China's Exports: What Products Are Sophisticated?

Enrico Marvasi

Manlio Masi Foundation and University of Rome Tor Vergata
enrico.marvasi@uniroma2.it

November 27, 2010

Outline

Introduction: Facts

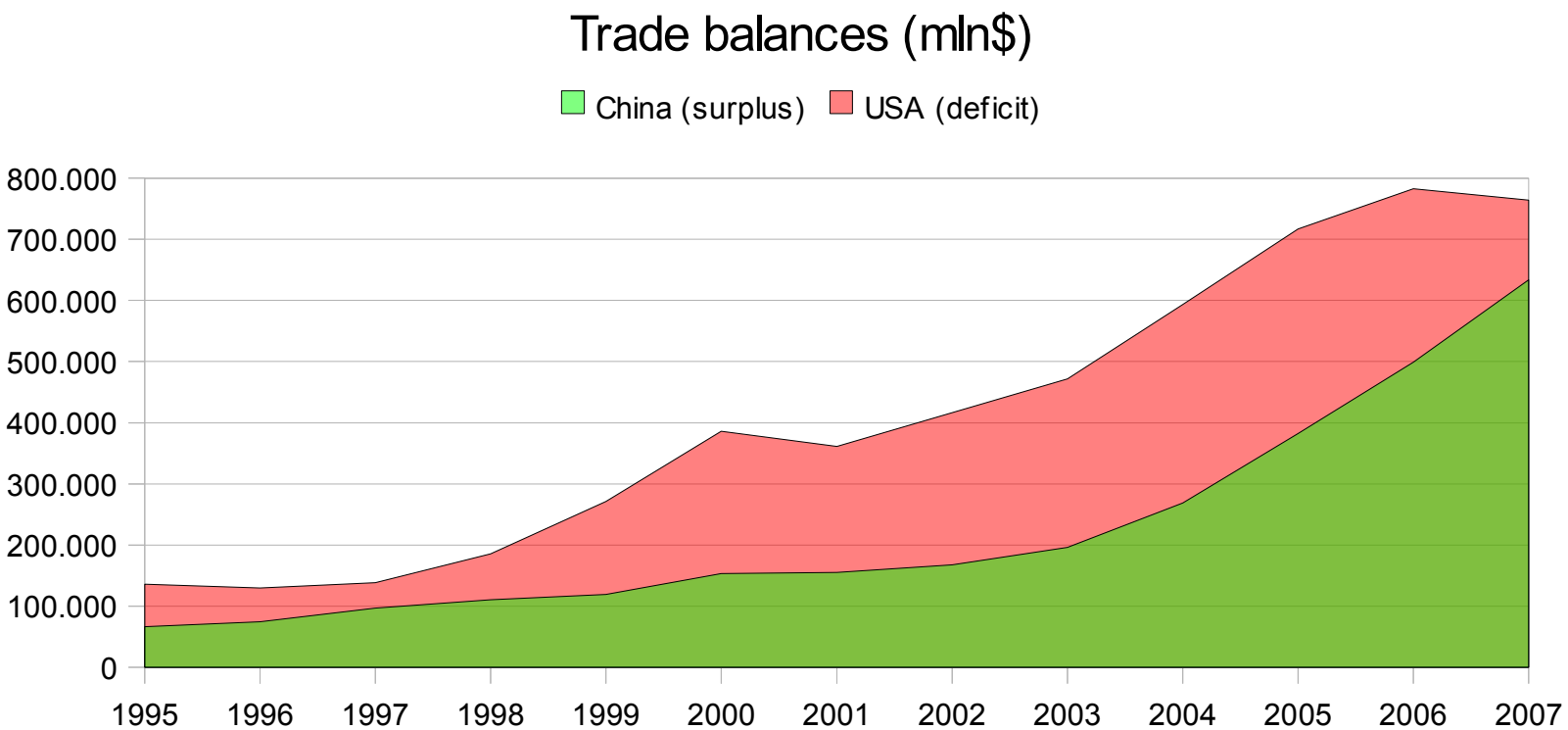
China's position in the world trade:

- First world exporter
- Large trade surplus (US deficit)
- Export growing faster than GDP
- Export accounts for over 40% of GDP

China's export composition changed rapidly:

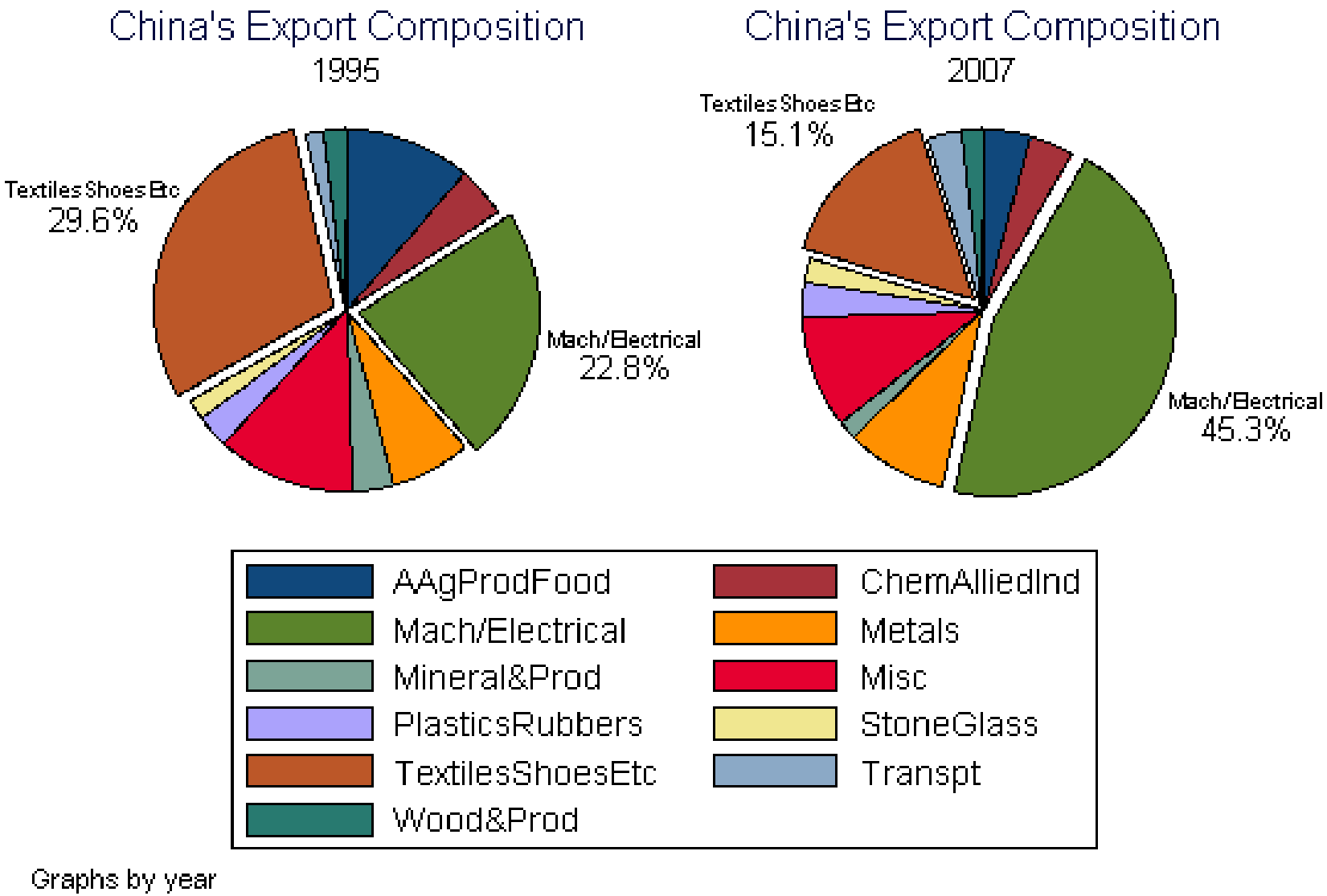
- Reduction in traditional sectors (Textile-Shoes)
- Boom in more advanced sectors (Machinery-Electricals)

