Trade Liberalization and Skill Upgrading: Evidence on the Impact of APTA on Chinese Manufacturers

Chujian Shao, Castiel Chen Zhuang*, Qiliang Chen

University of Washington

Friday, September 3rd, 2021

Introduction

- Why do firms train? Acemoglu and Pischke (1998) suggest that it is the positive "training premium" that gives firms a motivation to offer training.
  - Konings and Vanormelingen (2015) and Huang and Zhuang (2021) structurally estimate a production function in which training is endogenously decided by firms.
- Empirical findings show that firms who export are more skill-intensive than non-exporters, so a bilateral trade liberalization can induce firms to upgrade skill.
  - However, there is little direct empirical evidence showing causal effects of a reduction in tariffs on skill upgrading.

Background

- Asian Pacific Trade Agreement (APTA), previously the Bangkok Agreement, was signed in 1975 and renamed in 2005.
- China acceded APTA in 2001 and endorsed a preferential trade arrangement among developing Asian countries.
- A reduction in India's tariff leads to a boost in exports to the Indian market by Chinese manufacturing firms.
  - India's average applied effective tariff declines by about 15 percentage points from 2004 to 2007, but the change in the average tariff in the rest of the world is nearly zero during the same period.

Background

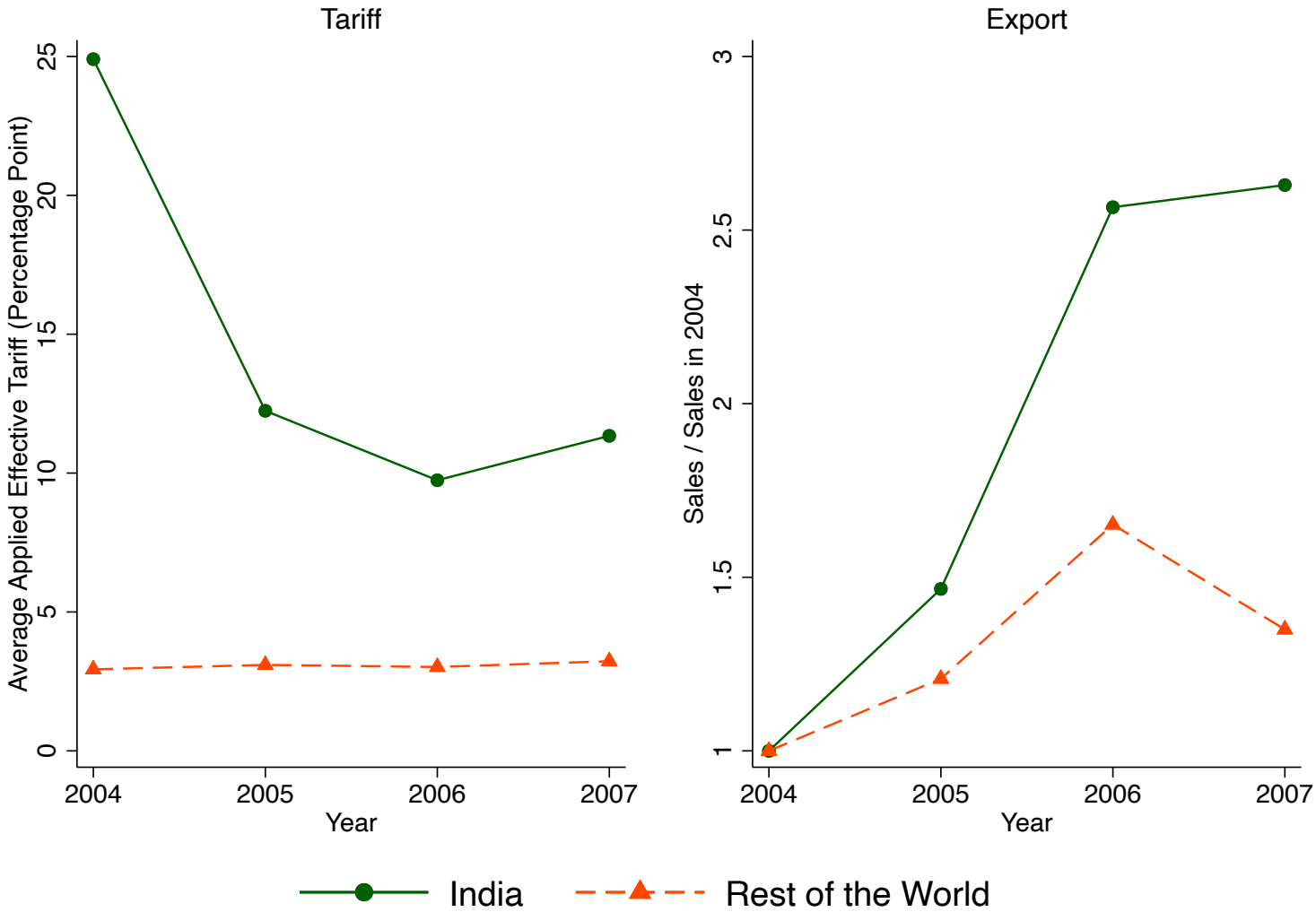

Figure 1: Trends of Tariffs and China's Export Sales (2004–2007)

Theoretical Model: Benchmark

- Fixed exporting costs:
  - only the more productive firms enter export markets
- Fixed skill-upgrading costs:
  - only the more productive exporters upgrade their skill levels
- Reduction in variable trade costs:
  - more firms enter the export market
  - more firms upgrade skill levels
- Heterogeneity in productivity is crucial for the above results.
  - If all firms export, variable trade costs would have no impact on skill upgrading.

Theoretical Model: Benchmark

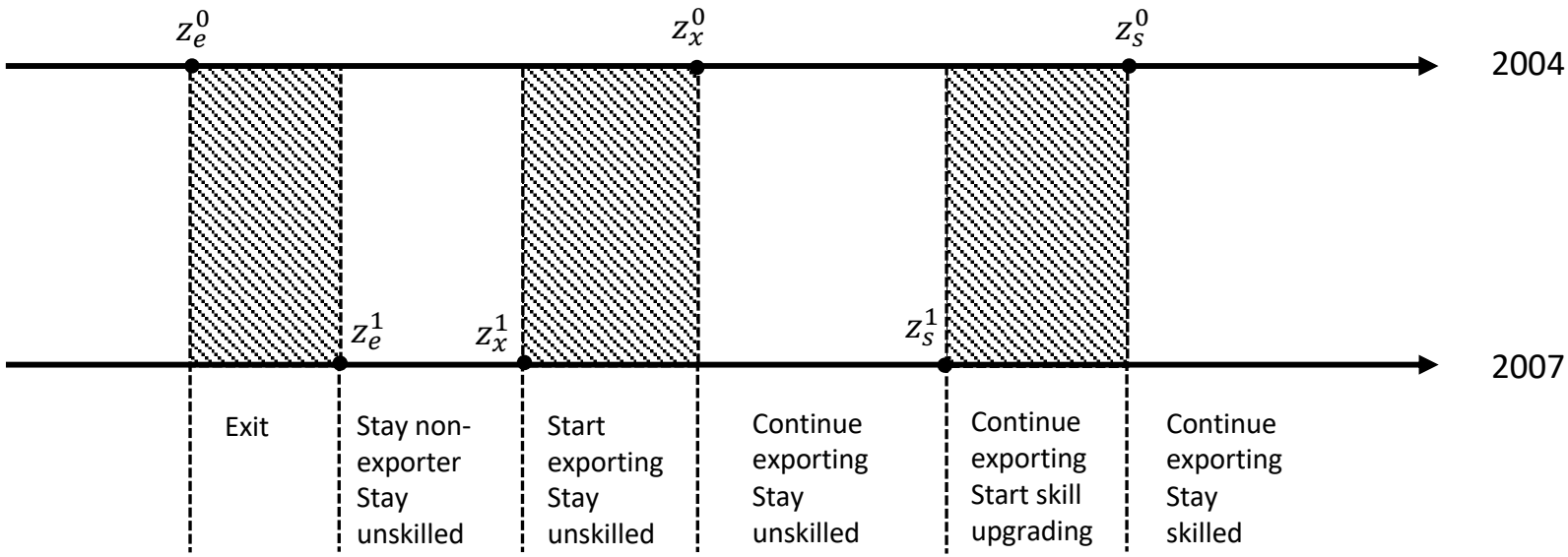

Figure 2: Effect of Lowering Variable Trade Costs: Benchmark Model

Theoretical Model: Extended

- Assume the export destination can be either a main trading partner, m, or a less preferential partner, o.
- Two export productivity cutoffs, and two skill-upgrading productivity cutoffs.
  - The export productivity cutoffs are both lower than the skill-upgrading cutoffs, as some firms are observed to switch export destinations.
- Reduction in variable trade costs:
  - more firms enter the Indian market
  - firms may upgrade or downgrade their skill levels

