

Vertical Specialization, Tariff Shirking and Trade

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Today's Globalized Toy

Topper the Trick Terrier is a robotic dog that can talk and stand on its head. But the real trick is where its parts come from. This year 75,000 copies of the dog were made by Qualiman Industrial Co. in Nanhai, China for a Li & Fung American customer, the Original San Francisco Toymakers. It sells for \$29.99 in the U.S.

PLASTIC EYES:
Shenzhen, China

PLASTIC BODY:
Malaysia
MICROFIBER FABRIC
FOR COAT:
Korea

MOTOR FOR LEGS:
Shaoguan, China
PLASTIC LEGS:
Taiwan

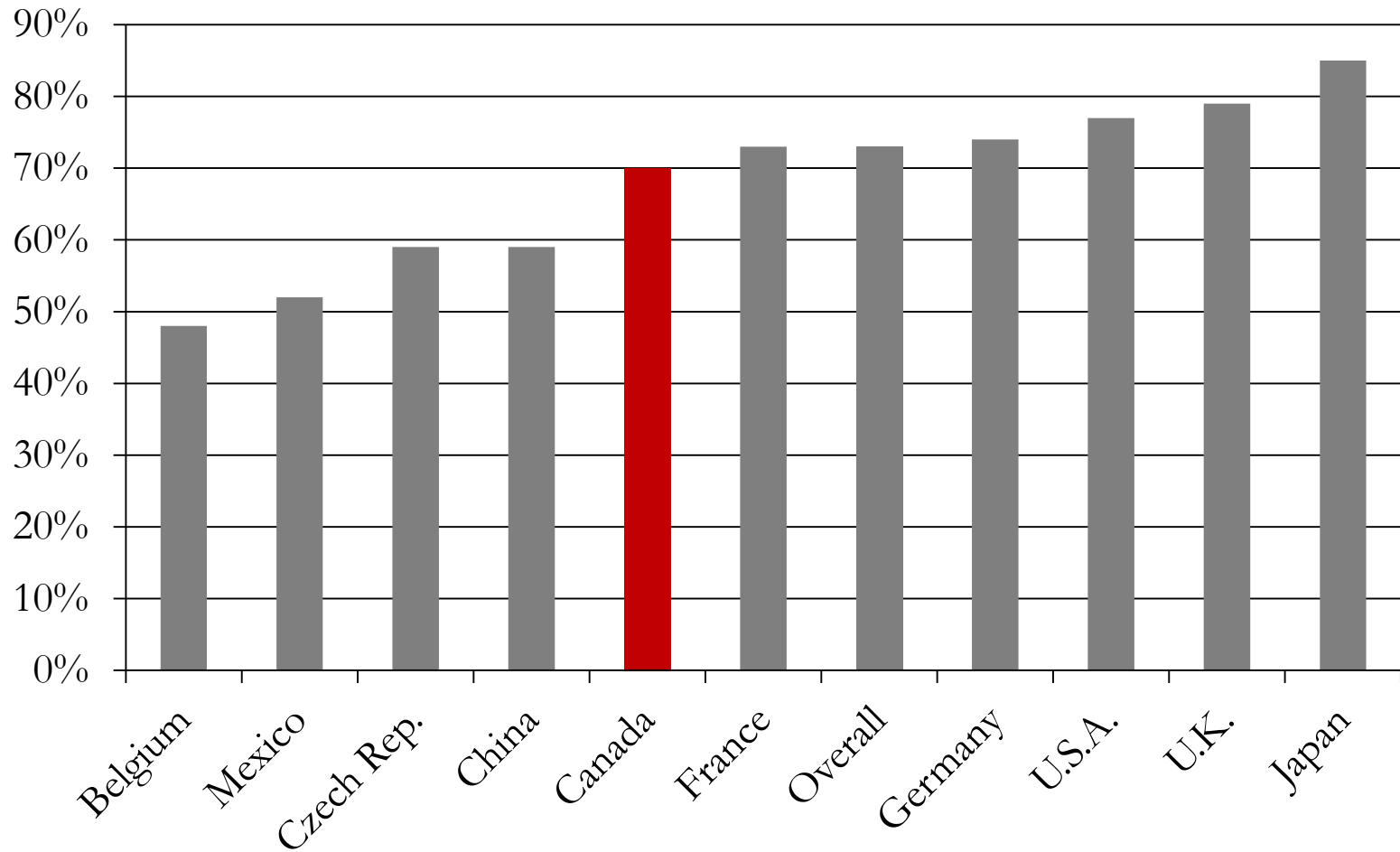
VOICE-RECOGNITION
REQUIREMENTS:
San Francisco
VOICE-RECOGNITION
PROGRAMMING: Taiwan

SPEAKER FOR TOY'S VOICE:
Dongguan, China

TRANSISTORS: Shenzhen, China
IC CHIPS: Taiwan
WIRING: Dongguan, China
PACKAGING: Hong Kong

Sources: Qualiman Industrial Co. Ltd.; Li & Fung.

