

2006 Tokyo Club Macro Conference

Is China Becoming a High Tech Superpower ?

The Contrasted Picture of China's Scientific and Technological Capabilities

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Ifri

Introduction 1.

- Since 2000, prominence of emerging countries in world trade, in particular China.

Inroads of emerging countries in export markets that had long been the preserve of advanced countries: electronics (China), IT services (India), cars (Eastern Europe).

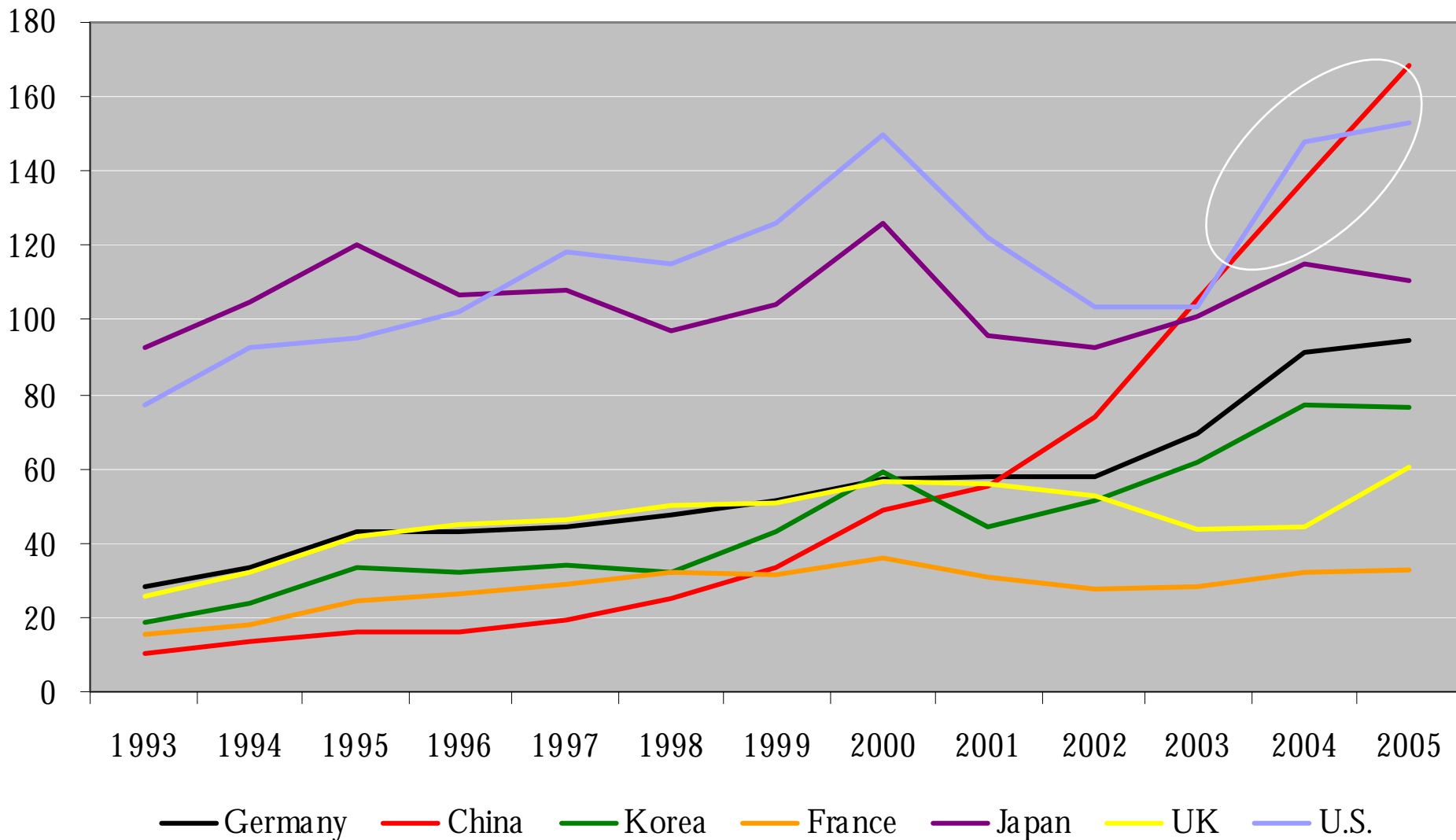
- Fears that emerging countries and China in particular are rapidly becoming technological powers and that the leadership (US) or growth potential of advanced countries (Europe) may be threatened.

Introduction 2. Outline

1. Is China's export performance in high tech products an economic exception? Rodrik (2006)
2. R&D resources in China
3. China's R&D output

