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Explaining China's Position in the Global Supply Chain

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Outline

- International production fragmentation
- Vertical specialization
- Antras' theory of offshoring
- Theory meets reality I: Examining the Chinese Data
- Theory meets reality II: Econometric Analysis
- Conclusions

Findings

- In relatively R&D-intensive industries, there is *less offshoring* to China, and very *high foreign content* in Chinese processing exports.

  ⟹ China is engaged in final assembly stages of the global chain.

- As R & D intensity falls, Chinese industries undertake *more processing trade*, and that processing trade has *lower foreign content*.

  ⟹ China produces more advanced stages of production domestically.

- The possibility of producing via a *foreign affiliate* in China *increases offshoring* to China, even for relatively R&D-intensive industries.

I. International production fragmentation

- **Definition:** Slicing the stages of production thinner and thinner, and producing these stages in various geographic locations

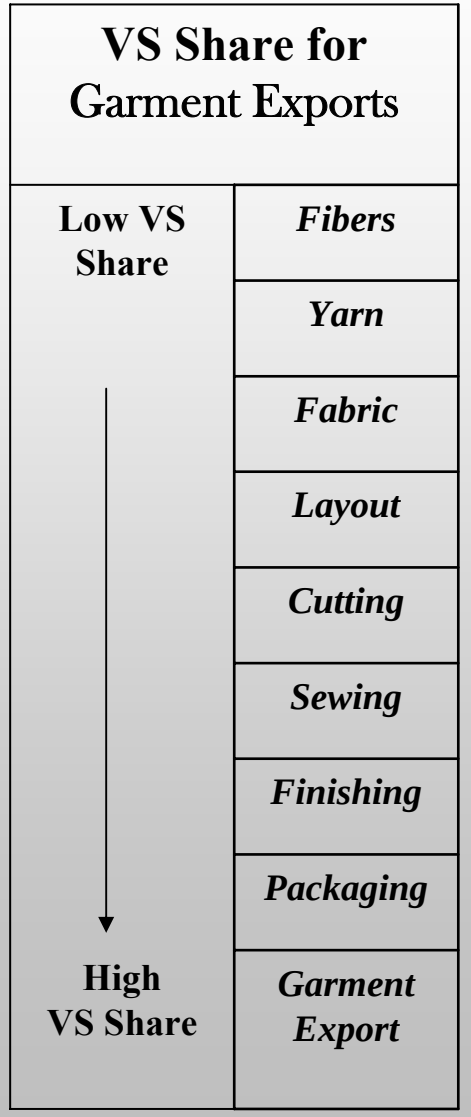
- **Impact on trade patterns:**
  - Goods cross borders many more times as they advance through the stages of production
  - Exports from countries in these global chains become "vertically specialized"

- **Importance:**
  - China is a key player in global supply chains for many products
  - Processing trade is extensive: over 50% of China's exports and about 40% of China's imports were classified as processing during 1995-2007.