China's Trade Surplus



China's GDP and Export

China's Change in Export Composition



China's Exports Sophistication

Rapid change in the export structure also at the product level

⇓

Rodrik *...export bundle is that of a country with an income per capita 3 times higher...* [Rodrik (2006)]

Schott *...export bundle overlaps significantly with that of developed economies...* [Schott (2008)]

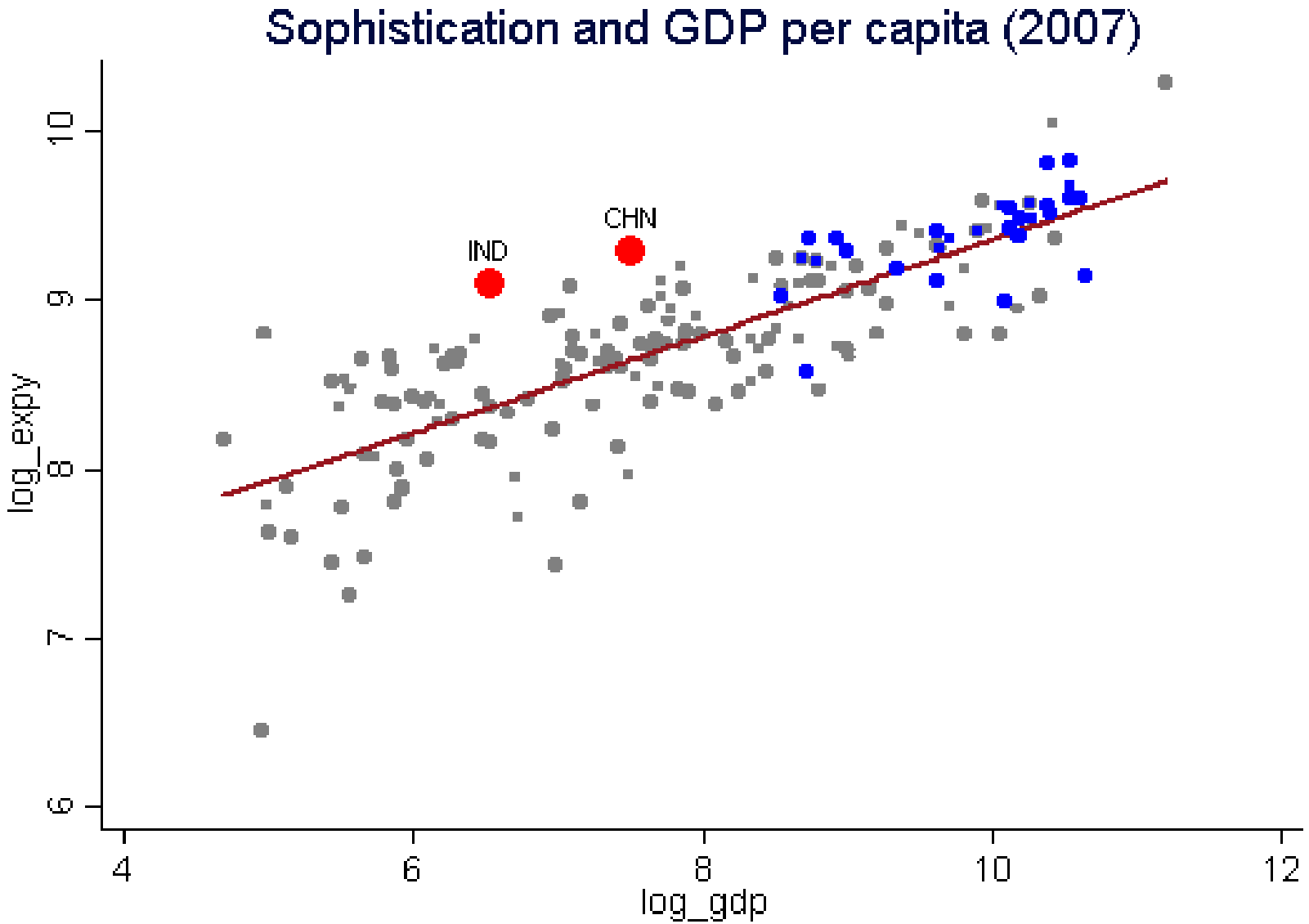
Issues:

a) What accounts for China's exports sophistication?

b) What products/sectors are sophisticated?

c) Crowding out of export from developed countries?
[see Giovannetti-Sanfilippo-Velucchi (2010)]

Is China Special?



a) What Accounts for Exports Sophistication?

1. Level of development (special) and size (not so special)

   [Rodrik (2006), Schott (2008), Xu (2010)]

2. Processing trade and sophisticated imports (mixed)

   [Amiti-Freund (2007), Wang-Wei (2008), Cui-Syed (2007)]

3. FDI and foreign firms (mixed)

   [Wang-Wei (2008), Xu-Lu (2009)]

4. Human capital and skill abundance (mixed)

   [Amiti-Freund (2007), Schott (2008), Wang-Wei (2008)]

5. Government policies

   [Rodrik (2006), Wang-Wei (2008)]

b) What Products Are Sophisticated?

1. Machinery, Chemicals and Consumer Electronics
   [Rodrik (2006), Schott (2008), Cui-Syed (2007), Van Assche-Gangnes (2007), Lemoine-ÜnalKesenci (2004)]
2. Low priced, low quality varieties (mainly consumer goods)
   [Rodrik (2006), Schott (2008), Fontagné-Gaulier-Zignago (2008), Wang-Wei (2008), Xu (2010)]

Our countribution:

- *6-digit* products, 179 countries, 95-07 (BACI data)
- Imports sophistication
- Consumption, Capital and Intermediate goods
- Price/quality differentiation

Import and Export

Is China importing sophisticated inputs?

We must consider the link between import and export:

- Processing trade is a large share of trade

  [50% in Amiti-Freund (2007), Cui-Syed (2007), Lemoine-ÜnalKesenci (2004)]