Share of domestic value added in total exports (2004)



Has the globalization of value chains gone too far?

- Offshoring has undermined the U.S. technological edge (Pisano and Shih, 2009)
- Global value chains have increased Asian dependence to Western business cycles (Gangnes, Ma and Van Assche 2013)
- Global value chains vulnerable to country-specific shocks such as natural disasters (e.g. Thailand floods)
- Companies are reshoring their production to the U.S. (Boston Consulting Group)

Fung et al. (2007)

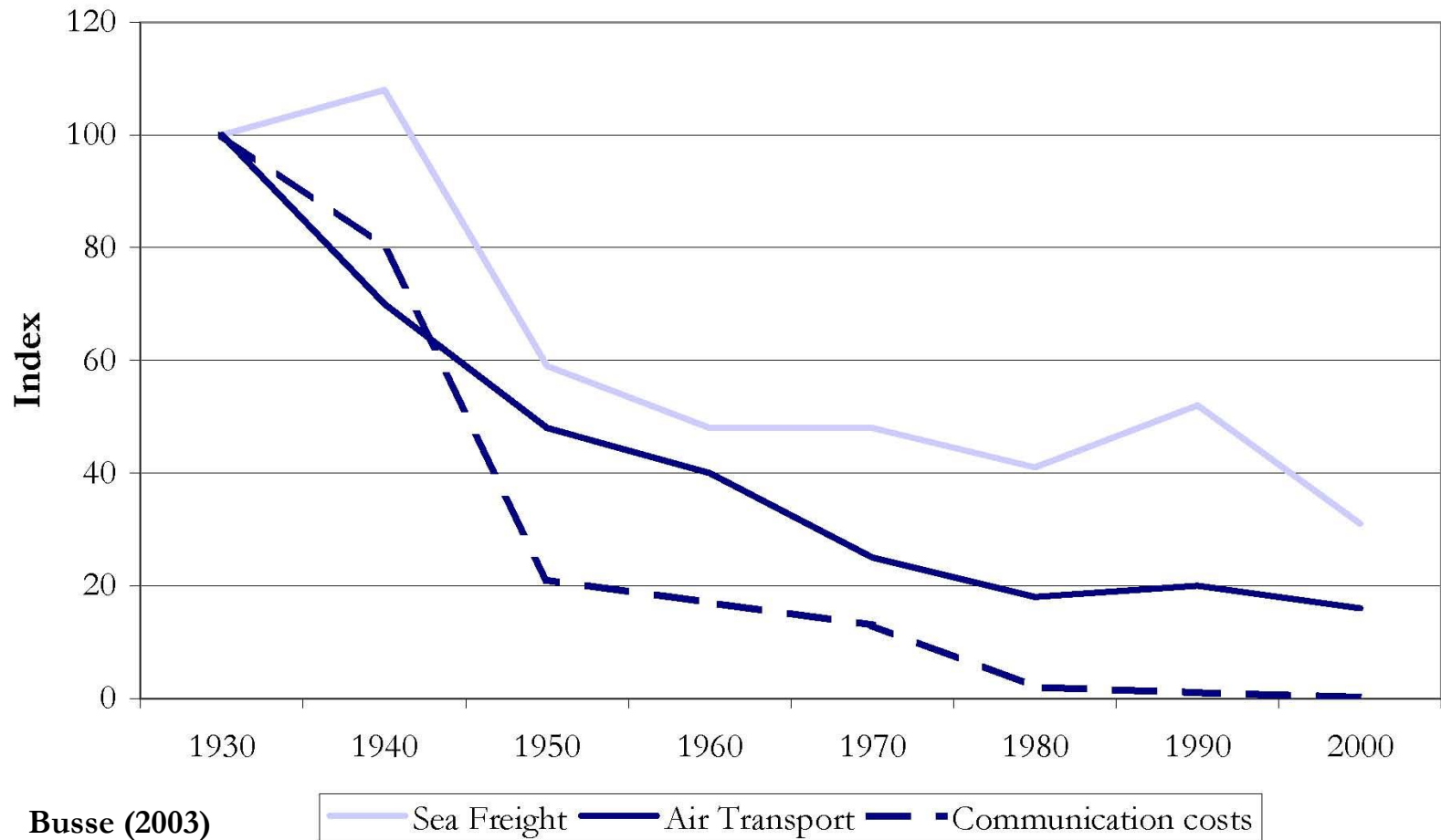
- “[O]n a Friday in early September 2006, the South African government announced that it would be imposing strict quotas on Chinese imports in two weeks. Li & Fung had orders already in production for South African retailers that would be affected by these changes. Managers began to look at contingency plans to move production to factories in different countries and even to move the last stage of existing orders to different end countries to satisfy non-China country-of-origin rules.”