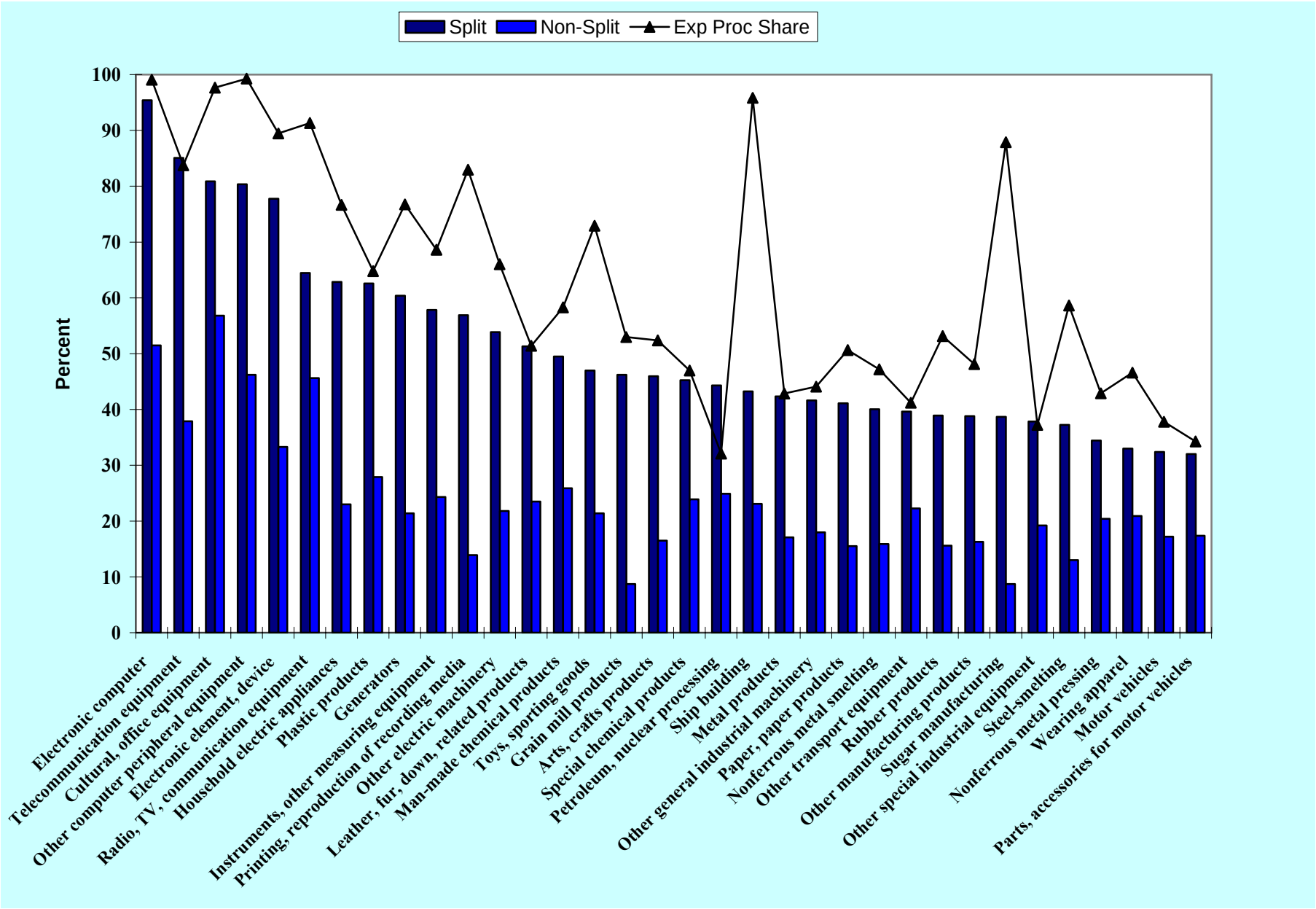
- ***But where is China in these supply chains?***

II. Vertical specialization

- Dean, Fung and Wang (2008) quantify the extent of vertical specialization by measuring the *foreign content* embodied in Chinese exports (**VS share**).
  - processing import data to more accurately identify imported intermediates.
  - input-output tables to capture direct and indirect use of imported intermediates (following Hummels, et al., 2001).
  - separate inferred input-output tables for processing and non-processing trade (from Koopman, Wang and Wei, 2008) to capture different "imported input intensities" in production.
- DFW find a wide range of VS shares across Chinese manufacturing exports.