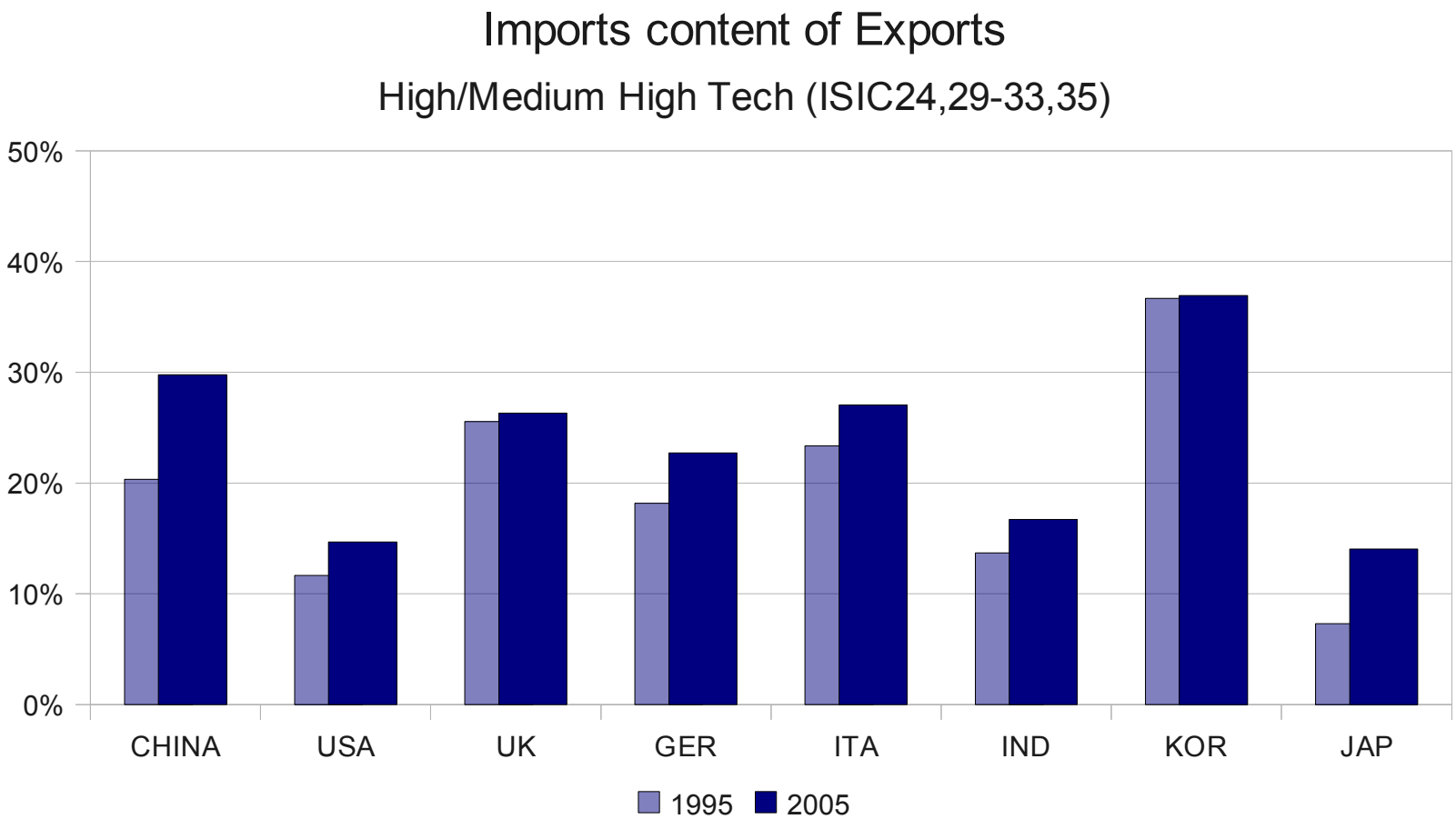
- Import content of export is high

  [25-40% OECD data, Hummels-Ishii-Yi (2001); 50-75% in Dean-Fung-Wang (2007), Koopman-Wang-Wei (2008)]

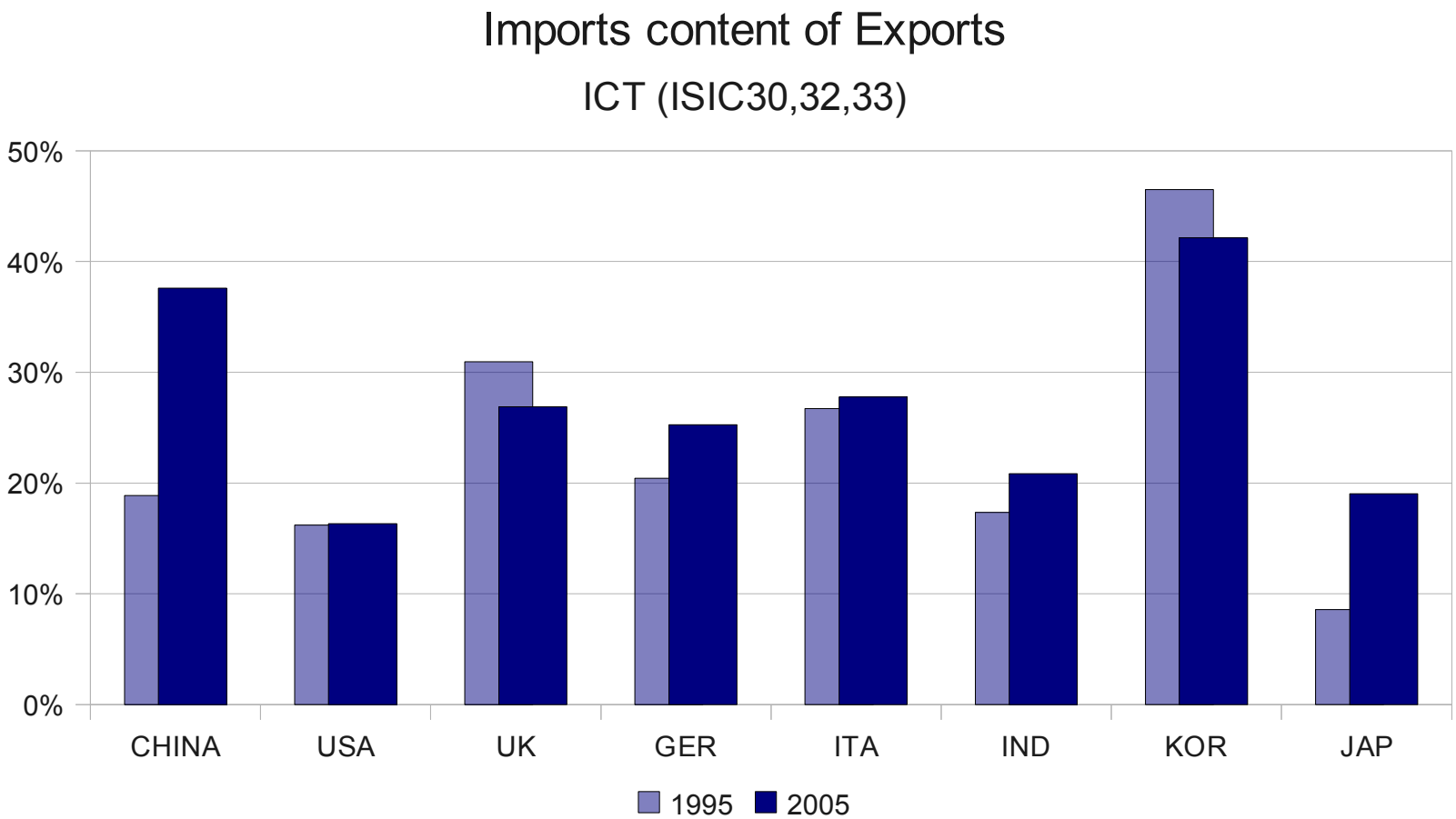
- Intra-industry trade increasing and relatively high

  [20% China-EU27 SITC *5-digit* in Dettmer *et al.* (2009), 35% China-Japan in 2004 SITC *3-digit*, 20% in 1992 China-OECD SITC *3-digit* Hellvin (1996)]