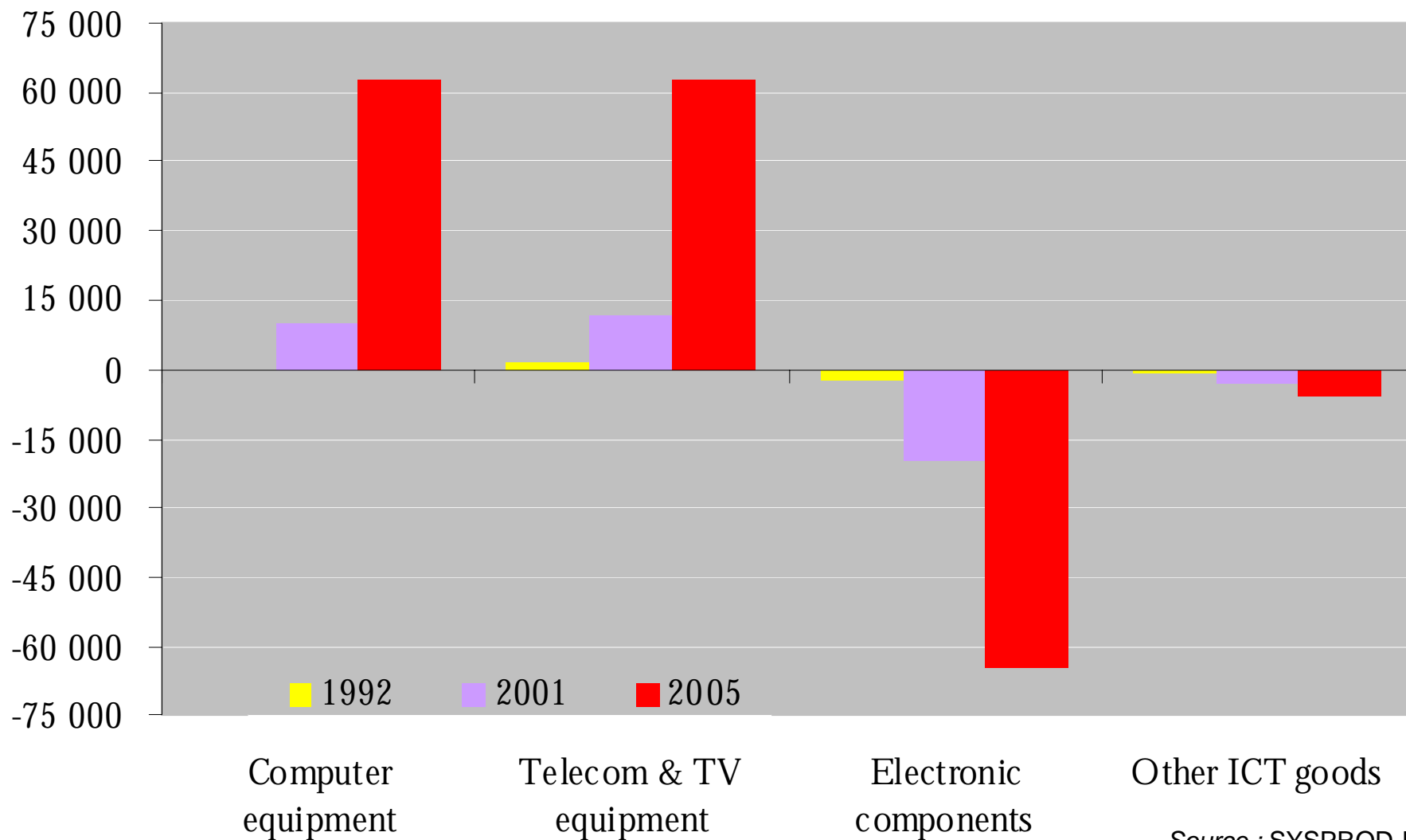
**Is China (really) a Large Exporter
of High Tech Products ?**