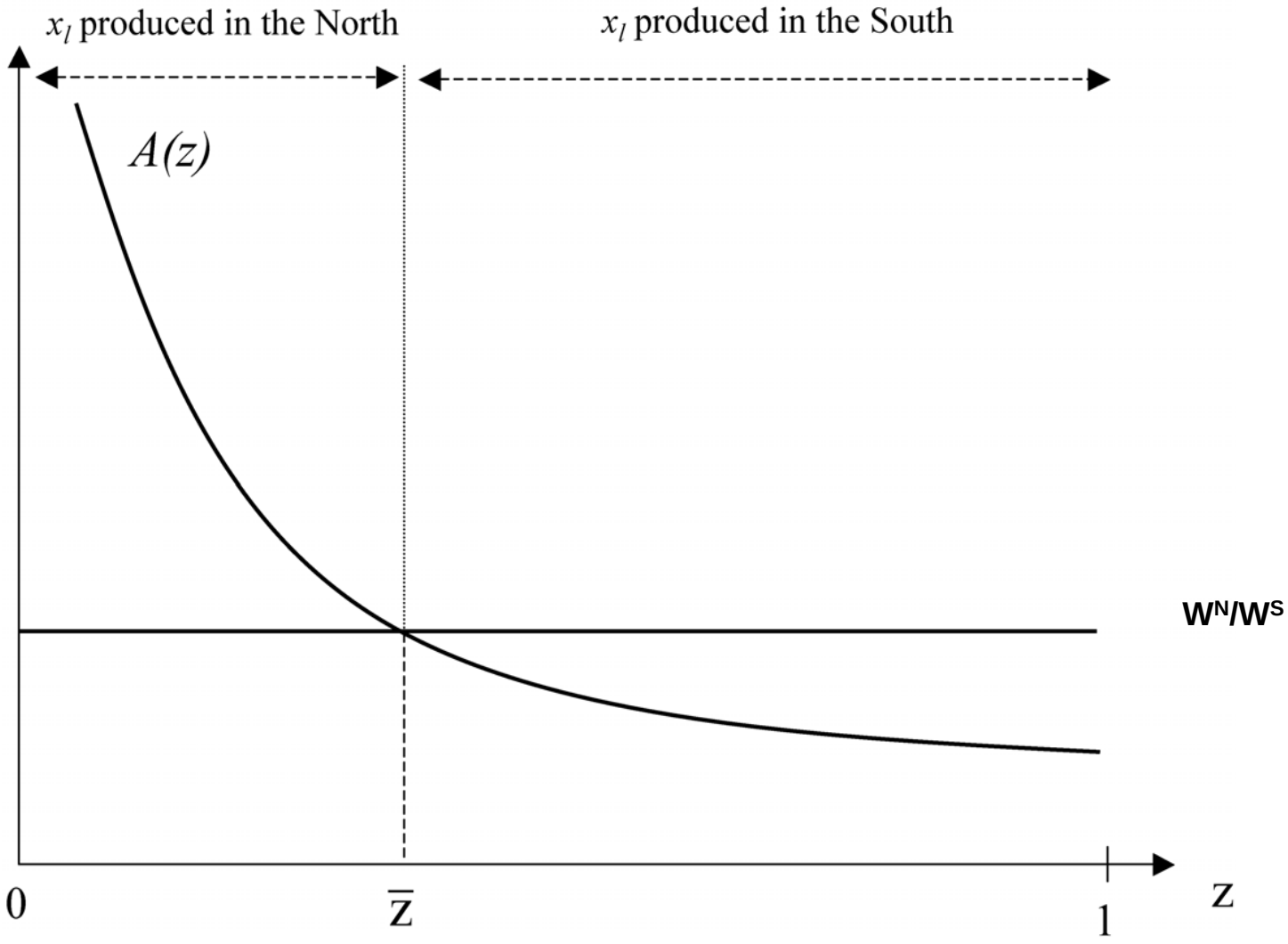
VS Shares of Chinese Merchandise Exports by Sector, 2002 (DFW 2008)