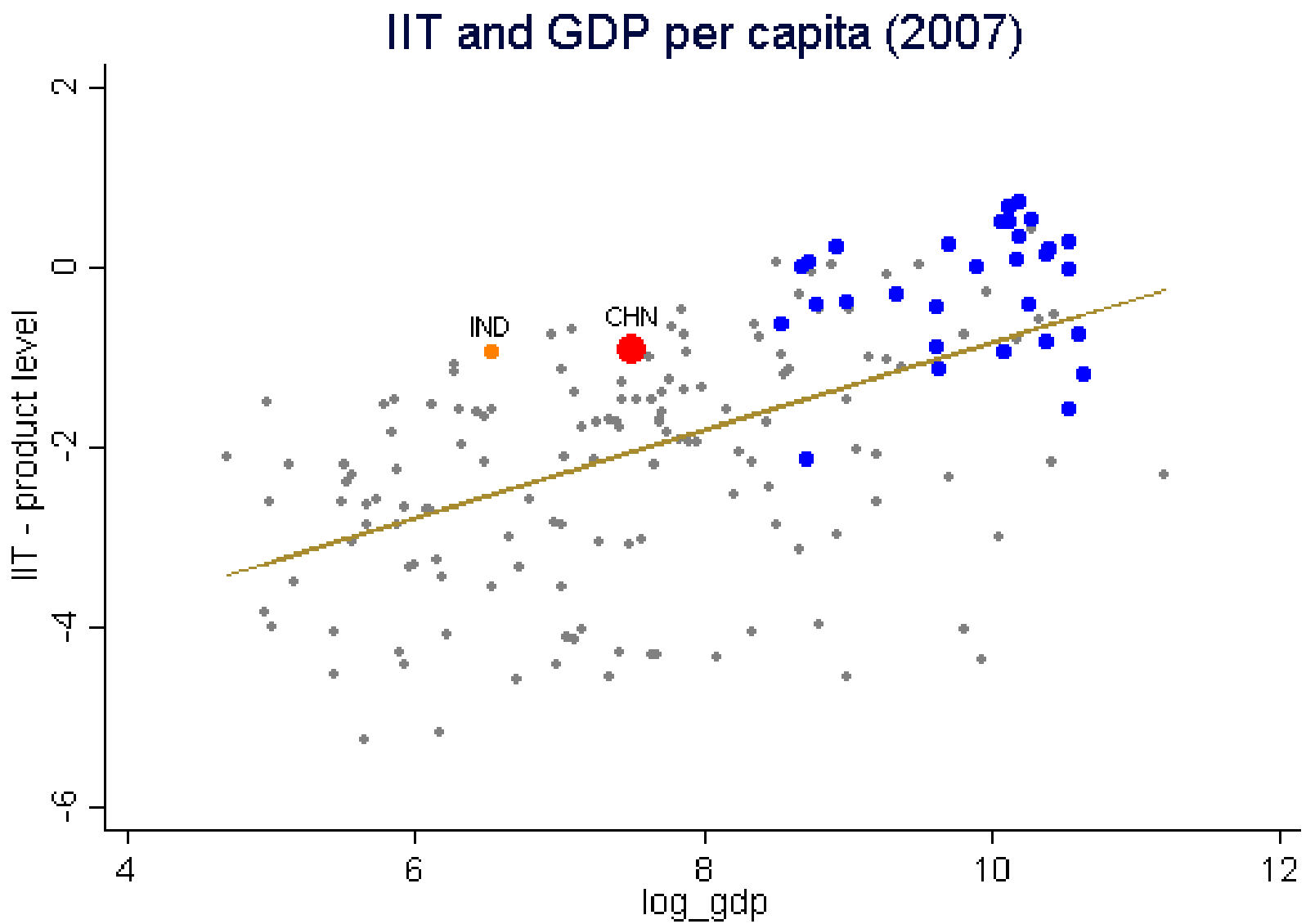
China's Import Content of Export in High-Tech



China's Import Content of Export in ICT



China's IIT is relatively high
(Grubel-Loyd index)



China's Export-Import Correlation

- China's IIT is downward biased due to China's surplus
- Export-Import regressions for additional evidence
  - baseline regression $x = \alpha + \beta m + \varepsilon$
  - IIT $\beta > 0$; inter-industry trade $\beta < 0$
  - GL index max only if $\alpha = 0$, $\beta = 1$ and $R^2 = 1$

Overall Trade OLS Coefficients $x = \alpha + \beta m + \varepsilon$

β	1995 (R^2)	2000 (R^2)	2007 (R^2)
Country level	.53* (.65)	.50* (.57)	.54* (.69)
Sector level	.36* (.22)	.38* (.21)	.42* (.27)
Product level	.29* (.09)	.30* (.10)	.37* (.16)
Country-Sector	.36* (.18)	.29* (.15)	.34* (.18)
Country-Product	.22* (.05)	.19* (.05)	.26* (.07)

* $p < .01$ robust s.e.

China's Export-Import OLS Coefficients

β		1995	2000	2007
Overall	Country-Product level	.22*	.19*	.26*
Some sectors	*Apparel (61-62)*	.47*	.33*	.47*
	Electronics (85)	.36*	.35*	.42*
	Opticals (90)	.24*	.31*	.37*
	Machinery (84)	.22*	.25*	.30*
	Chemicals misc. (38)	.18*	.24*	.29*
Some countries	*South Korea*	.16*	.22*	.33*
	Italy		.06*	.27*
	USA	.07*	.13*	.26*
	Germany		.09*	.21*
	Oil exporters	< 0*	< 0*	< 0*

* $p < .01$ robust s.e.

China's Extensive Margin

Number of products both imported and exported

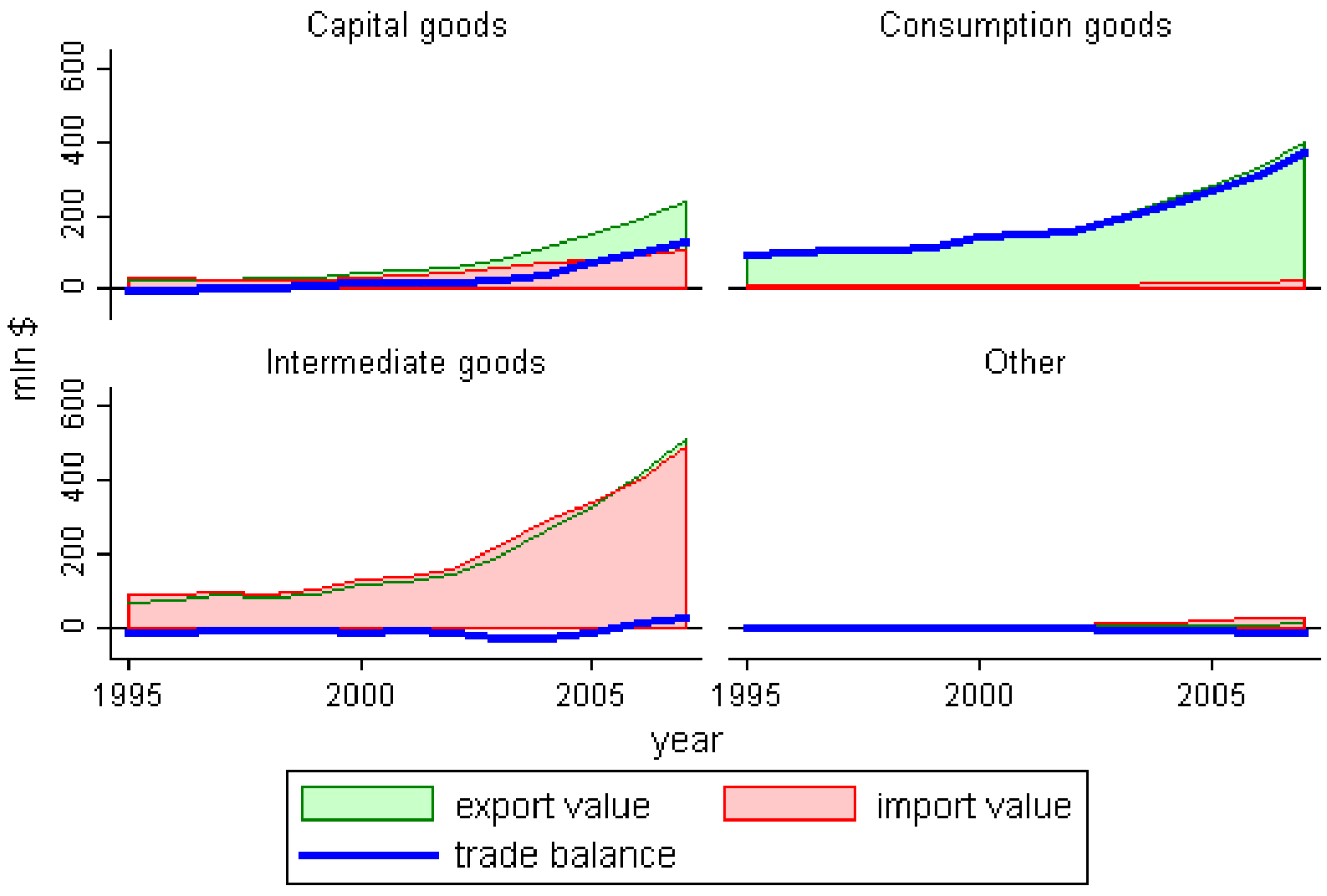
- Number of products traded correlates with country size
- Number of products/size affects sophistication measures (export overlap)

Countries trading more than 1000 products with China

	1995	2000	2007
1^{st}	Japan	Japan	USA
2^{nd}	USA	USA	Japan
3^{rd}	Korea	Korea	Korea
4^{th}	Singapore	Germany	Germany
5^{th}	Germany	Singapore	Italy
total	*16 countries*	*24 countries*	*33 countries*