This paper

- Global value chains may give firms the flexibility to rapidly respond to a trade policy shock by moving production elsewhere.
- We build a theoretical model that illustrates through which channels this may occur and what the implications are for trade.
- Using Chinese customs data, we find strong evidence in line with the theory.

Drivers of the emergence of global value chains

Transport and communication costs (in 1990 US\$)



Modularity revolution

The Modular Corporation

Work processes in practically every big department of a corporation can now be outsourced and managed to some degree offshore. Some of the biggest sectors in terms of global spending in 2005:

HUMAN RESOURCES

\$13 BILLION

Includes payroll administration, benefits, and training programs.

ENGINEERING

\$27 BILLION

Testing and design of electronics, chips, machinery, car parts, etc.

INFOTECH

\$90 BILLION

Software development, tech support, Web site design, IT infrastructure

ANALYTICS

\$12 BILLION

Includes market research, financial analysis, and risk calculation

CUSTOMER CARE

\$41 BILLION

Call centers for tech support, air bookings, bill collection, etc.

MANUFACTURING

\$170* BILLION

Contract production of everything from electronics to medical devices

FINANCE & ACCOUNTING

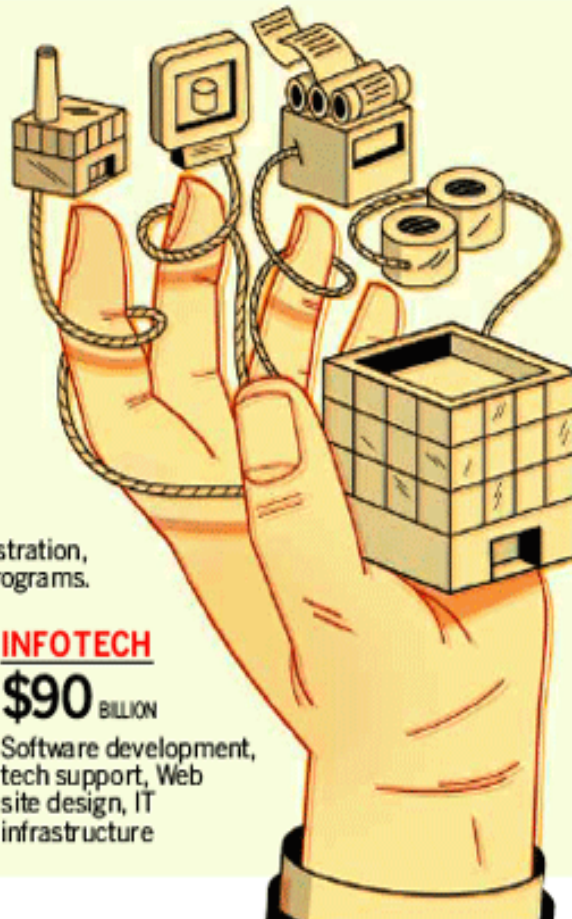
\$14 BILLION

Includes accounts payable, billing, and financial and tax statements

LOGISTICS & PROCUREMENT

\$179 BILLION

Includes just-in-time shipping, parts purchasing, and after-sales repairs



Data: IDC estimates. Analytics estimates by EvaluateSource
*Manufacturing estimate only for electronics

Vertical Specialization



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From “trade in goods” to “trade in tasks”

- Vertical specialization allows firms to arbitrage cost differences across countries at a more fine-grained task level, thus generating an extra productivity effect (Grossman & Rossi-Hansberg, 2008).
- Sources of comparative advantage at task level:
 - relative endowments
 - the quality of a country’s judiciary system (Acemoglu et al. 2007, Costinot 2009, Levchenko 2007, Nunn 2007).
 - Quality of a country’s transportation infrastructure (Gamberoni et al. 2010)