III. Antras' (2005) theory of offshoring

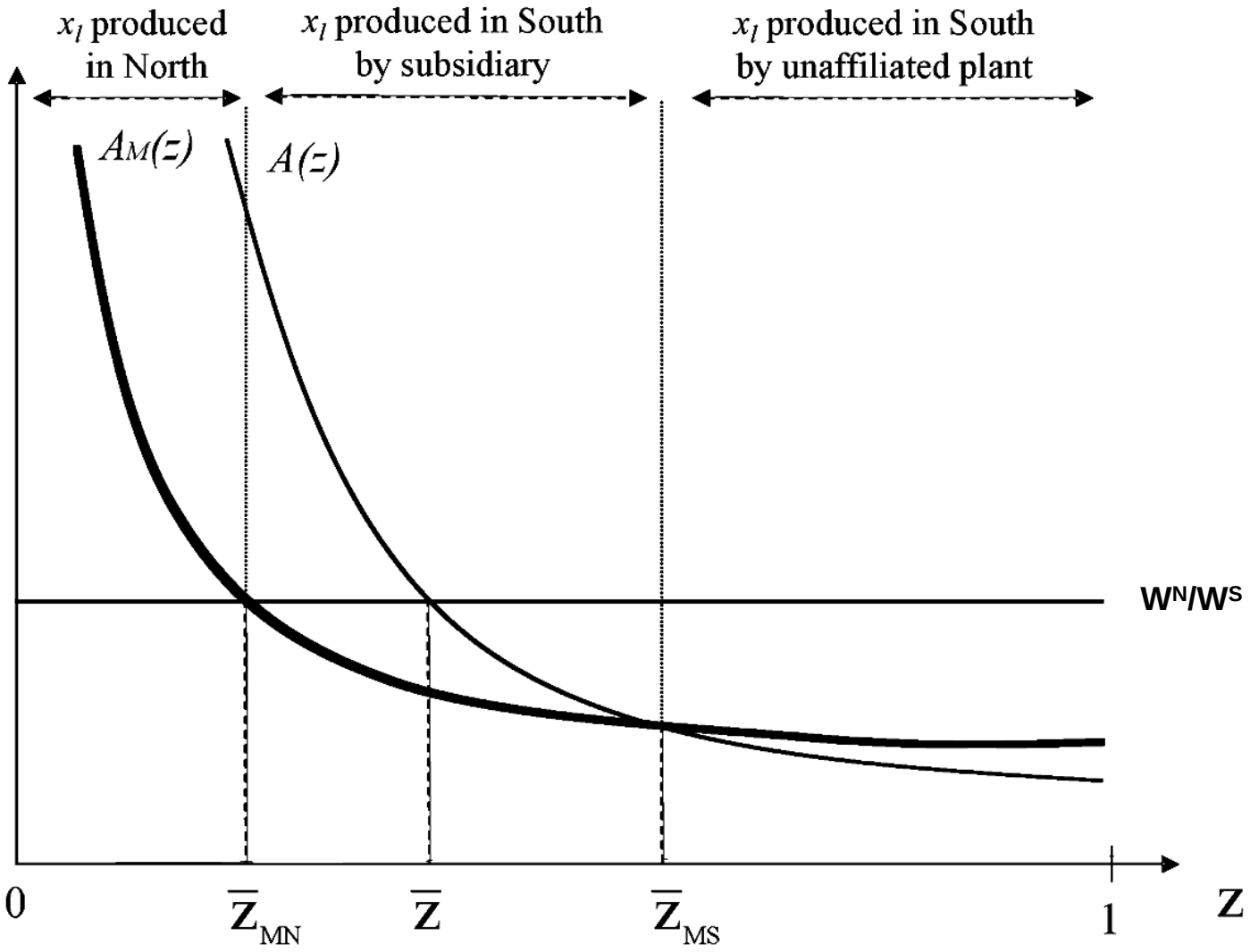
- When a product is new, and a high share of costs are due to R&D, offshoring may not take place.
    - RISK: Savings through offshoring the low-tech stages of production to a country with relatively lower wages will be outweighed by the possibility of low-quality, low-tech inputs.
- As the product matures, more stages of production become standardized, lowering this risk and leading to more offshoring.
- The ability to reduce this risk by using an affiliate firm for production abroad, increases the likelihood of offshoring.

Location choices for producing the low-tech input x_l (Antras, 2005)



The "low-tech intensity" of the product

An equilibrium with multinationals (Antras, 2005)



The "low-tech intensity" of the product

Hypotheses for a cross-section of industries

1. Offshoring increases as the "R&D intensity" of the product falls compared to the relative wage (w^N/w^S).

2. Given a level of R&D intensity, offshoring increases as the relative wage rises.

3. The possibility of producing via a foreign affiliate raises the likelihood of offshoring, even for R&D intensive goods.

4. Offshoring will be done less through foreign affiliates and more through independent southern firms as R&D intensity declines.