China's Trade by Product Class

China imports Intermediate products (mainly from Asia)



Graphs by Capital, Intermediate or Consumption goods

Sophistication Indexes
Construction

Export Sophistication [Rodrik (2006)]

- Product level

$$prody_p = \sum_c \frac{x_{cp}/\sum_c x_{cp}}{\sum_c x_{cp}/\sum_c x_{cp}} y_c = \sum_c \frac{RCA_{cp}}{\sum_c RCA_{cp}} y_c$$

- Country level

$$expy_c = \sum_p \frac{x_{cp}}{\sum_p x_{cp}} prody_p$$

Import Sophistication, our measure

- Country level

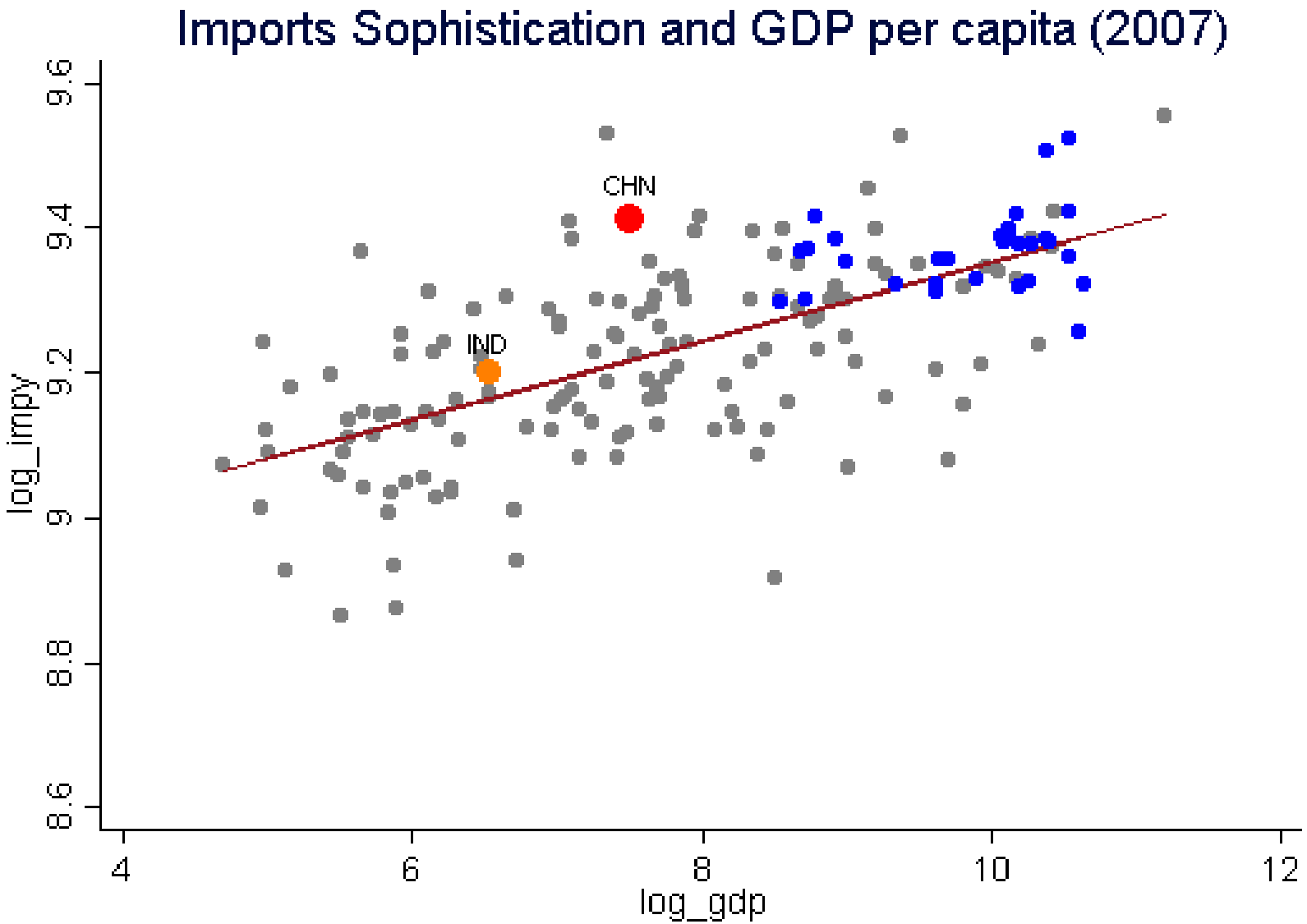
$$impy_c = \sum_p \frac{m_{cp}}{\sum_p m_{cp}} prody_p$$

Sophistication Indexes
Interpretation

1. Sophisticated products are those exported by developed countries (Rodrik's $prody_p$)
2. Sophisticated export if concentrated on sophisticated products (Rodrik's $expy_c$)
   - exporting products that developed countries export
   - export similarity with developed countries (see Schott)
3. Sophisticated import if concentrated on sophisticated products ($impy_c$)
   - importing products that developed countries export
   - import similarity with export from developed countries

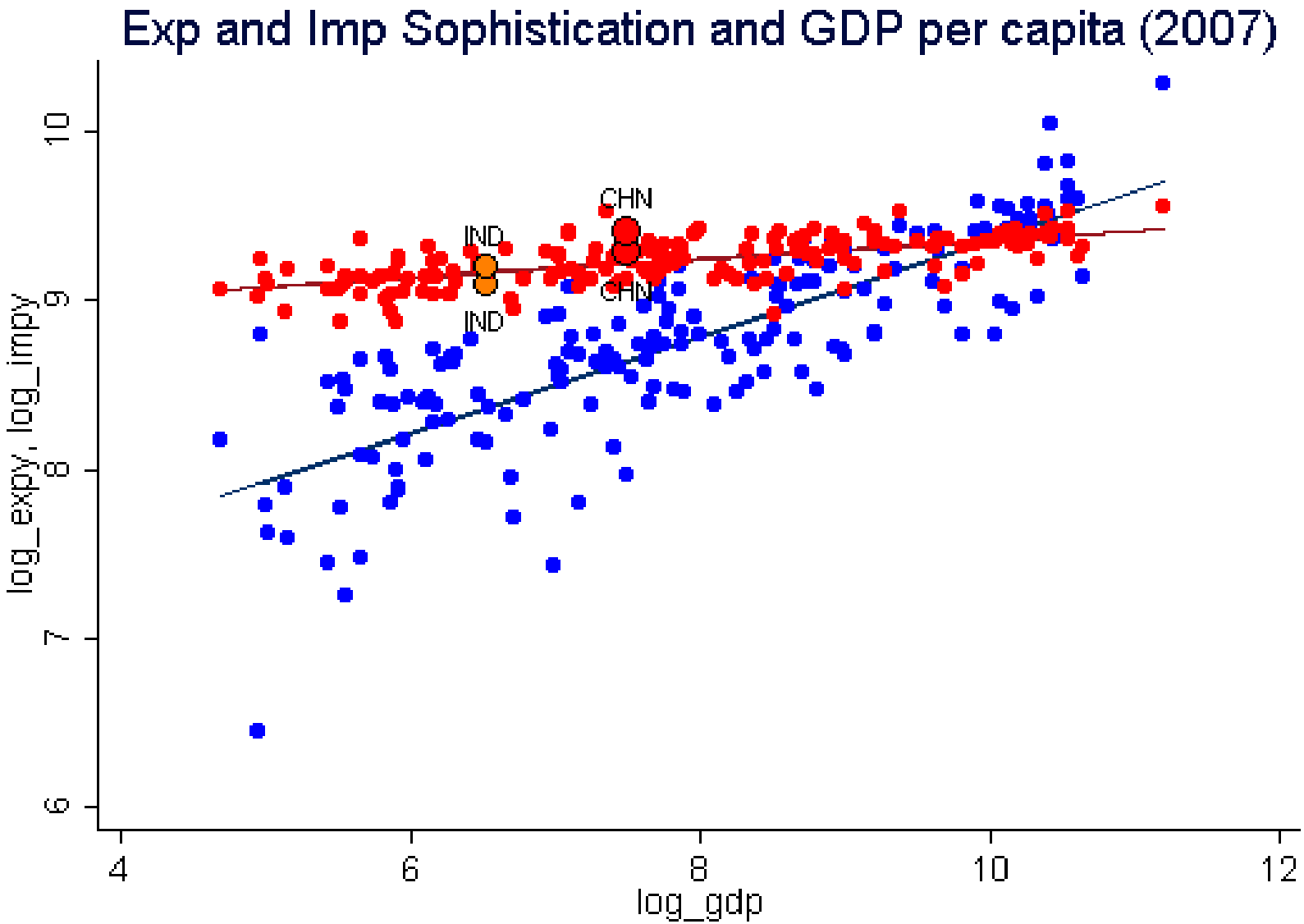
Is China importing product categories that are exported by developed countries and thus are relatively sophisticated?