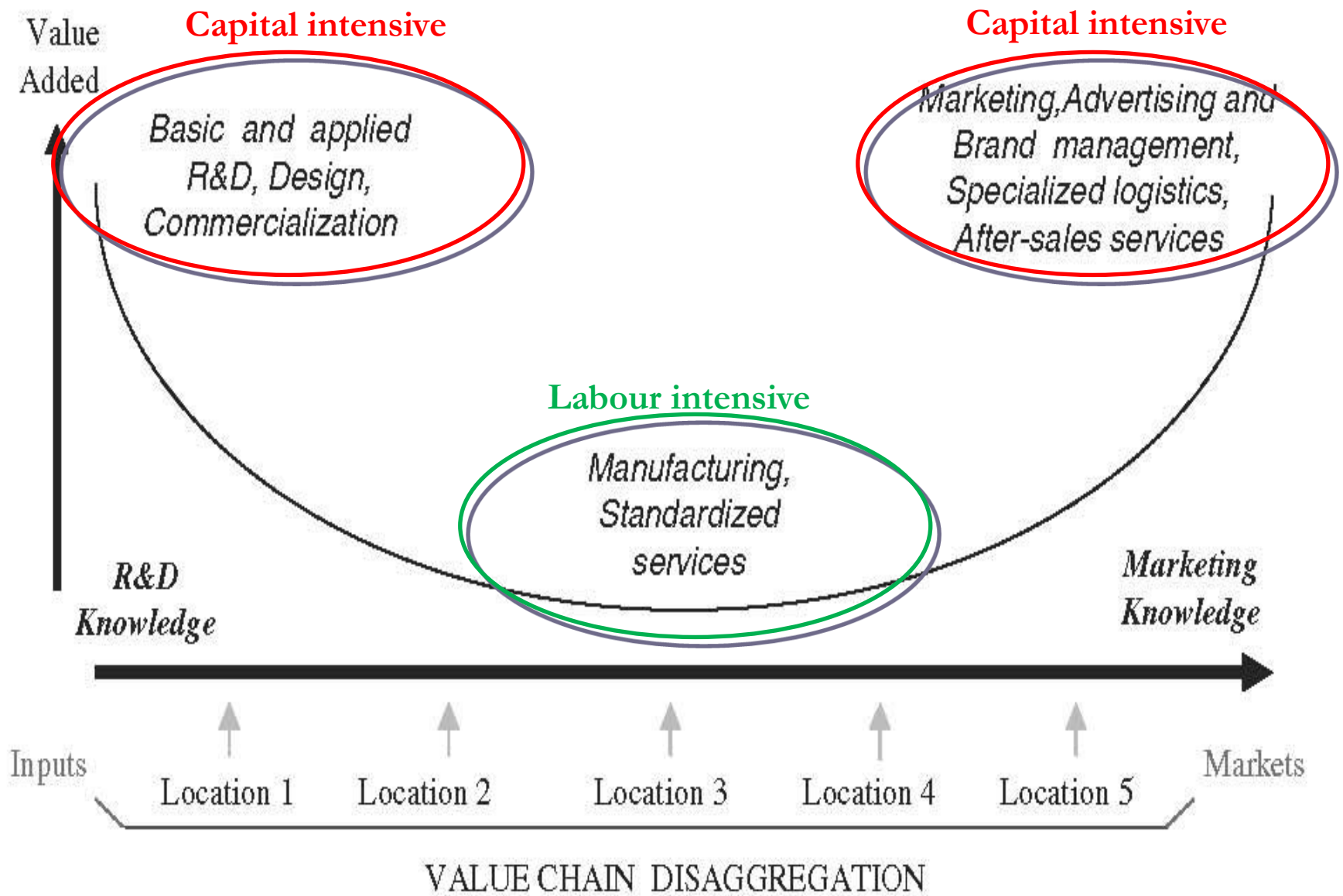


Figure 1. The smile of value creation (Mudambi, 2007).