Main Exporters of ICT, \$bn



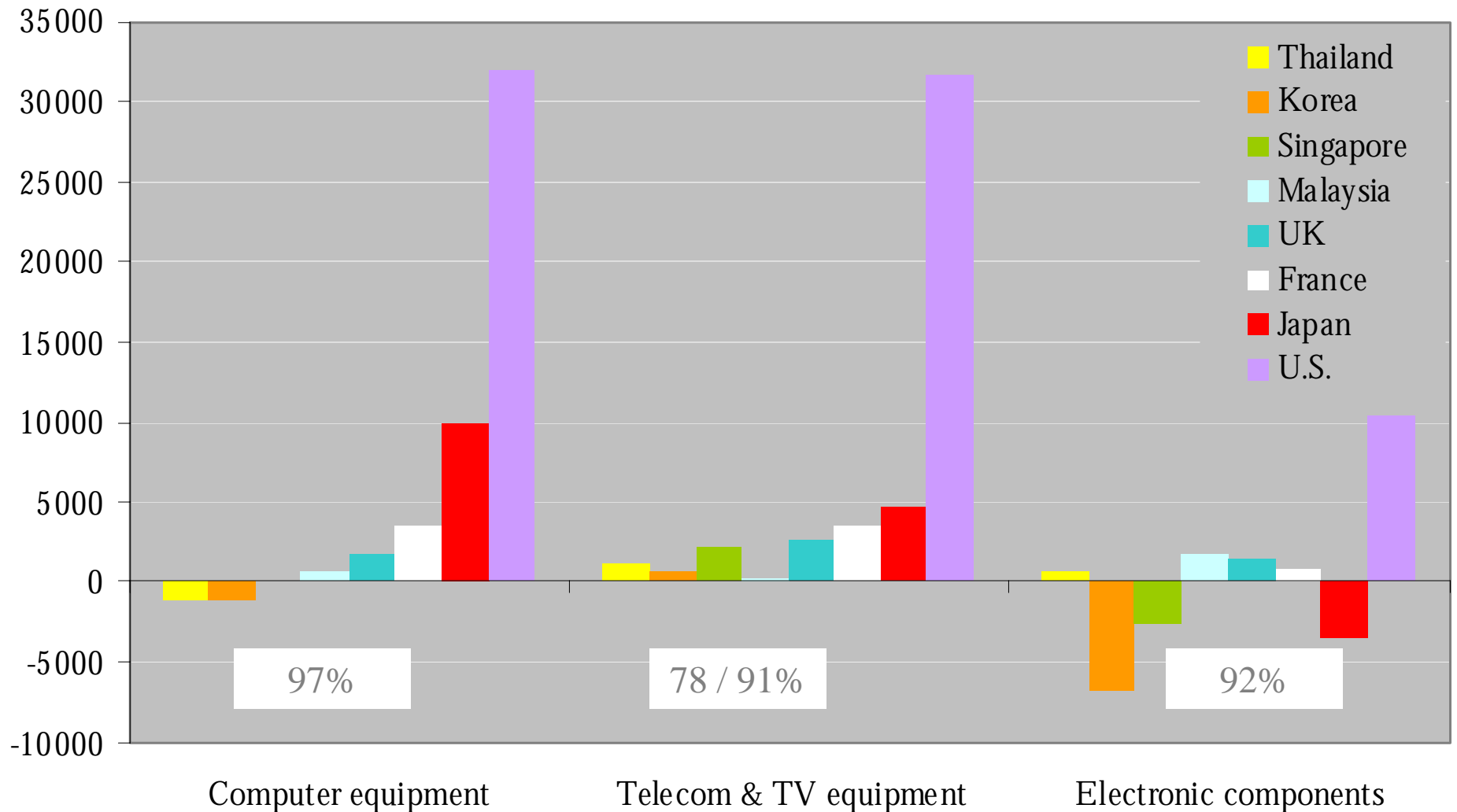
Source : SYSPROD-IFRI

ICT Trade Balance of China, \$ million



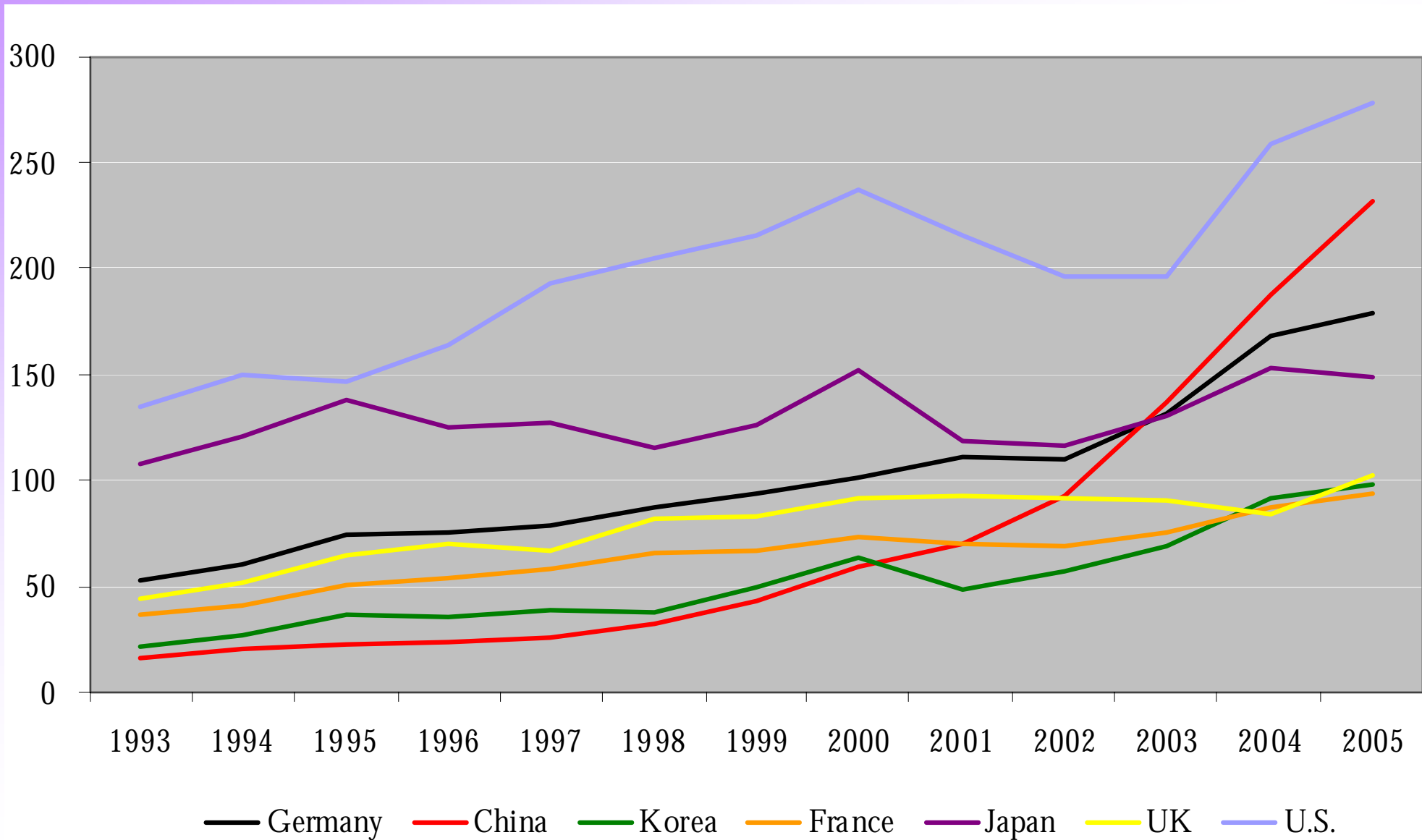
Source : SYSPROD-IFRI

Geographical Distribution of China 's Trade Balance ICT products, \$ million 2005