China's Import is Relatively Sophisticated

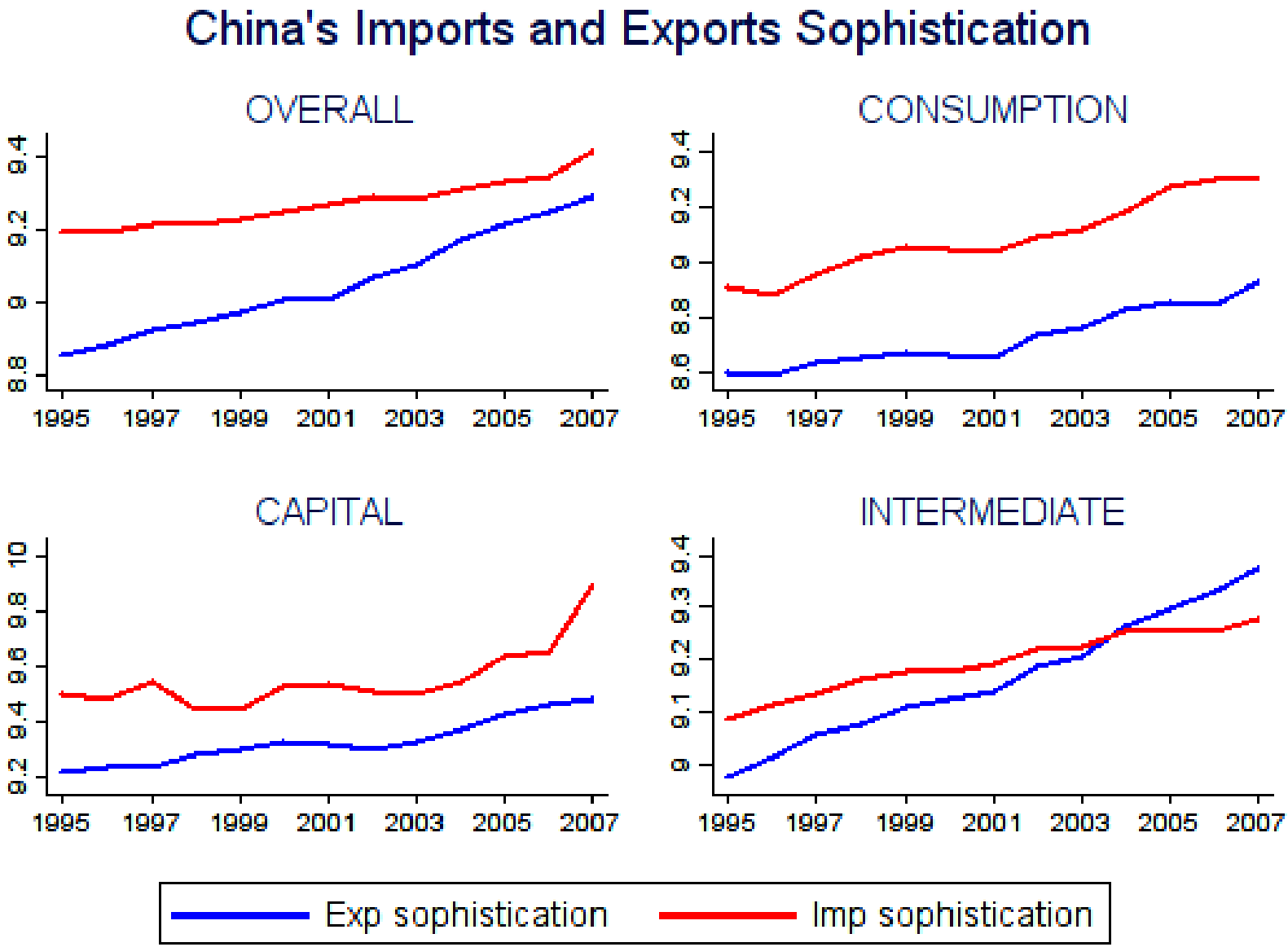


Import and Export Sophistication

China is unexpectedly sophisticated in both cases



Exporting Sophisticated Intermediate Products?



China's Export Sophistication

A more formal analysis

1. Possible determinants we control for:
   - Level of development → *Real GDP per capita*
   - Country size → *Real GDP, population*
   - Skill abundance → *Secondary education*
   - Import sophistication → *impy index*
2. China's relative sophistication → *China-years dummies*

Baseline Regression

$$\begin{aligned} expy_{ct} = \alpha_t &+ \beta_1 pcGDP_{ct} + \beta_2 GDP_{ct}(POP_{ct}) \\ &+ \beta_3 EDU_{ct} + \beta_4 impy_{ct} \\ &+ \gamma_1 China_{95-99} + \gamma_2 China_{00-03} + \gamma_3 China_{04-07} \\ &+ \varepsilon_{ct} \end{aligned}$$

China's Overall Sophistication is High

expy	(1)	(2)	(3)
GDPpc	0.230 ***	0.214 ***	0.180 ***
	(0.0196)	(0.0244)	(0.0248)
GDP	0.048 ***		0.061 ***
	(0.0115)		(0.0113)
EDU		0.115 **	0.133 **
		(0.0561)	(0.0517)
impy	0.440 **	0.657 ***	0.205
	(0.2167)	(0.1901)	(0.2089)
China 95-99	0.376 ***	0.526 ***	0.283 ***
	(0.0608)	(0.0481)	(0.0657)
China 00-03	0.300 ***	0.481 ***	0.231 ***
	(0.0616)	(0.0483)	(0.0644)
China 04-07	0.317 ***	0.475 ***	0.243 ***
	(0.0607)	(0.0462)	(0.0643)
Constant	1.709	0.499	3.388 *
	(1.7908)	(1.6775)	(1.7751)
R2 adjusted	0.72	0.71	0.75
year f.e.	yes	yes	yes
N	2266	1615	1615

Robust s.e. adjusted for country clustering in parentheses; significance *0.1 **0.05 ***0.01

Sophistication due to Intermediate Products

expy	consumption	capital	intermediate
GDPpc	0.193 ***	0.041 ***	0.212 ***
	(0.0257)	(0.0109)	(0.0265)
GDP	0.050 ***	0.018 ***	0.063 ***
	(0.0134)	(0.0052)	(0.0127)
EDU	-0.115 **	-0.006	0.247 ***
	(0.0553)	(0.0253)	(0.0580)
impy_consumption	0.363 *	0.060	-0.049
	(0.1857)	(0.0631)	(0.1650)
impy_capital	-0.012	0.346 ***	0.139
	(0.1329)	(0.0922)	(0.1265)
impy_intermediate	-0.177	0.013	-0.127
	(0.1868)	(0.0839)	(0.2302)
China 95-99	0.076	-0.058 **	0.463 ***
	(0.0638)	(0.0245)	(0.0748)
China 00-03	0.036	-0.030	0.427 ***
	(0.0600)	(0.0253)	(0.0739)
China 04-07	-0.083	-0.099 ***	0.420 ***
	(0.0702)	(0.0340)	(0.0779)
	(impy_other and constant term omitted)		
R2 adjusted	0.58	0.35	0.73
year f.e.	yes	yes	yes
N	1615	1615	1615

Robust s.e. adjusted for country clustering in parentheses; significance *0.1 **0.05 ***0.01

Main findings

1. Development (pcGDP) and size (GDP) $\rightarrow$ Positive corr.
2. Skill (EDU) $\rightarrow$ Positive corr. (Intermediate products)
3. Import sophistication (*impy*) $\rightarrow$ Not a major factor
4. China's sophitication $\rightarrow$ Intermediate products only

1 in line with the literature

2,3 in line with Wang-Wei (2008)

4 new evidence

- Delink between import and export?
- China's increased production capability? [Cui-Syed (2007)]

Deeper evidence: Within-Product Sophistication

- Vertically differentiated varieties within product categories
- Must consider relative prices ($r = UV_c/UV_w$)[1]

1. China's export is low priced
2. China's import is medium/high priced
3. Export and import prices are correlated
4. Export and import prices both diminishing
5. Same pattern within product classes and industries

Caveat: Exchange rates...