Footlooseness and organizational flexibility

- If a value chain can be sliced up across different countries, an **operational flexibility** can be built in a value chain to rapidly respond to a country-specific shock such as government policies, a natural disaster, or an exchange rate movement.
- Its ability to do so depends on the **footlooseness** of the activities

Anti-dumping policies push Hangzhou Zhongce towards overseas production

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The factory in Thailand will be built "mainly in order to circumvent anti-dumping," said Shen Jin-Rong

Shen Jin-Rong, chairman of Hangzhou Zhongce Rubber, has spoken out in opposition to anti-dumping measures against Chinese tyres undertaken by countries such as India, Brazil and Colombia. Chen declared that such measures "do not work" and announced Hangzhou Zhongce will establish a manufacturing facility outside of China "mainly in order to circumvent anti-dumping." Thailand has been named as the location for this new plant; Hangzhou Zhongce says it will erect a factory on a 67 acre site there at an investment cost of RMB 1 billion (£102 million).

[Related news:](#)

Three-country model

- Consider three countries: *North*, *South* and a third country
- *North* and *South* differ in two dimensions:
 - Wages are lower in *South* than *North*: $\omega^S < \omega^N$
 - Tariffs imposed by third country on *North* and *South* are different
- We assume that the marginal cost of production is lower in *South* than *North*:

$$\left(\frac{\omega^N}{\omega^S}\right)^{\varepsilon-1} \left(\frac{\tau^N}{\tau^S}\right)^{\varepsilon} > 1.$$

Heterogeneous Firms

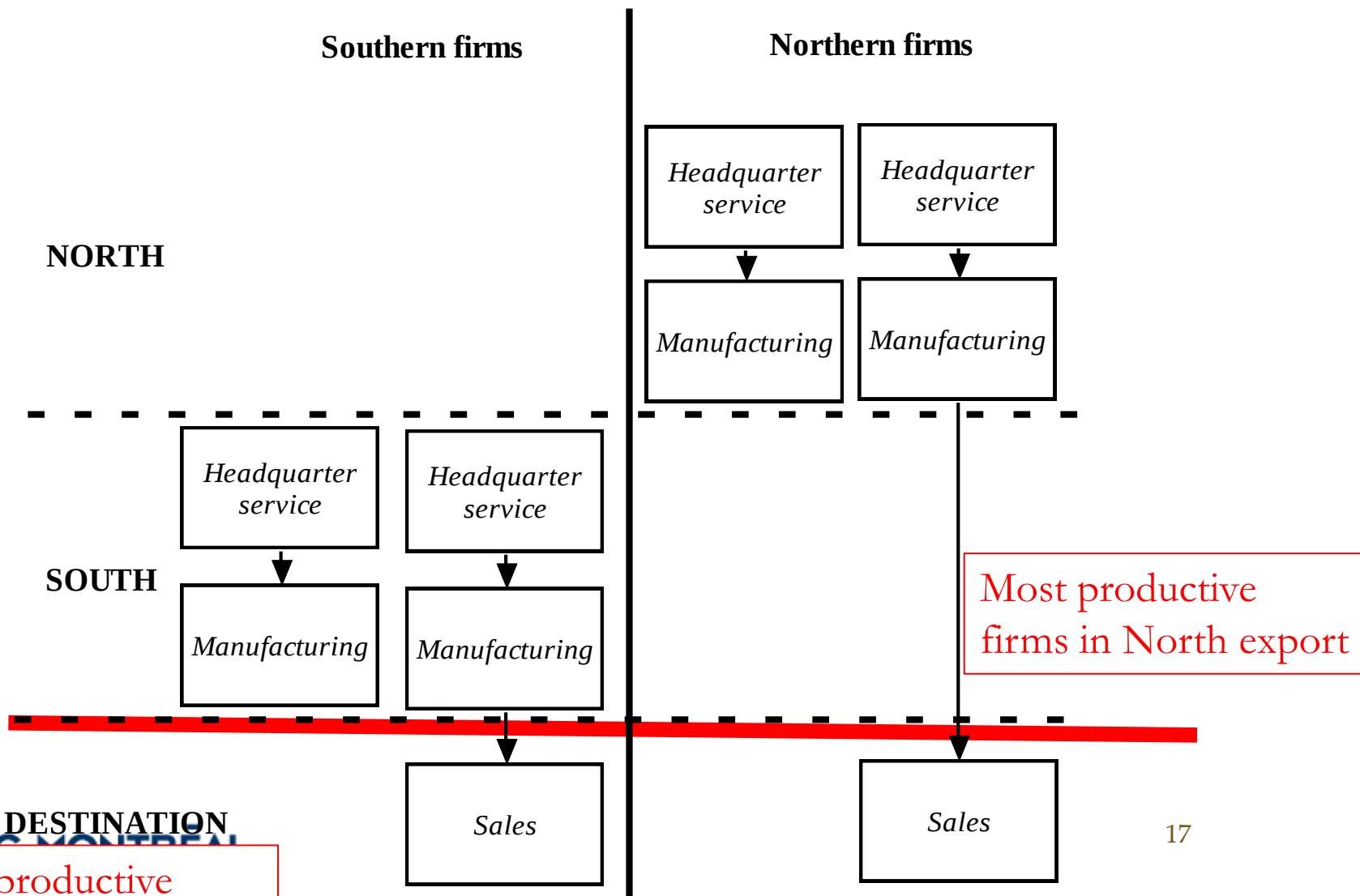
- We focus on a single industry with differentiated goods.
- A continuum of firms from *North* and *South* sell their products to a third country j .
- In each country l , each firm randomly draws a productivity from a cumulative Pareto distribution:

