit}	Log Marginal Cost _{fit}	Log Markup _{fit}
	(1)	(2)	(3)
Output Tariff _{it}	0.156 ***	0.047	0.109
	0.059	0.084	0.076
Input Tariff _{it}	0.352	1.160 **	-0.807 ‡
	0.302	0.557	0.510
Within R-squared	0.02	0.01	0.01
Observations	21,246	21,246	21,246
Firm-Product FEs	yes	yes	yes
Sector-Year FEs	yes	yes	yes
Overall Impact of Trade Liberalization	-18.1 **	-30.7 **	12.6
	7.4	13.4	11.9

Notes: The dependent variable is noted in the columns. The sum of the coefficients from the markup and marginal costs regression equals their respective coefficient in the price regression. The regressions exclude outliers in the top and bottom 3rd percent of the markup distribution, and include firm-product fixed effects and sector-year fixed effects. The final row uses the average 62% and 24% declines in output and input tariffs from 1989-1997, respectively, to compute the mean and standard error of the impact of trade liberalization on each performance measure. That is, for each column the mean impact is equal to the $-0.62 \times 100 \times \{\text{coefficient on output tariff}\} + -0.24 \times 100 \times \{\text{coefficient on input tariff}\}$. The regressions use data from 1989-1997. The table reports the bootstrapped standard errors that are clustered at the industry level. Significance: ‡ 11.3 percent, * 10 percent, ** 5 percent, *** 1 percent.

Lesson 6: Main Results

Table 10: Pro-Competitive Effects of Output Tariffs

	Log Markup _{ijt}			
	(1)	(2)	(3)	(4)
Output Tariff _{it}	0.143 ***	0.150 **	0.129 **	0.149 **
	0.050	0.062	0.052	0.062
Output Tariff _{it} x Top _{ip}			0.314 **	0.028
			0.134	0.150
Within R-squared	0.59	0.65	0.59	0.65
Observations	21,246	16,012	21,246	16,012
2nd-Order Marginal Cost Polynomial	yes	yes	yes	yes
Firm-Product FEs	yes	yes	yes	yes
Sector-Year FEs	yes	yes	yes	yes
Instruments	no	yes	no	yes
First-stage F-test	-	8.6	-	8.6

Notes: The dependent variable is (log) markup. All regressions include firm-product fixed effects, sector-year fixed effects and a second-order polynomial of marginal costs (these coefficients are suppressed and available upon request). Columns 2 and 4 instrument the second-order polynomial of marginal costs with second-order polynomial of lag marginal costs and input tariffs. Column 3 interacts output tariffs and the second-order marginal cost polynomial with an indicator if a firm-product observation was in the top 10 percent of its sector's markup distribution when it first appears in the sample. The regressions exclude outliers in the top and bottom 3rd percent of the markup distribution. The table reports the bootstrapped standard errors that are clustered at the industry level. Significance: * 10 percent, ** 5 percent, *** 1 percent.

Conclusion

- On average, prices fall 18 percent despite average output tariff declines of 62 percentage points.
- Marginal costs, however, decline on average by 31 percent due primarily to input tariff liberalization;
- The predominant force driving down marginal costs are lower input tariffs reducing the costs of imported inputs, rather than output tariffs reducing inefficiencies due to foreign competition.
- → in line with previous findings Amiti and Konings (2007) on Indonesia and Topalova and Khandelwal (2011) on India

Conclusion

- The reason the relatively large decline in marginal costs did not translate to equally large price declines was:
- **because markups increased**: on average, the trade reform raised relative markups by 13 percent.
- The increases in markups are due to the fact that prices do not respond fully to cost: Incomplete pass-through.
- **Firms that benefit the most from trade reforms** domestic Indian firms who benefit from lower production costs while simultaneously raising markups.