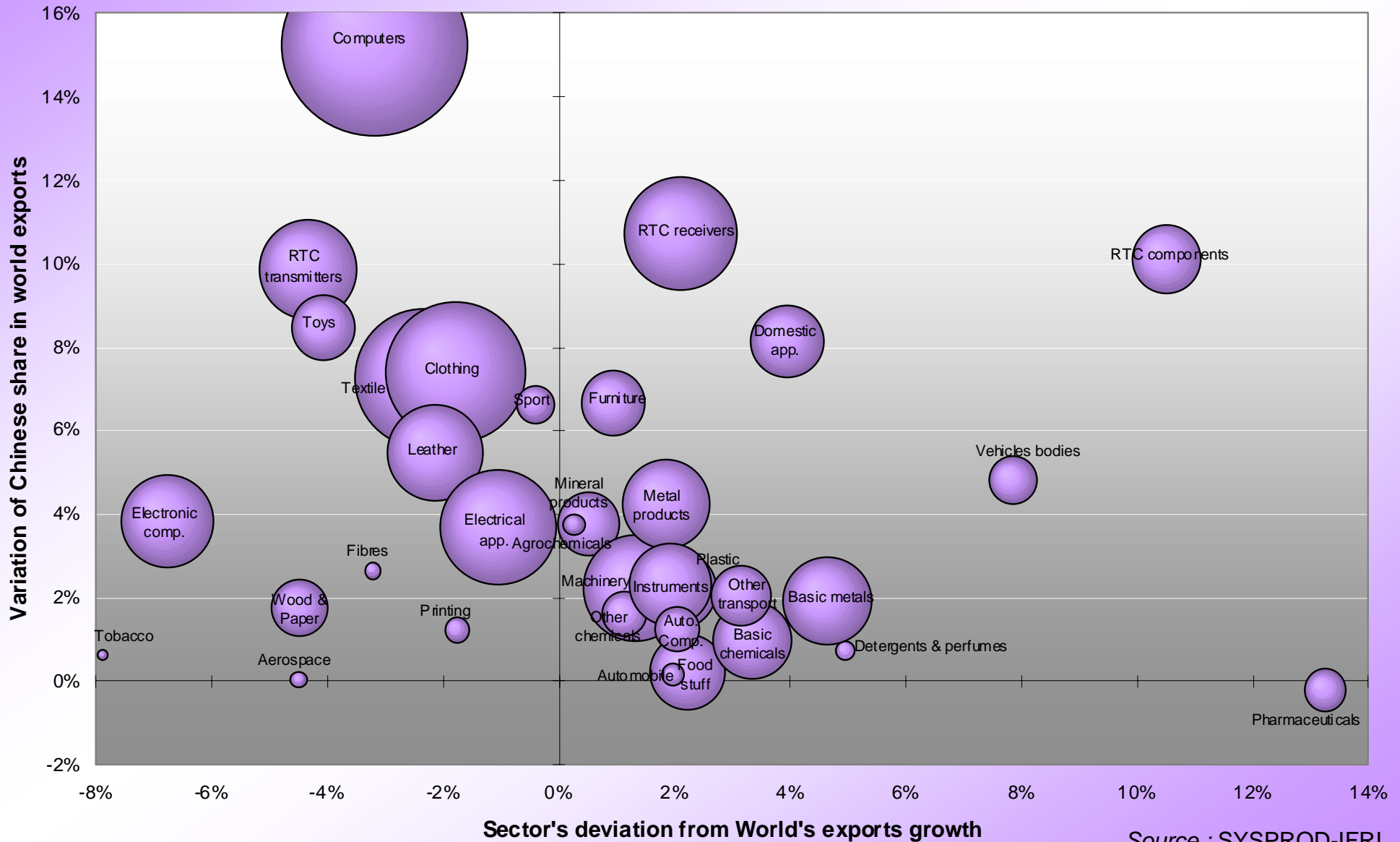
Source : SYSPROD-IFRI

Main Exporters of High Tech Manufactures, \$bn



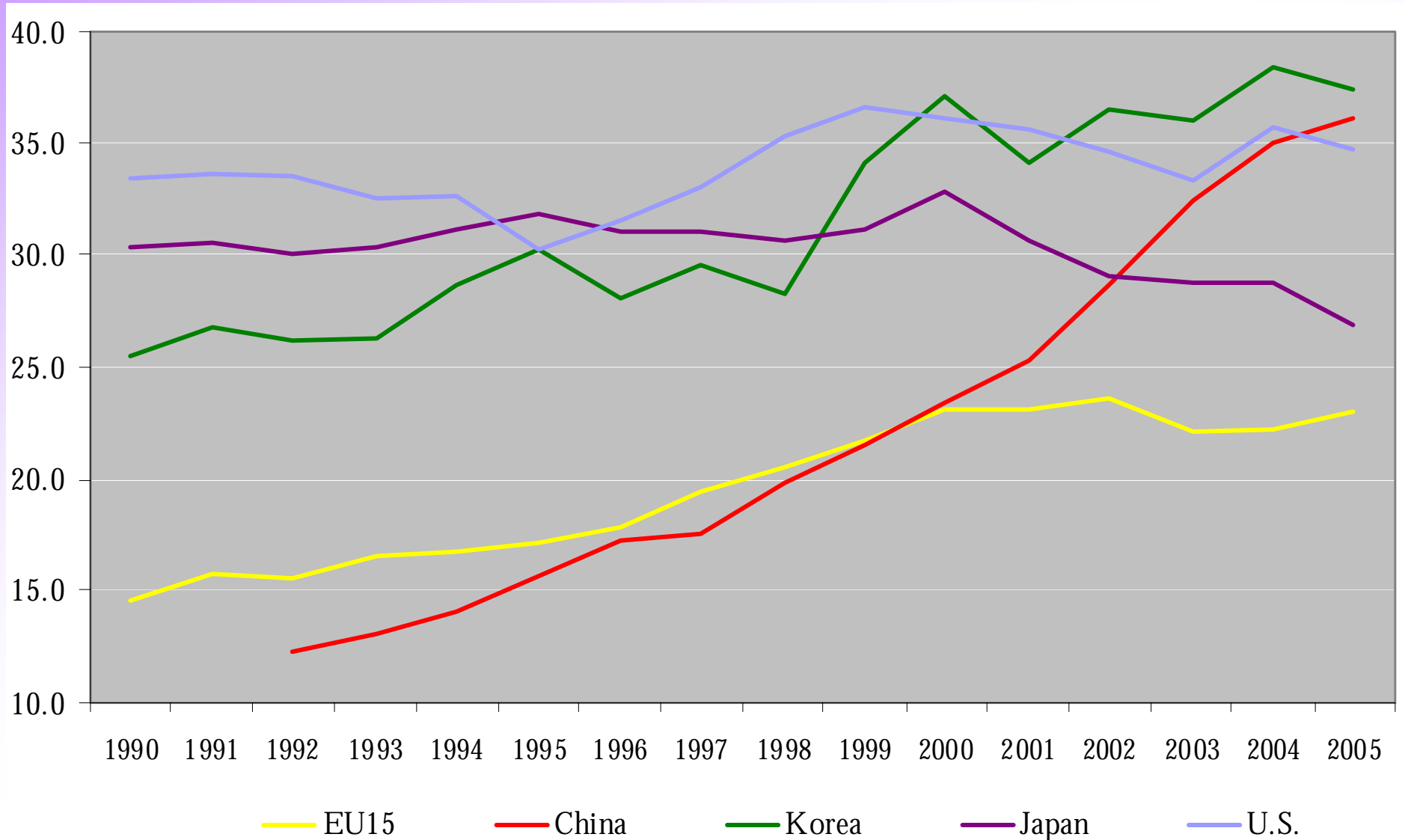
Source : SYSPROD-IFRI