$$G(\varphi) = 1 - \varphi^{-z}, \quad \text{where } z > \varepsilon - 1$$

Value chain structure

- Production consists of two value chain stages:
 - Headquarter services must be produced at home (*not footloose*).
 - Manufacturing can be offshored, at an extra fixed cost (*potentially footloose*).
- Two scenarios:
 - No vertical specialization
 - Vertical specialization

Scenario 1: No vertical specialization



Scenario 1: No vertical specialization

- Individual exports: $x^l = \frac{B}{1-\alpha} \left(\frac{\varphi}{\omega^l} \right)^{\varepsilon-1} \tau^{l-\varepsilon}$,
- Aggregate exports from l :

$$X^l = \int_{\varphi^l}^{\infty} x^l(\varphi) dG(\varphi)$$

where firms with $\varphi < \varphi^l$ do not export and firms with $\varphi > \varphi^l$ export

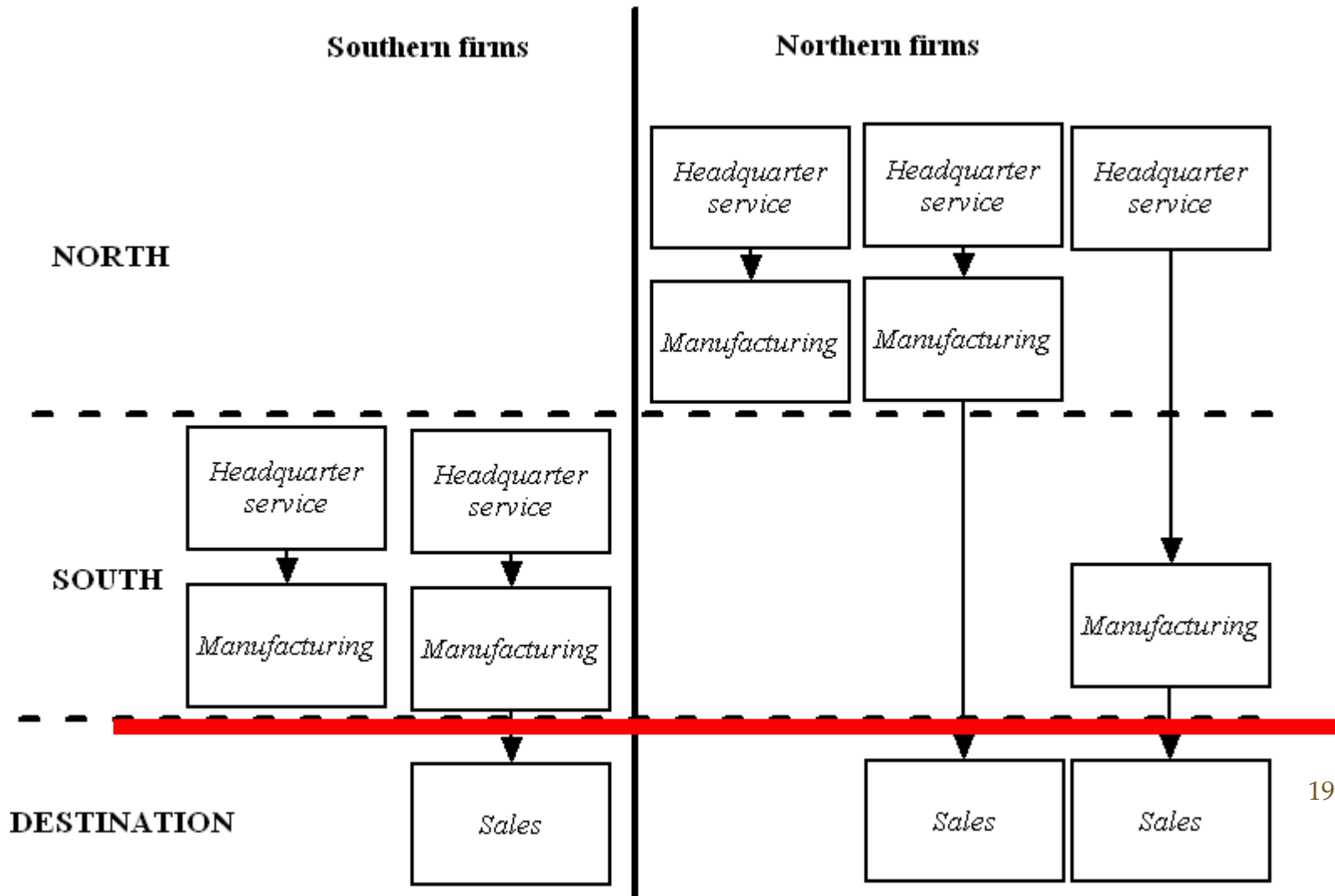
- Bilateral tariff change affects intensive and extensive margin

