Advanced International Trade: Lesson 3

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M2 Paris I

Lesson 3: Trade and Product Growth

Lesson 3: Trade and Technology

- Trade Liberalization and Product Innovation
- **Suggested readings:**
- Goldberg, P., Khandelwal, A, Pavcnik, N. and P. Topalova Imported Intermediate Inputs and Domestic Product Growth: Evidence from India, Quarterly Journal of Economics 125(4) 2010, pp. 1727-1767.

Lesson 3: Trade and Product Growth

Aim

- Study the impact of input-trade liberalization on firms' ability to produce new products for the domestic market.
- disentangling the effect from output tariffs cuts (foreign competition)

Motivation

- **Cost Effects**

- Trade provides domestic firms access to cheaper and previously unavailable inputs.

- New foreign inputs also lower the cost of innovation, enabling the creation of new varieties, and this generates dynamic gains from trade;

Input liberalization in India

- The trade liberalization dramatically increased Indian firms' access to new imported inputs;
- Growth in imported inputs is substantially higher than for final goods, 227 percentage points versus 90 percentage points
- 2/3 of the surge in imported inputs occurred in products not imported prior to the reforms.
- During the 1990s, a quarter of India's manufacturing output growth was driven by new products

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- **Country of origin of imports matters!**
- New imported inputs in large extent originated from more advanced countries
- Not only did India import about 35% more products, but products were, on average, sourced by 12.6 countries compared to 7.3 countries prior to the reform.
- These new inputs were sourced from more advanced countries (OECD countries)

Input liberalization and creation of new varieties

- Positive link between foreign inputs and innovation:
- Goldberg et al. (2008) for India find that firms in sectors with the largest input tariff cuts have a larger increase in firms' ability to manufacture new products.
- This indicates that access to new input varieties from abroad enables the creation of new varieties in the domestic market.

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Table 1: Extensive and Intensive Margin of India's Imports, 1987-2000

	Import Growth	Product Extensive Margin			Variety Extensive Margin			Intensive Margin
		Total	OECD	Non-OECD	Total	OECD	Non-OECD	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All Products	130	84	59	25	22	9	13	23
Final Products (Consumer Durable and Non-Durables)	90	33	21	11	25	9	16	32
Inputs (Capital, Basic, Intermediates)	227	153	115	38	42	15	26	32
Basic Products	260	154	124	30	62	31	31	45
Capital Products	125	37	27	10	33	23	10	55
Intermediate Products	297	278	200	78	28	-12	39	-9
HS Code 27 (Mineral Fuels and Oil)	89	59	0	59	11	1	11	19
HS Code 28 (Inorganic Chemicals)	227	7	4	2	92	4	88	128
HS Code 29 (Organic Chemicals)	158	4	2	2	58	12	46	95
HS Code 71 (Precious Stones and Metals)	668	666	576	89	28	20	8	-25
HS Code 72 (Iron and Steel)	27	34	16	18	24	4	20	-31
HS Code 84 (Nuclear Reactors, Boilers, and Machinery)	100	33	23	10	27	21	6	39
HS Code 85 (Electrical Machinery And Equipment)	173	72	63	9	35	19	16	66

Notes: The table decomposes import growth into the extensive and intensive margins between 1987 and 2000. The first column reports overall import growth. Column 2 reports the contribution to import growth due to the extensive (new HS6) margin. Columns 3 and 4 disaggregate column 2 according to the source country. Column 5 reports the contribution to growth due to existing HS6 codes. This product extensive margin is decomposed into the variety extensive margin (column 5) and the variety intensive margin (column 8). Columns 2, 5 and 8 to column 1. The variety extensive margin is decomposed in the variety extensive margins in columns 6 and 7. All variables are deflated by wholesale price indices. Please see tex for the list of OECD countries.