Theoretical Model: Extended

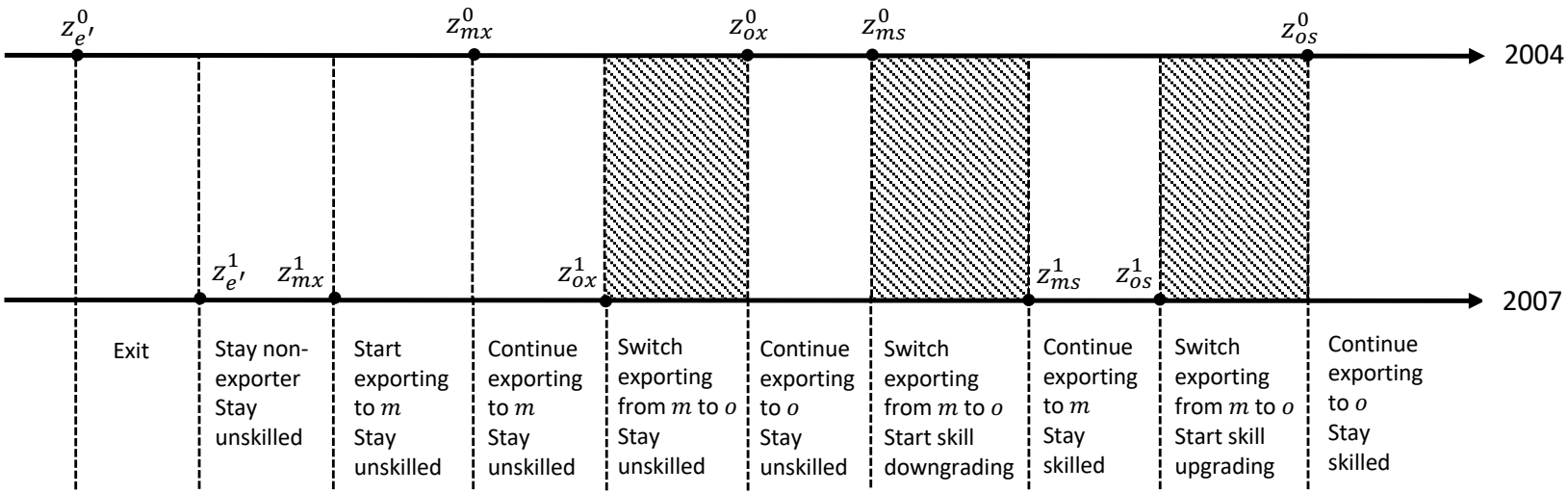

Figure 3: Effect of Lowering Variable Trade Costs: Extended Model

Data

- Obtain data from various sources
  - Tariff data from WITS between 2004 and 2007
  - Firm characteristics and training spending from CIED
  - Firm export destinations and corresponding export sales from CCD
  - Average capital and skill intensity in the industry in the U.S. in the 1980s from the NBER productivity database
  - Import demand elasticity and export supply elasticity as estimated by Broda and Weinstein (2006) and Broda et al. (2008)

- Select the sectors covered by India's consolidated list of concessions of the first 3 rounds of negotiations to APTA member countries and the 4-digit CIC industries with information on India's tariffs
  - End up with a balanced panel of 110,632 manufacturing firms ($\geq$ 10 employees, operating in 131,460 4-digit CIC industries) in each year from 2004 to 2007

Empirical Models

Analyze the export entry decision using an index model

$$EX_{ijst}^{k} = \begin{cases} 1 & \text{if } \beta_{\tau^{ex}}^{k}\tau_{jt}^{ex} + \alpha_{st}^{k} + \mu_{i}^{k} + \epsilon_{ijst}^{k} > 0 \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