Dynamics of Chinese Manufacturing Exports by sector, 2000-2004

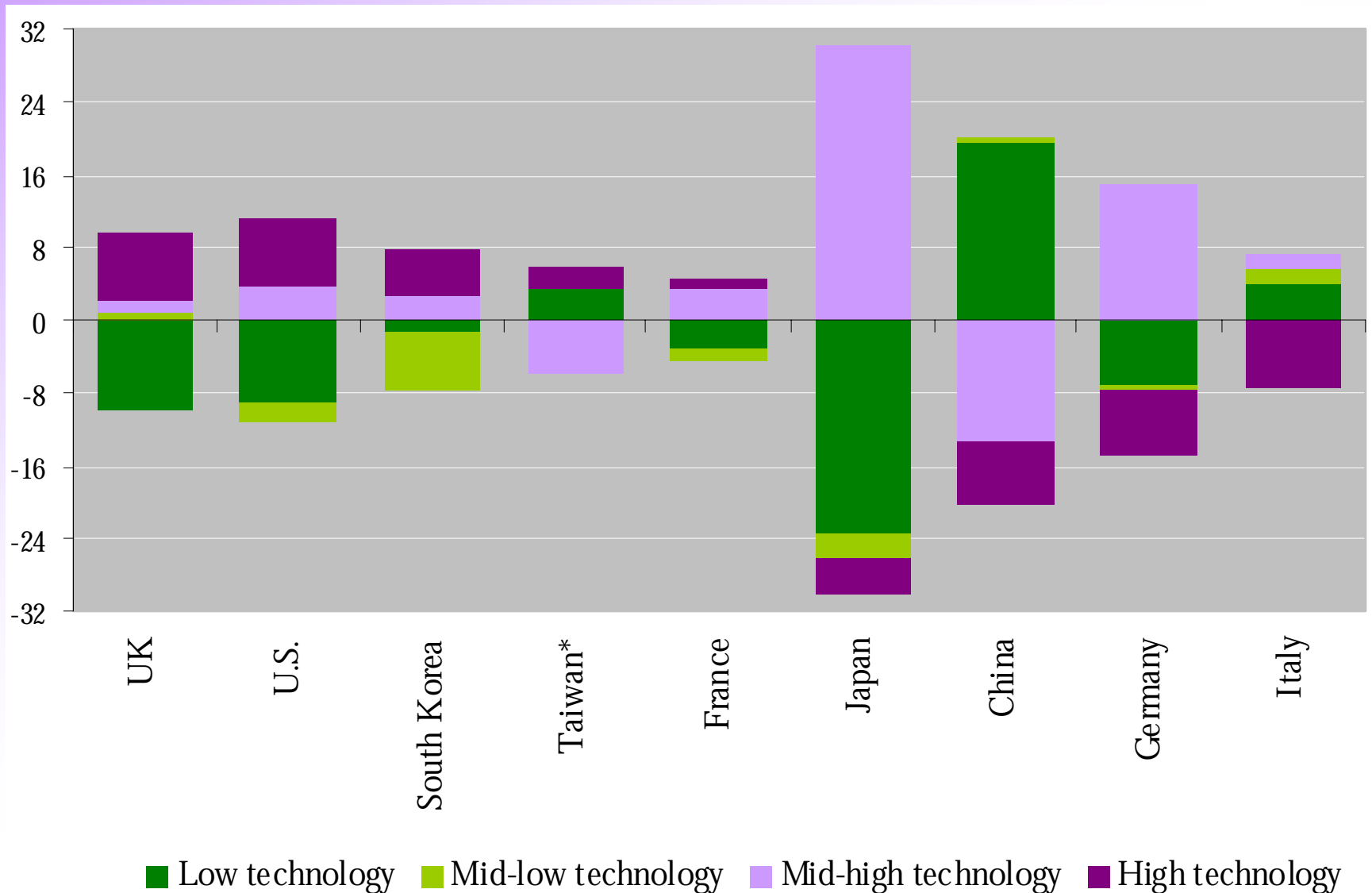


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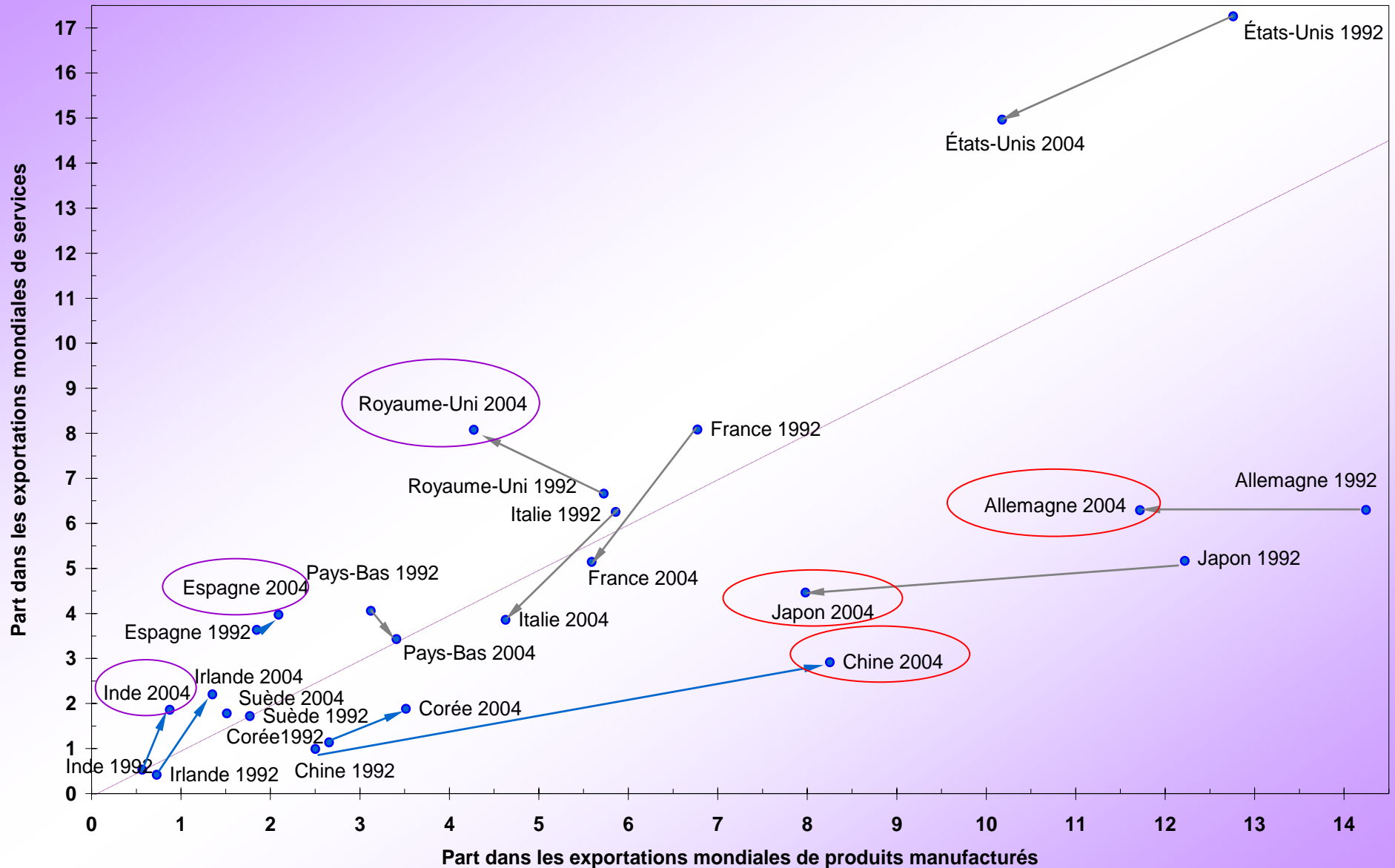
High Tech Exports as a Share of Manufactured Exports, in %



Contribution of High Tech Industries to the Trade Balance, as % of Manufacturing Trade, 2005

