Do All Inputs Matter? Export Market Expansion, Capital Goods Adoption, and Upgrading

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INTRODUCTION

- **How do firms respond to expanding export markets?**
- Firms in developing countries may **upgrade** by accessing high-quality inputs, skilled workers, and advanced technologies utilized in industrialized economies.
- Previous studies have extensively documented the effects of accessing **intermediate inputs** (e.g., materials). **However, little is known about the impact driven by capital goods** (e.g., machinery and equipment).

THIS PAPER

Research Questions:

1. Does export market expansion facilitate capital goods adoption?

2. Does the adoption of capital goods affect firm-level upgrading? If so, how?

Reduced-Form Analysis:

- Use a policy change as a natural experiment
- **Event:** Multi-Fibre Arrangement (MFA) quota removal policy in 2005
- **What:** Large-scale export market expansion policy
- **Who:** Textile and apparel exporters in China
- **Design:** Firm-level data (2001-2015) + DID design

Theoretical Framework:

- Incorporate firm's decisions on capital goods adoption
- Existence of fixed costs + adjustment frictions in adopting high-end machine
- Endogenous technological change ⇒ allow productivity change

DATA

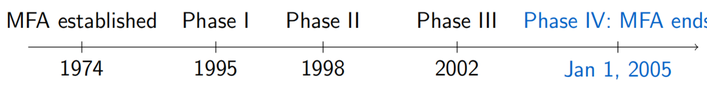
China's Customs Transaction Data (Customs) (2001-2015):

- Essential for identifying direct machine imports at the firm level
- **Key Variables**: value, quantity, import country of origin, and export destination countries
- Following **International Textile Manufacturers Federation (ITMF**), define a firm that adopted high-end machines if it imported textile machines from high-income OECD countries at least once

China's Annual Survey of Manufacturers (ASM) (2001-2013):

- **Key Variables**: wage, employment, sales, export shares, asset, gross output, etc.
- Detailed firm characteristics: firm name, location, ownership, founding year, etc.

POLICY BACKGROUND



- **US, Canada, and EU** imposed quotas on textile products that developing countries could export
- All MFA quotas were lifted in China, and the Arrangement expired on **Jan 1, 2005**
- **536** out of 1128 HS 8-digit textile products were directly affected

		US	Canada	EU
HS 6203.19.90	men's suits, w/o wool	quota	quota	quota
HS 6203.19.10	men's suits, w/ wool	no quota	no quota	no quota
HS 6104.51.00	women's skirts	quota	quota	no quota

- The application varies across products and destination countries of export

EMPIRICAL STRATEGY

Construct a continuous measure of exposure to policy:

$$\textbf{Exposure}_i = \frac{\sum_{pd \in quota} Sales_{ipd}}{Sales_i}, \text{ in t=2004}$$

where i=firm; p=HS 8-digit product; d=destination country of export

$$Treat_i = \begin{cases} 1 & \text{if } Exposure_i > \overline{Exposure} \\ 0 & \text{if } Exposure_i \leq \overline{Exposure} \end{cases}$$

$$Y_{it} = \gamma_i + \lambda_t + \beta Treat_i \times Post_t + \delta X_{it} + \epsilon_{it} \qquad (1)$$

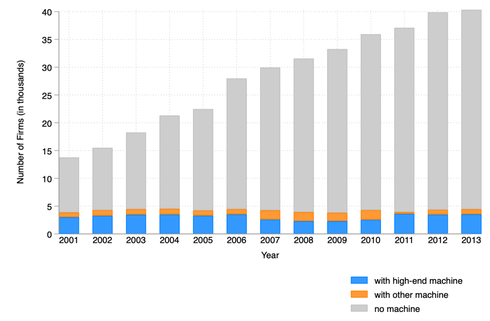
$$Y_{it} = \gamma_i + \lambda_t + \sum_{k \neq 2004} \beta_k \mathbb{1}\{t = k\} \times Treat_i + \delta X_{it} + \epsilon_{it} \qquad (2)$$

- Y_{it}: outcome variables for firm i in year t
- e.g., export (import) value and quantity of textile products (machines)
- $Treat_i$: = 1 for firms in the treatment group and 0 otherwise
- $Post_t$: = 1 in the post-treatment period and 0 otherwise
- γ_i, λ_t: firm and year FE

RESULTS

1. Export market expansion facilitates firm-level capital goods adoption.

- Only a small fraction of firms owned imported machines.
- Firms more exposed to the policy are more likely to import high-end machines.



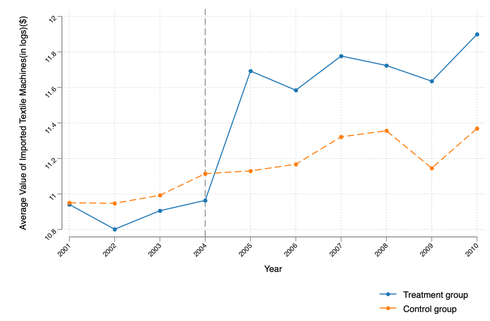


Table 1. Effects on Machine Imports (DID Specification)