Take first differences to eliminate time-invariant plant and sector heterogeneity, and obtain

$$\Delta EX_{ijst}^{0} = \beta_{\tau^{ex}}^{0}\Delta\tau_{jt}^{ex} + \Delta\alpha_{st}^{0} + \Delta\epsilon_{ijst}^{0} \tag{2}$$

Control for changes in China's import tariffs w.r.t. the world and India, firm characteristics in the initial year (2004), and four-digit industry characteristics:

$$\Delta EX_{ijst}^{0} = \beta_{\tau^{ex}}^{0}\Delta\tau_{jt}^{ex} + \beta_{\tau^{im}}^{0}\Delta\tau_{jt}^{im} + \beta_{z}^{0}Z_{ij2004} + \beta_{c}^{0}c_{j} + \Delta\alpha_{st}^{0} + \Delta\epsilon_{ijst}^{0} \tag{3}$$

Empirical Models

To check for robustness, control the export status in the previous year and estimate the equation in levels with the following regression:

$$EX^0_{ijst} = \beta^0_{\tau^{ex}} \Delta\tau^{ex}_{jt} + \gamma^0 EX^0_{ijs,t-1} + \alpha^0_{st} + \epsilon^0_{ijst} \tag{4}$$

Estimate the impact of the change in India's tariffs on each quartile of the initial firm size distribution (a proxy for initial productivity, not a perfect measure) with the following equation:

$$\Delta EX^0_{ijst} = \sum_{n=1}^{4} \beta^0_{\tau^{ex},n}(\Delta\tau^{ex}_{jt} \times Q_{ij,n}) + \sum_{n=1}^{4} \delta^0_n Q_{ij,n} + \beta^0_{\tau^{im}} \Delta\tau^{im}_{jt} + \Delta\alpha^0_{st} + \Delta\epsilon^0_{ijst} \tag{5}$$

Empirical Models

Similarly, for skill upgrading decisions, estimate

$$\log TS_{ijst} = \beta_{\tau^{ex}} \tau_{jt}^{ex} + \beta_{\tau^{im}} \tau_{jt}^{im} + \alpha_{st} + \mu_i + \epsilon_{ijst} \tag{6}$$

Also, estimate the impact of the change in India's tariffs on each quartile of the initial firm size distribution with the equation below:

$$\Delta \log TS_{ijst} = \sum_{n=1}^{4} \beta_{\tau^{ex},n} (\Delta \tau_{jt}^{ex} \times Q_{ij,n}) + \sum_{n=1}^{4} \delta_n Q_{ij,n} + \beta_{\tau^{im}} \Delta \tau_{jt}^{im} + \Delta \alpha_{st} + \Delta \epsilon_{ijst} \tag{7}$$

Empirical Results

- The probability of entry in the export market increases by 1.55 percentage points when the average reduction in India's tariffs is around 15 percentage points from 2004 to 2007.
  - Only significant in some sectors, such as "ship and floating devices manufacturing".
  - Robust to lagged-dependent variable specification.
  - Less significant in the sub-sample of baseline exporters.

- The effect of the reduction in India's tariffs on firm entry in the export market is significant in the last three quartiles of the firm size distribution, but not in the first quartile.
  - Consistent with the model, firms with intermediate to high productivity level should be affected.
  - As for the firms in the fourth quartile, 1) firm size may not be a perfect measure of productivity, and 2) some relevant policies targeting large enterprises in China might explain this finding.

Empirical Results

- The 15 percentage point decline in India's tariffs increases labor training provided by firms by about 0.11 to 0.13 log points.
  - Again, this is significant in the selected sectors.
  - In other sectors, such as the "textile industry", there is even a reverse effect (skill downgrading)—more firms in these sectors may fall in the productivity range between z_{ms}^0 and z_{ms}^1 in Figure 3.
  - Not significant in the sample of baseline exporters; one possible explanation is that some continuing exporters switch to the Indian market due to an increase in skill upgrading productivity cutoff in non-Indian countries and no longer produce high-skill products, and some exiting exporters no longer demand high-skill workers when serving the domestic market only.