$$-\frac{dX^l/d\tau^l}{X^l/\tau^l} = -\frac{\tau^l}{X^l} \left(\int_{\varphi^l}^{\infty} \frac{\partial x^l(\varphi)}{\partial \tau^l} dG(\varphi) \right) + \frac{\tau^l}{X^l} \left(x^l(\varphi^l) G'(\varphi^l) \frac{\partial \varphi^l}{\partial \tau^l} \right),$$

- Elasticity of exports with respect to bilateral tariff

$$-\frac{dX^l}{X} \frac{\tau^l}{d\tau^l} = \varepsilon + (z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon - 1}.$$

Scenario 2: Vertical specialization



Result 1: Northern exports more elastic under VS

- Aggregate exports from North:

$$X^N = \int_{\varphi^N}^{\varphi^{NO}} x^N(\varphi) dG(\varphi).$$

- Bilateral tariff change affects intensive and extensive margin:

$$-\frac{dX^N/d\tau^N}{X^N/\tau^N} = -\frac{\tau^N}{X^N} \left(\int_{\varphi^N}^{\varphi^{NO}} \frac{\partial x^N(\varphi)}{\partial \tau^N} dG(\varphi) \right) + \frac{\tau^N}{X^N} \left[x^N(\varphi^N) G'(\varphi^N) \frac{\partial \varphi^N}{\partial \tau^N} - x^N(\varphi^{NO}) G'(\varphi^{NO}) \frac{\partial \varphi^{NO}}{\partial \tau^N} \right]$$

- Elasticity of Northern exports with respect to bilateral tariff

$$-\frac{dX^N/d\tau^N}{X^N/\tau^N} = \varepsilon + (z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon - 1} \left(1 + \chi \frac{X^{NO}}{X^N} \right), \quad \text{where } \chi = \frac{\left(\frac{\omega^N}{\omega^S} \right)^{\varepsilon-1} \left(\frac{\tau^N}{\tau^S} \right)^{\varepsilon}}{\left(\frac{\omega^N}{\omega^S} \right)^{\varepsilon-1} \left(\frac{\tau^N}{\tau^S} \right)^{\varepsilon} - 1} > 1.$$

Logic: extra tariff shirking effect

- Result is driven by an extra extensive margin due to tariff shirking.
 - Under no vertical specialization, more productive Northern firms cannot avoid tariff hikes by offshoring their manufacturing to the South.
 - Under vertical specialization, some Northern firms (around the threshold productivity) can circumvent the tariff hike by offshoring manufacturing to the South, leading to an extra extensive margin effect.