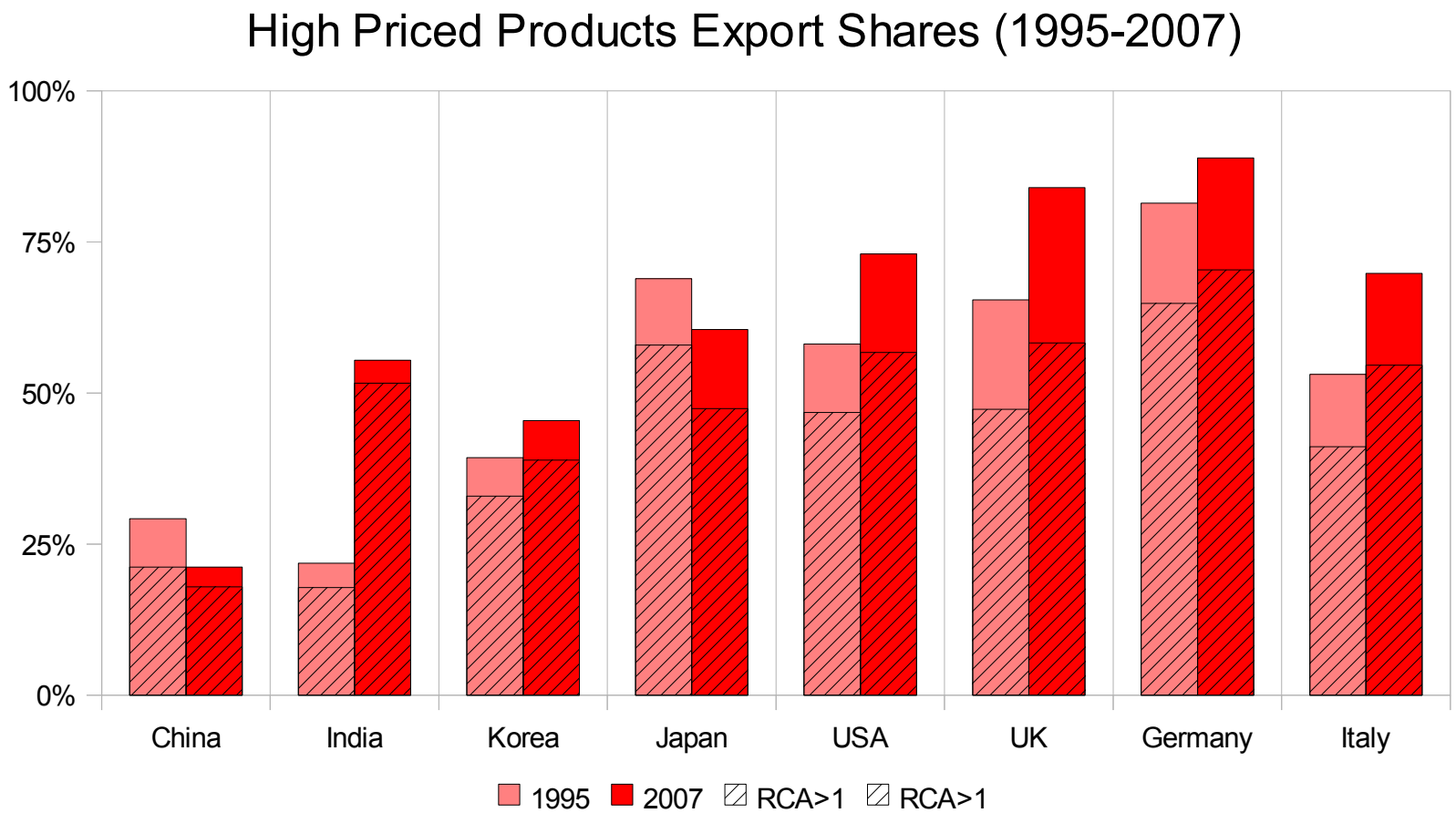
[1] BACI import and export both at f.o.b prices

Relative Price Regressions

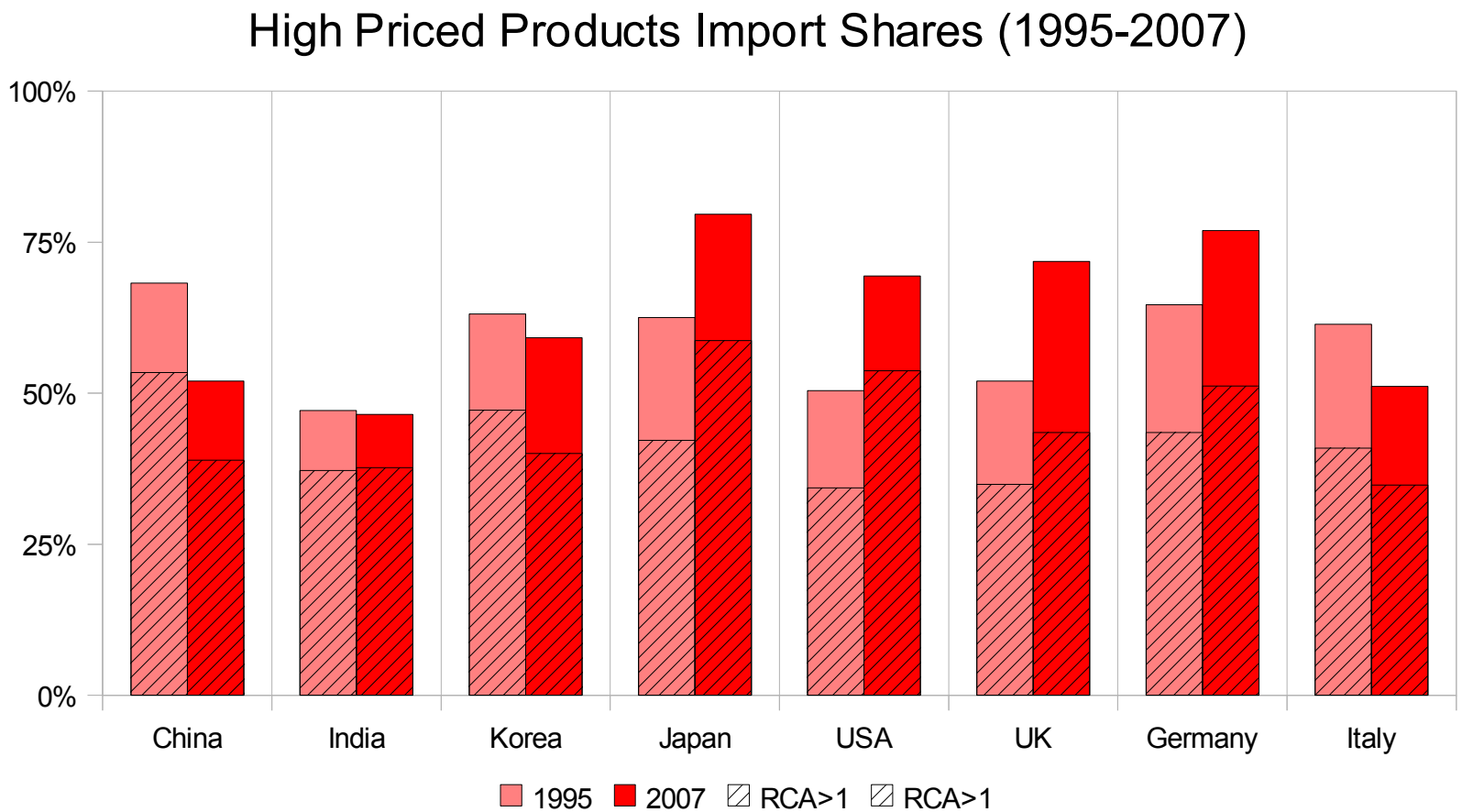
	log(r_export)	log(r_export)	log(r_import)
log(GDPpc)	0.117 ***	0.101 ***	0.071 ***
	(0.0179)	(0.0175)	(0.0107)
China 95-99	0.111 ***	-0.009	0.504 ***
	(0.0366)	(0.0359)	(0.0243)
China 00-03	-0.198 ***	-0.254 ***	0.228 ***
	(0.0352)	(0.0333)	(0.0249)
China 04-07	-0.322 ***	-0.350 ***	0.141 ***
	(0.0283)	(0.0271)	(0.0188)
log(r_import)		0.189 ***	
		(0.0119)	
constant	-0.649 ***	-0.572 ***	-0.274 ***
	(0.1437)	(0.1403)	(0.0885)
R2	0.19	0.20	0.26
product-year fixed effects	yes	yes	yes
countries	179	179	179
products	4763	4762	4762
years	95-07	95-07	95-07
N	4,812,467	4,579,707	4,654,384