IV. Theory meets reality I: Examining the Chinese Data

Variable	Definition	Source
VS shares (2002)	Value of direct and indirect imported intermediates/ value of merchandise exports	Dean, Fung and Wang (2008) *Concorded from IO classification to ISIC revision 3, 4-digit*
RD Intensity (2002)	US R&D expenditure/output	OECD *ISIC revision 3, 4-digit*
US average wage (2004)	US wages and salaries/# of employees	UNIDO *ISIC revision 3, 4-digit*
Chinese average wage (2002)	Payroll/average employment	NBS Survey of Industrial Enterprises *Concorded from Chinese 2002 industrial classification to ISIC revision 3, 4-digit*

Figure 6: US R&D Intensity, US-China Relative Wages, and VS Shares 2002

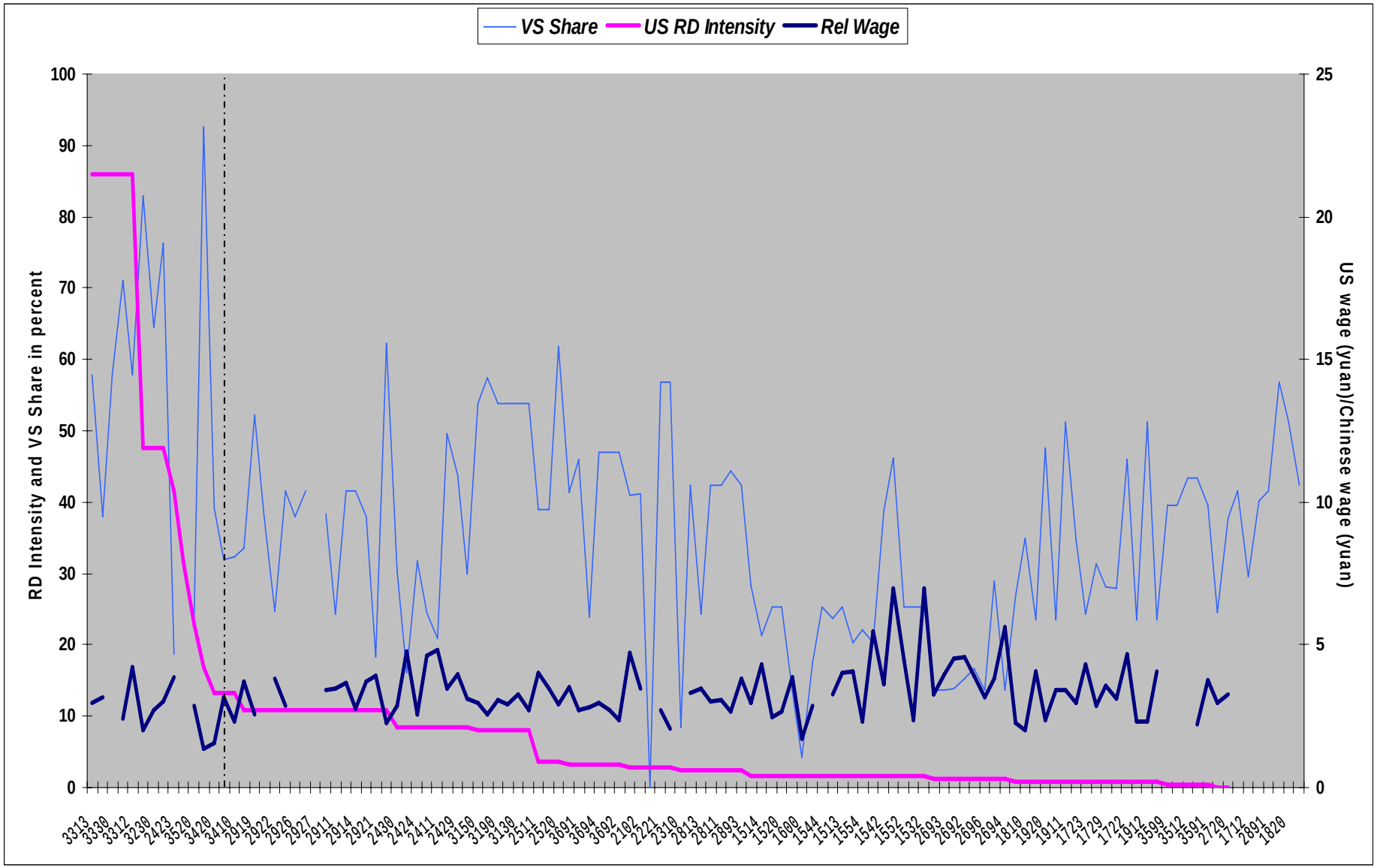


Table 1. Sector Descriptive Statistics by RD Intensity (mean values), 2002

Sectors Grouped by RD Intensity	(1) US RD Intensity	(2) Relative Wage	(3) VS Share	(4) Processing VS Share	(5) Processing Export Share	(6) FIE Share of Processing Exports
>20%	**21.50**	3.19	56.47	79.72	0.71	0.71
10-20%	**10.80**	2.91	60.61	76.76	0.61	0.69
4-8%	**3.96**	2.25	44.02	75.22	0.52	0.70
1-3%	**2.39**	3.37	39.55	72.59	0.40	0.70
<1%	**0.42**	3.44	31.34	66.57	0.38	0.68
All Sectors	2.47	3.33	36.17	69.44	0.42	0.69

V. Theory meets reality II: Econometric Analysis

$$\boldsymbol{VSshare}_i = \boldsymbol{f}(\boldsymbol{PXshare}_i, \boldsymbol{PVSshare}_i) \qquad (3)$$

$$+ \qquad +$$

$$PXshare_i = g(RDInt_i, RelWage_i, RDInt_i * PXshare_i^{FIE}) \qquad (4)$$

$$- \qquad + \qquad +$$

$$PVSshare_i = h(RDInt_i, RelWage_i) \qquad (5)$$

$$+ \qquad -$$

Substitute (4) and (5) into (3) and simplify:

$$\boldsymbol{VSshare}_i = a_0 \boldsymbol{lnRDInt}_i + a_1 \boldsymbol{lnRelWage}_i + a_2 \boldsymbol{lnRDInt}_i * \boldsymbol{PXshare}_i^{\boldsymbol{FIE}} \qquad (6)$$

Table 2.