Result 2: Southern exports by Northern firms more elastic than those by Southern firms

- Elasticity of Southern exports by Southern firms with respect to bilateral tariff

$$-\frac{dX^S}{X^S} \frac{\tau^S}{d\tau^S} = \varepsilon + (z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon - 1}.$$

- Elasticity of Southern exports by Southern firms with respect to bilateral tariff

$$-\frac{dX^{NO}/d\tau^S}{X^{NO}/\tau^S} = \varepsilon + (z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon - 1} \chi, \quad \text{where } \chi = \frac{\left(\frac{\omega^N}{\omega^S}\right)^{\varepsilon-1} \left(\frac{\tau^N}{\tau^S}\right)^{\varepsilon}}{\left(\frac{\omega^N}{\omega^S}\right)^{\varepsilon-1} \left(\frac{\tau^N}{\tau^S}\right)^{\varepsilon} - 1} > 1.$$

- Impact of tariff hike on share of Southern exports by Northern firms

$$\frac{\partial s^{NO}}{\partial \tau^S} = -\frac{1}{\tau^S} s^{NO} (1 - s^{NO}) (z - (\varepsilon - 1)) \frac{\varepsilon}{\varepsilon - 1} (\chi - 1) < 0.$$

Result 3: Implications for production along the chain

- Tariff shirking:
 - reduces the effect of a country-specific tariff on the profits of firms that can adopt global value chains.
 - reduces the vulnerability of headquarter-services in North to a country-specific tariff shock.
 - increases the vulnerability of manufacturing in both North and South to a country-specific tariff change.

Testable Implications

- Do we find evidence that Southern exports that are part of global value chains are more sensitive to a country-specific tariff hike than Southern exports that are part of local value chains?

Data

- We draw on both province-level (1997-2009) and firm-level trade data (2000-2006) from China Customs Statistics.
 - *Processing trade*: firms enjoy the right of duty-free imports of intermediate goods that are used in their export processing activity, but face restrictions in selling to the domestic market
 - *Ordinary trade*: firms need to pay import duties on imported goods but can sell their output locally
- Processing exports are intrinsic part of global value chains, while ordinary exports have more extensive local value chains.

Data

- As our measure of country-specific trade policy shocks, we use anti-dumping cases against China as identified in the World Bank's Global Antidumping Database (Bown, 2010).
 - Benefit of antidumping is that they are generally imposed on a specific country and not across the board.
- We match the two datasets at the HS-6 digit level, the most disaggregated level at which the two datasets are comparable.

Table 2: Province-level estimation results

Dependent variable: $Share_{ijkt}$			
	Benchmark	Foreign PT/Domestic OT	Foreign PT/Domestic OT/only AD sectors
	(1)	(2)	(3)
AD	-7.590*** (0.606)	-8.371*** (0.720)	-11.118*** (0.736)
Year FE	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
Observations	931,293	713,761	410,630
R^2	0.16	0.19	0.18

Comments: Coefficients are reported with robust standard errors that are clustered at the province level. Standard errors are given in parentheses. The individual coefficient is statistically significant at the *10%, **5% or ***1% level.

Intensive versus extensive margins (Morrow and Brandt, 2013)

- We define *intensive margin* as exports by incumbent firms, i.e. firms with at least one year of positive bilateral exports in an industry before and after AD imposition.
- We define *extensive margin* as exports by non-incumbent firms, i.e. exports by firms which did not export in a year prior or after AD imposition.

Table 3: Firm-level estimation results and decomposition using value of exports

Dependent: Share of processing exports in Total Value of Export

	Benchmark			Domestic OT/Foreign PT		Domestic OT/Foreign PT/Import Cut off		Domestic OT/Foreign PT/Import Cut off/AD	
	Pooled	Intensive	Extensive	Intensive	Extensive	Intensive	Extensive	Intensive	Extensive
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
AD	-3.13*** (0.834)	-2.07* (1.147)	-2.41** (1.176)	-3.247** (1.402)	-3.271** (1.361)	-4.021** (1.420)	-3.569** (1.373)	-2.451* (1.468)	-4.449*** (1.401)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	370,871	91,692	279,179	76,637	217,223	76,250	216,889	28,029	124,457
R2	0.28	0.44	0.32	0.44	0.33	0.44	0.33	0.46	0.34

Comments: Coefficients are reported with robust standards errors that are clustered at the FIRM level. Standard errors are given in parentheses. The individual coefficient is statistically significant at the *10%, **5% or ***1% level.

Conclusion

- Vertical specialization has made it easier for firms to alter their production and trade structure to circumvent tariff shocks.
- While tariff shirking has reduced the effectiveness of trade policy, it has increased the elasticity of trade to country-specific tariff shocks.
- Using Chinese data, we find strong evidence that export processing trade is more sensitive to anti-dumping shocks than ordinary trade.

Conclusion (2)

- **Reshoring** may simply be the reaction of firms to circumvent the shock of Chinese wage increases.
- **Thai floods** had such a big impact on the entire value chain since the production activities were not footloose.