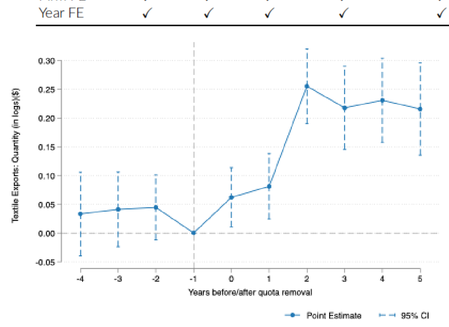
	(1) value	(2) quantity	(3) price	(4) value (OECD)	(5) quantity (OECD)	(6) price (OECD)	(7) OECD frac (value)	(8) OECD frac (quantity)
Treat × Post	0.319**	0.351*	0.677***	0.207*	0.354*	0.580***	0.005	0.044**
	(0.152)	(0.187)	(0.159)	(0.119)	(0.204)	(0.175)	(0.012)	(0.017)
Obs	101,455	101,455	101,455	72,864	72,864	72,864	72,864	72,864
Mean	11.505	5.203	6.298	11.393	5.029	6.364	.912	.904
R-squared	0.662	0.721	0.643	0.661	0.715	0.637	0.399	0.403
No. firm	17,430	17,430	17,430	14,910	14,910	14,910	14,910	14,910
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓

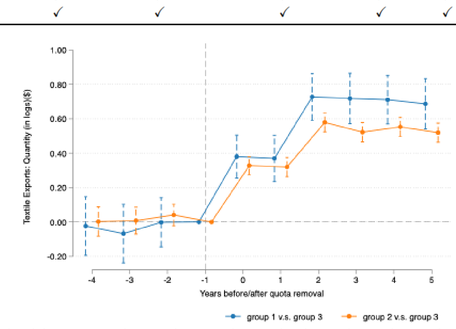
2. Capital goods adoption boosts export performance and is a key driver of product upgrading.

- Machine-adopting firms export wider product varieties, at higher prices, and with higher inferred quality to more high-income countries.

Table 2. Effects on Textile Exports (DID Specification)

	(1) value	(2) quantity	(3) price	(4) value (OECD)	(5) quantity (OECD)	(6) price (OECD)	(7) OECD frac (value)	(8) OECD frac (quantity)	(9) variety	(10) destination
Treat × Post	0.250***	0.211***	0.061***	0.113***	0.192***	0.026***	0.026***	0.028***	0.122*	0.400***
	(0.012)	(0.012)	(0.005)	(0.020)	(0.020)	(0.009)	(0.004)	(0.004)	(0.064)	(0.054)
Obs	400,108	400,108	400,108	101,486	101,486	101,486	101,486	101,486	400,108	400,108
Mean	12.803	11.457	1.344	12.272	10.696	1.574	.677	.669	8.813	5.954
R-squared	0.792	0.815	0.832	0.782	0.800	0.833	0.605	0.605	0.773	0.640
No. firm	75,412	75,412	75,412	29,170	29,170	29,170	29,170	29,170	75,412	75,412
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Firm FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

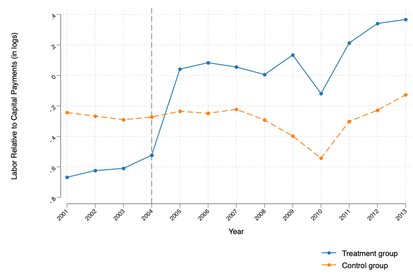


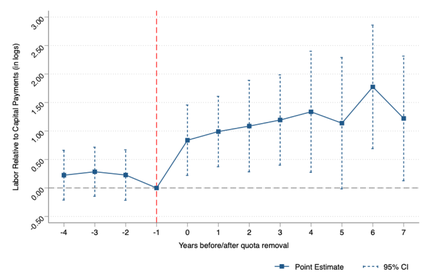


Note: Firms are divided into 3 groups. In Group 1, firms are highly exposed to policy and own high-end machines before the event. Firms in Group 2 are highly exposed to policy but do not own high-end machines. Group 3 firms are less exposed to policy.

3. Capital goods adoption also determines process upgrading by affecting labor.

- ↑ firm-level labor-capital share after the event

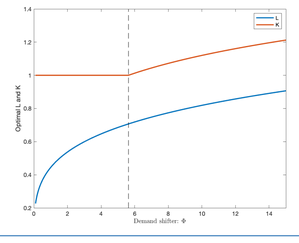


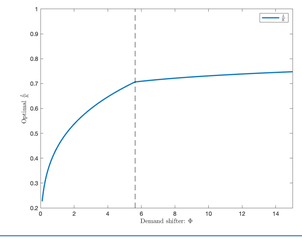


THEORETICAL FRAMEWORK

Entry	*Stage 1*	*Stage 2*	*Export*
Draw φ	Choose K	Given K, choose L	f_x

- A generalized CES production technology: $F(\varphi, L, K) = \varphi\left[\alpha^{\frac{2}{\varepsilon}}(\overline{K} + K)^{\frac{\varepsilon-1}{\varepsilon}} + \beta^{\frac{2}{\varepsilon}} L^{\frac{\varepsilon-1}{\varepsilon}}\right]^{\frac{\gamma\varepsilon}{\varepsilon-1}}$
- β is affected by capital goods accumulation
- Static Max Problem: $\max_{\{L_j, K_j, p_j, \mathbb{1}\}} \pi_j = p_j q_j - w \cdot L_j - r \cdot (\overline{K} + K_j) - \boldsymbol{C}(K_j) - \mathbb{1} \cdot f_x$
- where $\boldsymbol{C}(K) = fK + \eta K^{\theta}$ is the adjustment cost for adopting high-end machines





CONCLUSIONS

1. Export market expansion facilitates firm-level capital goods adoption.
2. Capital goods boost export performance and is a key driver of upgrading.
3. Welfare gains from trade may be underestimated if the unique role of capital goods in determining process upgrading is not taken into account.