Robust s.e. adjusted for country clustering in parentheses; significance *0.1 **0.05 ***0.01

China's Export is Low Priced
(low priced if $r < 1$)



China's Import is Medium-High Priced
(high priced if $r > 1$)



Market Segments

- *Do results change if we consider within-product sophistication?*

Splitting the market into price segments

1. Fontagné-Gaulier-Zignago (2008)
   [they use the same dataset and set $\alpha = 4$]

$$r \leq 1 \Rightarrow \begin{cases} \text{low-end} & = 1 - r^{\alpha} \\ \text{middle-end} & = r^{\alpha} \end{cases}$$

$$r > 1 \Rightarrow \begin{cases} \text{middle-end} & = 1/r^{\alpha} \\ \text{high-end} & = 1 - 1/r^{\alpha} \end{cases}$$

2. Set UVs thresholds as a robustness check
   [low-end $r < 1/1.25$; high-end $r > 1.25$]

High-End Segment: China is Not Sophisticated

expy	(1)	(2)	(3)
GDPpc	0.290 ***	0.278 ***	0.256 ***
	(0.0380)	(0.0479)	(0.0566)
GDP	0.019		0.023
	(0.0197)		(0.0196)
EDU		0.092	0.097
		(0.0978)	(0.0990)
impy	0.366 ***	0.475 ***	0.485 ***
	(0.1046)	(0.1351)	(0.1357)
China 95-99	0.133	0.154	0.030
	(0.1354)	(0.1048)	(0.1602)
China 00-03	0.233	0.261 **	0.131
	(0.1420)	(0.1050)	(0.1635)
China 04-07	-0.865 ***	-0.843 ***	-0.966 ***
	(0.1337)	(0.0939)	(0.1495)
Constant	1.738 **	1.036	0.564
	(0.8527)	(1.0026)	(1.1106)
R2 adjusted	0.36	0.40	0.41
year f.e.	yes	yes	yes
N	2266	1615	1615

Robust s.e. adjusted for country clustering in parentheses; significance *0.1 **0.05 ***0.01

Sophisticated Inputs and Intermediate Products

expy	consumption	capital	intermediate
GDPpc	0.271 ***	0.108 ***	0.229 ***
	(0.0494)	(0.0283)	(0.0687)
GDP	0.038 *	0.015	0.013
	(0.0198)	(0.0103)	(0.0246)
EDU	-0.303 ***	-0.061	0.277 **
	(0.0936)	(0.0601)	(0.1250)
impy_consumption	0.238 **	-0.118 **	0.225 *
	(0.0940)	(0.0560)	(0.1153)
impy_capital	0.174 **	0.408 ***	0.057
	(0.0819)	(0.1010)	(0.0813)
impy_intermediate	0.316 ***	0.300 ***	0.249
	(0.1137)	(0.0820)	(0.1760)
China 95-99	-0.626 ***	-1.070 ***	0.612 ***
	(0.1433)	(0.0947)	(0.2037)
China 00-03	-0.611 ***	-0.724 ***	0.643 ***
	(0.1351)	(0.0799)	(0.1960)
China 04-07	-1.511 ***	-1.454 ***	-1.006 ***
	(0.1480)	(0.1051)	(0.1872)
	(impy_other and constant term omitted)		
R2 adjusted	0.45	0.31	0.37
year f.e.	yes	yes	yes
N	1610	1609	1610

Robust s.e. adjusted for country clustering in parentheses; significance *0.1 **0.05 ***0.01

Low-End Segment: China is Sophisticated

expy	(1)	(2)	(3)
GDPpc	0.150 ***	0.107 **	-0.001
	(0.0368)	(0.0453)	(0.0508)
GDP	0.102 ***		0.115 ***
	(0.0253)		(0.0267)
EDU		0.386 ***	0.412 ***
		(0.1021)	(0.1000)
impy	0.395 ***	0.466 ***	0.436 ***
	(0.1146)	(0.1101)	(0.1117)
China 95-99	1.024 ***	1.351 ***	0.752 ***
	(0.1518)	(0.0928)	(0.1649)
China 00-03	0.898 ***	1.363 ***	0.729 ***
	(0.1502)	(0.1002)	(0.1599)
China 04-07	1.143 ***	1.509 ***	0.903 ***
	(0.1443)	(0.0953)	(0.1598)
Constant	0.434	1.016	-0.709
	(1.1224)	(1.0086)	(1.1364)
R2 adjusted	0.22	0.22	0.28
year f.e.	yes	yes	yes
N	2266	1615	1615

Robust s.e. adjusted for country clustering in parentheses; significance *0.1 **0.05 ***0.01

Mainly Intermediate and Capital Goods

expy	consumption	capital	intermediate
GDPpc	-0.023	-0.061	0.089
	(0.0591)	(0.0468)	(0.0629)
GDP	0.135 ***	0.070 ***	0.102 ***
	(0.0348)	(0.0250)	(0.0322)
EDU	0.217 *	0.193 **	0.538 ***
	(0.1130)	(0.0806)	(0.1206)
impy_consumption	0.300 **	0.254 ***	0.228 **
	(0.1277)	(0.0838)	(0.1021)
impy_capital	0.045	0.248 ***	0.072
	(0.0552)	(0.0782)	(0.0613)
impy_intermediate	0.442 ***	0.203 *	0.239 *
	(0.0968)	(0.1078)	(0.1308)
China 95-99	0.337 *	0.849 ***	1.037 ***
	(0.1987)	(0.1581)	(0.1868)
China 00-03	0.433 **	1.018 ***	0.788 ***
	(0.2053)	(0.1675)	(0.1825)
China 04-07	0.020	0.594 ***	1.459 ***
	(0.1957)	(0.1852)	(0.2103)
	(impy_other and constant term omitted)		
R2 adjusted	0.26	0.24	0.28
year f.e.	yes	yes	yes
N	1614	1609	1614

Robust s.e. adjusted for country clustering in parentheses; significance *0.1 **0.05 ***0.01

Conclusion

Evidence on the determinants of exports sophistication

- Development main factor, high/middle-end varieties
- Size important in general, low/middle-end varieties
- Skill abundance important for Intermediate products
- Sophisticated inputs important for high/low-end Consumer/Capital goods

Evidence on China's sophistication

- Overall sophistication consistent with development and size for Consumer/Capital goods
- Low/middle-end Consumption goods
- Low-end Capital products
- Intermediate products