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Table 2c: Import Extensive Margin and Tariffs

	All Products	Intermediate	Final Goods
	Panel A: Variety: HS6-country		
Lagged Tariff	-0.073 ***	-0.094 ***	-0.044 **
	0.009	0.011	0.020
R-squared	0.86	0.86	0.86
Observations	35,833	20,093	11,836
	Panel B: Variety: HS8		
Lagged Tariff	-0.011 **	-0.017 ***	-0.003
	0.005	0.006	0.009
R-squared	0.89	0.9	0.86
Observations	35,833	20,093	11,836
	Panel C: Variety HS8-country		
Lagged Tariff	-0.086 ***	-0.118 ***	-0.038 *
	0.011	0.013	0.023
R-squared	0.88	0.88	0.88
Observations	35,833	20,093	11,836
All regressions also include:			
Year FEs	yes	yes	yes

Identification Strategy

- Exploit variation across sectors in input tariffs.
- Between 1989 and 1997 input tariffs declined in India on average by 24 percentage points
- But there was heterogeneity across industries in tariff cuts
- Within firm estimation: firm fixed effects to control for time?invariant firm characteristics,
- Year fixed effects: to capture unobserved aggregate shocks.

Estimation Strategy

- $ln(n_{it}^{q}) = \alpha_i + \alpha_t + \beta\tau_{qt}^{inp} + \mu_i + _{it}$
- $ln(n_{it}^{q})$ = number of products manufactured by firm i operating in industry q at time t,
- τ_{qt}^{inp} = input tariff that corresponds to the main industry in which firm i operates,
- Firm and year fixed effects.

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Table IVa: Product Scope and Input Tariffs

	(1)		(2)		(3)		(4)	
Input Tariff	-0.323	**	-0.310	**	-0.327	**	-0.281	**
	0.139		0.150		0.150		0.125	
Output Tariff			-0.013		-0.014		-0.010	
			0.043		0.041		0.041	
Delicensed					-0.032		-0.026	
					0.023		0.021	
FDI Liberalized							0.037	
							0.024	
Year Effects	yes		yes		yes		yes	
Firm FEs	yes		yes		yes		yes	
R-squared	0.90		0.90		0.90		0.90	
Observations	14,882		14,864		13,435		11,135	

Notes: The dependent variable in each regression is (log) number of products manufactured by the firm. The delicenced variable is an indicator variable obtained from Aghion et al (2008) which switches to one in the year that the industry becomes delicensed. The FDI variable is a continuous variabled obtained from Topalova and Khandelwal (*forthcoming*) with higher values indicating a more liberal FDI policy. As with the tariffs, the licensed and FDI policy variables are lagged. All regressions include firm and year fixed effects and are run from 1989-1997. Standard errors clustered at the industry level. Significance: * 10 percent, ** 5 percent, *** 1 percent.

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Main results

- A 10 percentage point fall in tariffs results in a 3.2% expansion of a firm?s product scope.
- During the period input tariffs declined on average by 24 percentage points implying that within?firm product scope expanded 7.7 percent.
- Firms increased their product scope on average by 25 percent between 1989 and 1997,
- $->$ estimates imply that declines in input tariffs accounted for 31 percent of the observed expansion in firms' product scope.

Robustness tests

- Control for time varying industry and product shocks (sector specific technological progress, that may be correlated with input tariff changes.)
- Control for pre existing sector and firm trends
- Firm trends: year fixed effects interacted with a dummy that indicates whether the firm manufactured multiple products in its initial year.
- Control for shocks to firms of similar sizes over time: classify firms into output and TFP deciles (initial year), and interacts the deciles with year dummies

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Table IVb: Reduced-Form Robustness Checks

Product scope regressed on input tariffs, firm and year fixed effects, plus controls			
(1) NIC2 X Year FEs	-0.323 *	(7) Initial Products X Year FEs	-0.408 ***
	0.191		0.128
(2) NIC3 X Year FEs	-0.424 **	(8) Initial Output Decile X Year FEs	-0.311 **
	0.204		0.146
(3) Pre-reform Industry Product Growth X Year FEs	-0.327 **	(9) Initial TFP Decile X Year FEs	-0.321 *
	0.145		0.163
(4) Pre-reform Industry Output Growth X Year FEs	-0.315 **	(10) Initial R&D Dummy X Year FEs	-0.312 **
	0.141		0.154
(5) Pre-reform Industry TFP Growth X Year FEs	-0.336 **	(11) Poisson Model	-0.286 *
	0.141		0.162
(6) Initial MPF Dummy X Year FEs	-0.393 ***	(12) Constant Firms	-0.403 *
	0.127		0.206
Long-Difference Robustness Checks			
	Dependent variable: 1997-1989 Change in Log Product Scope		*Dependent variable:* 1997-1991 Change in Log Scope — 1991-1989 Change in Log Scope
(13) ΔInput Tariffs$_{1997\text{-}1989}$	-0.315	(14) ΔInput Tariffs$_{1997\text{-}1991}$ —	-0.234
	0.237	ΔInput Tariffs$_{1991\text{-}1989}$	0.251
Observations	696	Observations	662