The Determinants of VS Share across Chinese Industry Exports, 2002

	Equation (6)
Dependent var: VS Share	GLS
ln US R&D Intensity	-8.26** (-3.61)
ln Relative Wage	-3.96 (-0.54)
ln US RD Intensity * FIE Share of Processing Exports	9.28** (2.87)
Constant	28.67** (3.10)
Industry effects	yes
Clustering	yes
Obs	100
R^2	0.80
Root MSE	8.39

A Two stage analysis

First stage: $$PXshare_i = g(RDInt_i, RelWage_i, RDInt_i * PXshare_i^{FIE}) \quad (7)$$

Second Stage: $$VSshare_i = b_0 lnRDInt_i + b_1 lnRelWage_i + b_2 PXshare_i .$$

$PVS\ Share_i$

Table 3. The Determinants of VS Share in Chinese 2002 Exports: Two Stage Decision

	(6)	(6)
	IV First Stage (t-statistics)	IV Second Stage (z-statistics)
Dependent Variable	*Processing Export Share*	*VS Share*
ln US R&D Intensity	-18.21** (-4.49)	2.32* (2.36)
ln Relative Wage	-31.44** (-3.09)	3.46 (0.56)
ln US RD Intensity * FIE Share of Processing Exports	26.38* (2.47)	-
Instrumented Processing Export Share	-	0.56** (7.68)
Constant	0.70** (4.97)	9.46 (1.00)
Obs	*100*	*100*
R^2	*0.67*	*0.48*
F-statistic	*27.22***	-
Root MSE	*0.17*	*11.77*
Wald X^2	-	*118.60***

Conclusions

- The ability of a firm to insure against "quality" risk plays a role in determining China's place in the global supply chain.
- In relatively R&D-intensive industries, where lower-tech inputs have unique requirements, China appears to be at the end of the global chain.
- In more standardized products, where input requirements are more universal, China produces more advanced stages of the global chain.
- The possibility of producing via a *foreign affiliate* in China increases the extent of processing exports, even in relatively R&D-intensive industries.

Further work

- FIE: Wholly-owned vs. equity joint ventures
- Processing trade: processing and assembly vs. processing with imported inputs