Empirical Results

- Again, firms in the middle range of the productivity distribution (second and third quartiles) are positively affected by trade integration, so do those in the first quartile.
  - The 15 percentage point reduction in India's tariffs from 2004 to 2007 increases spending on training of these firms by 0.14–0.18 log points.
  - Why would firms in the low or lower-middle range of the size distribution increase human capital investment after trade liberalization? One possible reason is that Chinese local governments protect and support some smaller domestic firms and state-owned enterprises. This is beyond the benchmark model.

Empirical Results

- To further explore the extended model, let's focus on new exporters' destination decisions, and the training decisions of new exporters to India.

Sample	Selected sectors New exporters			Selected sectors New exporters to India		
Dependent variable	Change in status of exporting to India			log(training spending)		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔIndia's tariffs						
× first size quartile	-1.721***	-1.723***	-1.888***	-8.054	-15.082*	-3.714
	(0.484)	(0.562)	(0.522)	(6.791)	(8.015)	(5.745)
× second size quartile	-1.533***	-1.555***	-1.676***	-13.208*	-20.970**	-10.031
	(0.486)	(0.555)	(0.512)	(7.591)	(8.530)	(6.596)
× third size quartile	-1.450***	-1.471**	-1.522***	-11.187	-18.683**	-7.860
	(0.485)	(0.565)	(0.502)	(7.409)	(8.943)	(5.681)
× fourth size quartile	-1.600***	-1.615***	-1.654***	-15.153	-23.569**	-12.200*
	(0.533)	(0.603)	(0.549)	(9.079)	(10.006)	(7.083)
ΔChina's tariffs w.r.t. world		yes			yes	
ΔChina's tariffs w.r.t. India			yes			yes
Sector FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Firm-level controls	yes	yes	yes	yes	yes	yes
Industry controls		yes	yes		yes	yes
Observations	2,475	2,475	2,475	489	489	489
R^2	0.025	0.026	0.028	0.035	0.061	0.054

Empirical Results

- Coefficients in each quartile are statistically significant.
  - In particular, the 15 percentage point decline in India's tariffs increases the probability of entering the Indian market by 24.23 percentage points among new exporters in the high productivity group (fourth quartile).
  - It is consistent with the extended model prediction as there are 3 shaded areas located at different productivity levels in Figure 3.
- Trade liberalization is shown to have significantly positive effects on skill upgrading of new exporters targeting India in the last three quartiles, according to column 5.
  - Effect magnitude: quartile 4 > quartile 2 > quartile 3, as quartiles 2–4 are likely to correspond "maintain skill levels", "skill downgrading", and "skill upgrading" respectively

Empirical Results

- What about sales? The model mechanism implies that firms gain higher revenues when trade costs are lower, and find it more profitable to export and have greater incentives in skill upgrading.

Dependent variable	Change in log(export sales to India)			Change in log(domestic sales)		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔIndia's tariffs	-40.851***	-41.207***	-43.108**			0.016
	(13.352)	(13.727)	(17.650)			(1.577)
ΔChina's tariffs w.r.t. India						
Output		yes		0.302	0.521	0.518
				(0.862)	(1.995)	(1.984)
Input		yes			-1.515	-1.517
					(14.819)	(14.862)
ΔChina's tariffs w.r.t. world			yes			
Sector FE	yes	yes	yes	yes	yes	yes
Year FE	yes	yes	yes	yes	yes	yes
Firm-level controls	yes	yes	yes	yes	yes	yes
Industry controls		yes	yes		yes	yes
Observations	489	489	489	489	489	489
R^2	0.141	0.154	0.153	0.063	0.071	0.071

Empirical Results

- The reduction in India's tariffs increases China's export sales to India.
  - The 15 percentage point reduction in India's tariffs leads to an increase in export sales to India by about 6.18 log points, when the change of China's import tariffs with respect to India is controlled for.
  - The coefficients are large in magnitude because the export sales are at the firm level instead of the industry level. The firm level data can help emphasize how a small group of firms respond to changes in trade costs.

- The theoretical model also shows that the reduction in trade costs leads to a decline in domestic sales and causes more low productivity firms to exit the market.
  - These results are not significant. This is probably due to the fact that China as a developing country has a rapid growth rate, as well as a large population.

The End

Thank you!