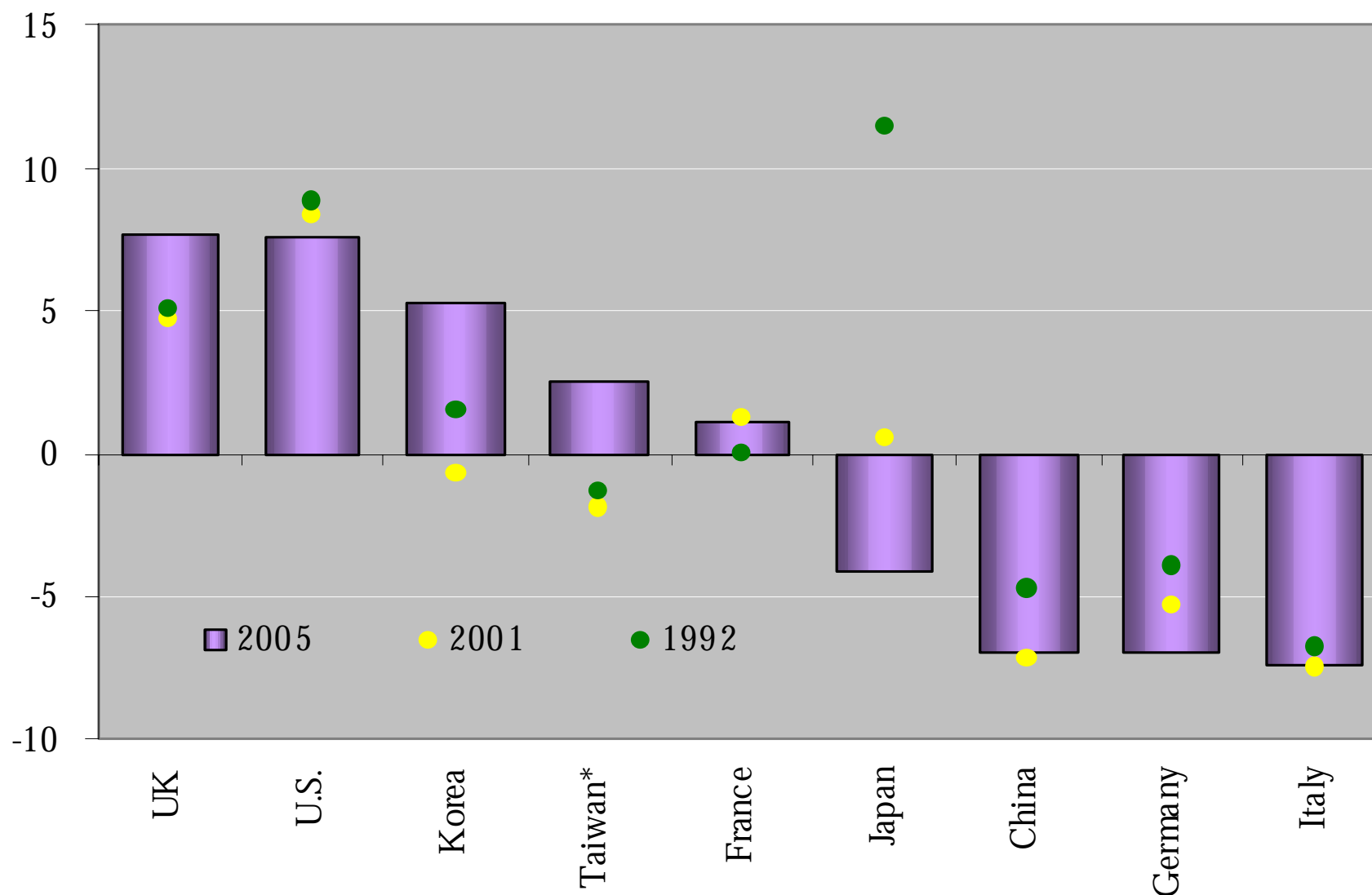


Share in world exports of manufactures and services, %



Source: WTO

Contribution of High Tech Industries to the Trade Balance, as % of Manufacturing Trade, 1992-2005



R&D Resources in China

- R&D Spending and Researchers**
- Tertiary Education**

R&D Resources and Intensity

	GERD 2004 Million PPP\$	GERD as a % of GDP ¹	Number of researchers 2003	Researchers per 000 employment ²
US	312,535.4	2.68	1,334,628	9.6
Japan	112,714.7	3.15	675,330	10.4
China	102,622.9	1.44	926,252	1.2
Germany	58,687.6	2.49	268,943	6.9
France	39,740.3	2.16	192,790	7.7
UK	33,705.7	1.88	157,662	n.a.
Korea	24,273.7	2.63	151,254	6.8
Canada	19,326.5	1.93	112,624	7.2
Russia	16,457.8	1.29	477,647	7.1
Taiwan	13,493.6	2.45	67,599	7.1
Spain	11,071.8	1.05	92,523	5.2
Sweden	10,340.0	3.98	47,836	11.0
Australia	9,608.6	1.69	73,344	7.8

Source : OECD

Students Enrolled in Tertiary Education, 2004

Country	Total enrolment in tertiary education	Tertiary students per 100,000 hab.
China	19,417,044	1,494
United States	16,900,471	5,776
India	11,852,936	1,107
Japan	4,031,604	3,146
Mexico	2,322,781	2,226
United Kingdom	2,247,441	3,791
Germany	2,185,224	2,660
France	2,160,300	3,600

Source : UNESCO

The Supply Paradox: Comparing Tertiary Education Attainment

- Comparing degrees

Bachelor degrees in Engineering, Computer science, Electrical and IT: 644,100 in China, 215,000 in India, 222,300 in the U.S.

(Gereffi and Wadhwa 2006)

- Employability

Surveys and interviews with multinational companies hiring engineers in China

- Lower educational attainment than East Asian countries

Bosworth and Collins (Tokyo Club contribution)

Assessment of China's R&D Output and Overall S&T Capabilities

World Share of Scientific Publications, in %

	Korea	France	China	FRG	UK	Japan	USA	EU-15
1993	0.18	5.98	1.69	7.45	8.89	8.19	34.73	33.78
1994	0.58	5.99	1.70	7.54	8.97	8.57	33.66	34.12
1997	1.16	6.31	2.66	8.32	8.73	8.98	31.94	35.72
2000	1.76	6.31	3.89	8.69	9.22	9.49	30.93	36.55
2003	2.43	6.10	5.51	8.35	8.46	9.40	30.68	35.96
2004	2.70	5.81	6.52	8.11	8.33	8.81	30.18	35.18