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Table IVc: Input Tariffs and Other Firm Outcomes

	Output (1)		TFP (2)		R&D (3)	R&D (4)	
Input Tariff	-1.125	**	-0.454	*	-1.559	-0.077	
	0.436		0.233		1.751	1.124	
Input Tariff X Large Firm						-1.903	*
						1.111	
Year Effects	yes		yes		yes	yes	
Firm FEs	yes		yes		yes	yes	
R-squared	0.92		0.81		0.21	0.21	
Observations	14,874		13,714		14,233	14,233	

Notes: The dependent variable in column 1 is log output. The dependent variable in column 2 is firm TFP obtained from Topalova and Khandelwal (*forthcoming*). Columns 3 and 4 are R&D expenditures. Column 4 includes an interaction with a dummy if the firm is above median size. All regressions include firm and year fixed effects and are run from 1989-1997. Standard errors clustered at the industry level. Significance: * 10 percent, ** 5 percent, *** 1 percent.

Channels

- Input tariff cuts reduce input prices and also allows firms to access new varieties of foreign inputs
- Disentangling price changes from variety growth
- Regress change in firms' product scope on changes in a price and a variety indexes.

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Table VIa: Product Scope and Channels: OLS

	(1)	(2)	(3)
Conventional Price Index	-0.156		-0.124
	0.121		0.113
Variety Index		-5.97 **	-5.70 **
		2.55	2.41
R-squared	0.002	0.009	0.010
Observations	696	696	696

Notes: Table reports OLS regressions of firm scope on the imported input price indices. Column 1 includes the conventional index, column 2 includes the variety index and column 3 includes both indices. Regression is run for years 1989 and 1997. Standard errors clustered at the industry level. Significance: * 10 percent, ** 5 percent, *** 1 percent.

Lesson 3: Trade and Product Growth

Table IVb: Product Scope and Channels: Instrumental Variables

	1st Stage Regressions		2nd Stage Regressions				
	{Conv. Price Index}$_q$	{Variety Index}$_q$	{ΔFirm Scope}$_f$	{ΔFirm Scope}$_f$	{ΔFirm Scope}$_f$	{ΔFirm Scope}$_f$ — 1998/99 IO Matrix	{ΔFirm Scope}$_f$ — Polynomial Instruments
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
{Δ Input Tariff}$_{q,97\text{-}89}$	1.340 ***	-0.007					
	0.476	0.020					
{Δ Input Tariff}$_{q,97\text{-}89}$ X {Proximity}$_q$	-0.707	0.121 *					
	1.618	0.065					
{Conventional Price Index}$_q$			-0.240		-0.033	-0.047	-0.493 *
			0.211		0.299	0.245	0.271
{Variety Index}$_q$				-14.24 *	-13.40	-14.88 *	-14.80 ***
				7.56	10.46	8.97	5.00
F-test 1st Stage Instruments			[5.3,p=.01]	[3.1,p=.05]	[5.3,p=.01; 3.1,p=.05]	[33.4,p=.00; 5.5,p=.01]	[21.4,p=.00; 12.8,p=.00]
Observations	696	696	696	696	696	696	696

Notes: Table reports IV regressions of firm scope on the imported input price indices. The instruments are changes in input tariffs and changes in input tariffs interacted with the proximity measure described in the text. Columns 1 and 2 report the first stage regressions for the conventional price and variety indices, respectively. Columns 3-7 report the second stage regressions. Column 6 uses the 1998/99 input-output matrix. Column 7 includes third-order polynomials of the instruments and is estimated using a continuously-updated GMM estimator. The regressions are run for years 1989 and 1997. Standard errors clustered at the industry level. Significance: * 10 percent; ** 5 percent; *** 1 percent.

Lesson 3: Trade and Product Growth

Conclusion

- First work to identify the effects of input-tariff liberalization on domestic firm product scope.
- Evidence on substantial gains from trade through access to new imported inputs.
- Lower input tariffs account on average for 31 percent of the new products introduced by domestic firms.
- This effect is driven to a large extent by increased firm access to new input varieties that were unavailable prior to the trade liberalization.