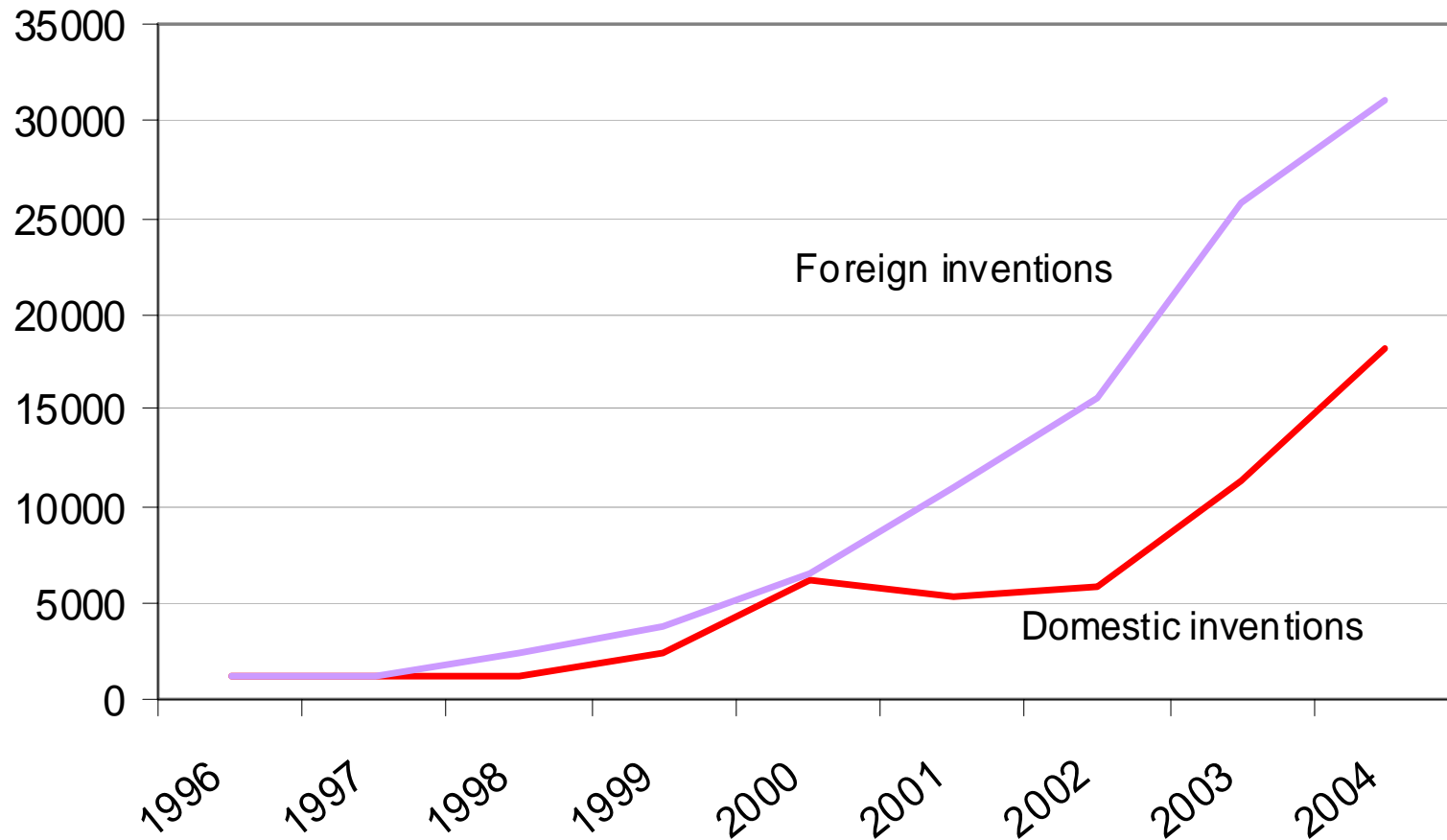
Source : Zhou and Leydesdorff (2006)

Ranking of Countries for Scientific Publications and Citations, 2003

Rank	Country	Number of papers	Average citations per paper
1	United States	2,705,652	12
2	Japan	713,542	7
3	Germany	655,586	9
4	United Kingdom	598,470	10
5	France	484,291	9
6	Canada	358,007	10
7	Italy	310,557	8
8	Russia	285,856	3
9	China	236,996	3
10	Australia	211,549	8
16	South Korea	111,406	4

Source : Seong *et al.* (2005)

Number of Chinese Invention Patent Grants, 1996-2004



Source : China 's National Bureau of Statistics

Four Classifications of National S&T Capabilities

	Science and Technology Capacity Index RAND	Technology Achievement Index UNDP	Indicator of Technological Capabilities ArtCo	Technology Index WEF	Comparison between the four classifications			TI 2004
					Rank mean	Standard dev.	Rank on the mean	
US	1	2	4	1	2.0	1.41	1	
Finland	4	1	2	3	2.5	1.29	2	
Sweden	3	3	1	5	3.0	1.63	3	
Canada	2	9	5	2	4.5	3.32	4	
Australia	8	10	8	4	7.5	2.52	5	
Norway	10	12	6	6	8.5	3.00	6	
Japan	5	4	7	19	8.8	6.95	7	
UK	9	7	11	8	8.8	1.71	8	
Netherlands	12	6	9	11	9.5	2.65	9	
Germany	6	11	10	12	9.8	2.63	10	
Korea	16	5	15	7	10.8	5.56	11	
Mexico	36	30	35	29	32.5	3.51	34	
South Africa	32	35	32	34	33.3	1.50	35	
Thailand	41	36	37	31	36.3	4.11	36	
Brazil	35	37	38	37	36.8	1.26	37	
Philippines	42	38	39	32	37.8	4.19	38	
China	33	39	41	39	38.0	3.46	39	
Egypt	43	43	44	43	43.3	0.50	43	
India	37	46	47	44	43.5	4.51	44	

Conclusions 1.

A contrasted picture of China 's S&T capabilities

- Size vs. Intensity: R&D spending, number of researchers
- Quantity vs. Quality: Tertiary education, publications, patents
- Stocks vs. Flows: cumulated investment vs dynamic growth
- Domestic vs. Global contributions ? Large role of foreign firms and global connections

Conclusions 2.

Has China 's technological capability « taken off » ?

- Clearly above 1% R&D intensity ?
- The path between 1 and 2%

R&D efficiency: linkages between public research and firms' R&D

Domestic innovation capability and technonationalism