An Introduction to the WIOD Database: Slicing Up Global Value Chains

Workshop "Frontiers of International Input-Output Analysis" (at IDE-JETRO,Tokyo)

February 1, 2012

SEVENTH FRAMEWORK PROGRAMME

Who is in WIOD?

- University of Groningen (The Netherlands)
- Institute for Prospective Technological Studies (Spain)
- Wiener Institut für Internationale Wirtschaftsvergleiche (Austria)
- Zentrum für Europäische Wirtschaftsforschung (Germany)
- Österreichisches Institut für Wirtschaftsforschung (Austria)
- Konstanz University of Applied Sciences (Germany)
- The Conference Board Europe (Belgium)
- CPB Netherlands Bureau for Economic Policy Analysis
- Institute of Communication and Computer Systems (Greece)
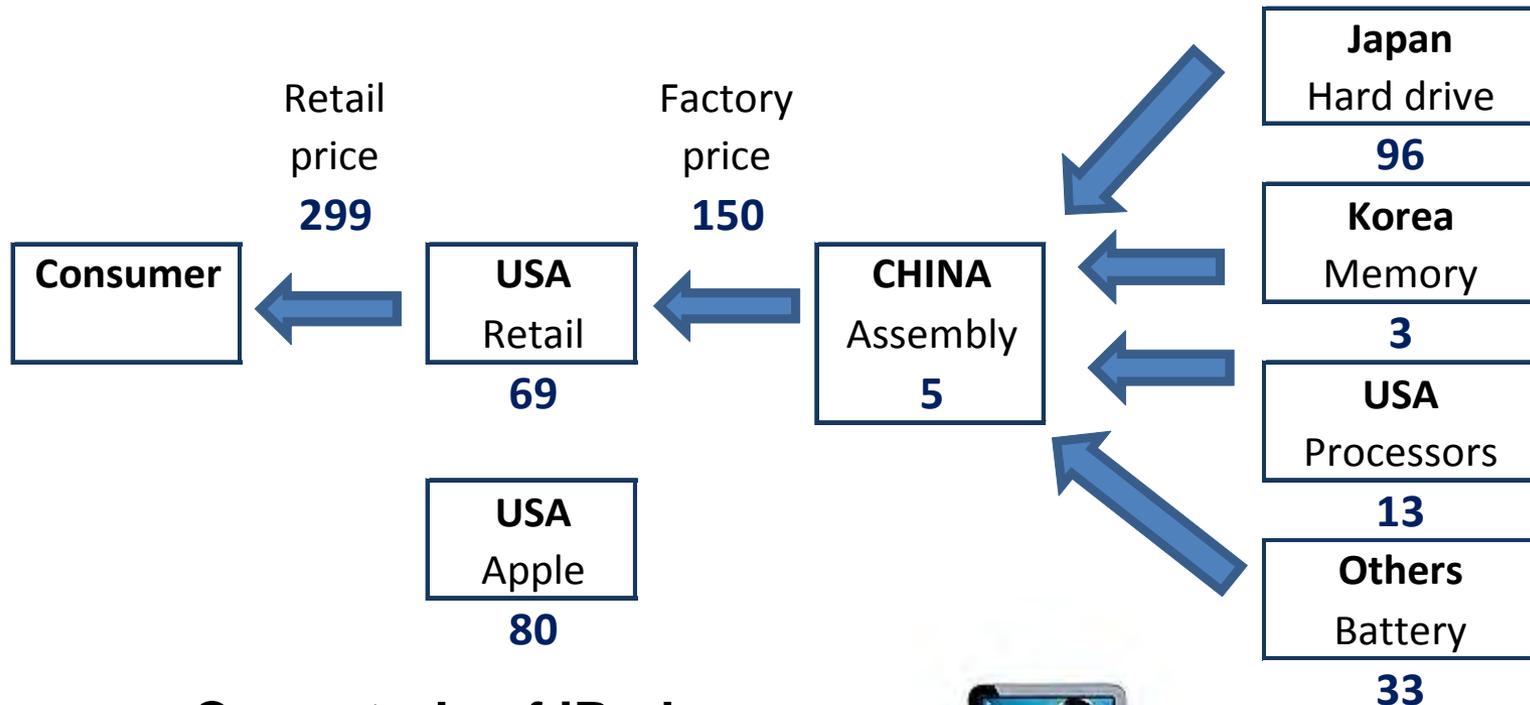- Central Recherche SA (France)
- OECD (France)

Issues to be Addressed by WIOD

> ➢ Trade statistics only report on value of exported and imported goods and services, but do not tell anything about how much value was added in exporting country. How much Chinese value added is embodied in US electronics imports of from China?

➢ How do strong reductions in consumer demand in e.g. the U.S. ripple through to other countries? To what extent will labor of different skill levels be hit differently?

➢ American multinationals relocated substantial parts of their supply chains to East Asia, to benefit from a flexible, cheap and well-educated workforce. What did these relocations imply for emission levels of GHGs in these regions?

Global Production Networks imply a global value distribution

Retail price **299**

Factory price **150**

| Japan |
| Hard drive |
| **96** |

Consumer ← **USA** Retail **69** ← **CHINA** Assembly **5** ←

| Korea |
| Memory |
| **3** |

| USA |
| Apple |
| **80** |

| USA |
| Processors |
| **13** |

| Others |
| Battery |
| **33** |

Case study of iPod:
(Dedrick, Kraemer and Linden, 2010, *Industrial and Corporate Change*)

This Presentation

➢ **SLICING UP GLOBAL VALUE CHAINS**: Fragmentation of production implies a geographical re-distribution of the value added and an increasing interdependence

➢ Link industry-level data on factor inputs by means of data on national production structures and international trade data

➢ **MAIN ISSUES**:

➢ Measure the share of foreign value added in domestic output of final products

➢ Trends in value added contribution of various production factors (types of labour and capital) in various regions

➢ Illustrations on the basis of **preliminary** data

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Global Value Chain of Final Output from German transport equipment manufacturing (1995 and 2006)
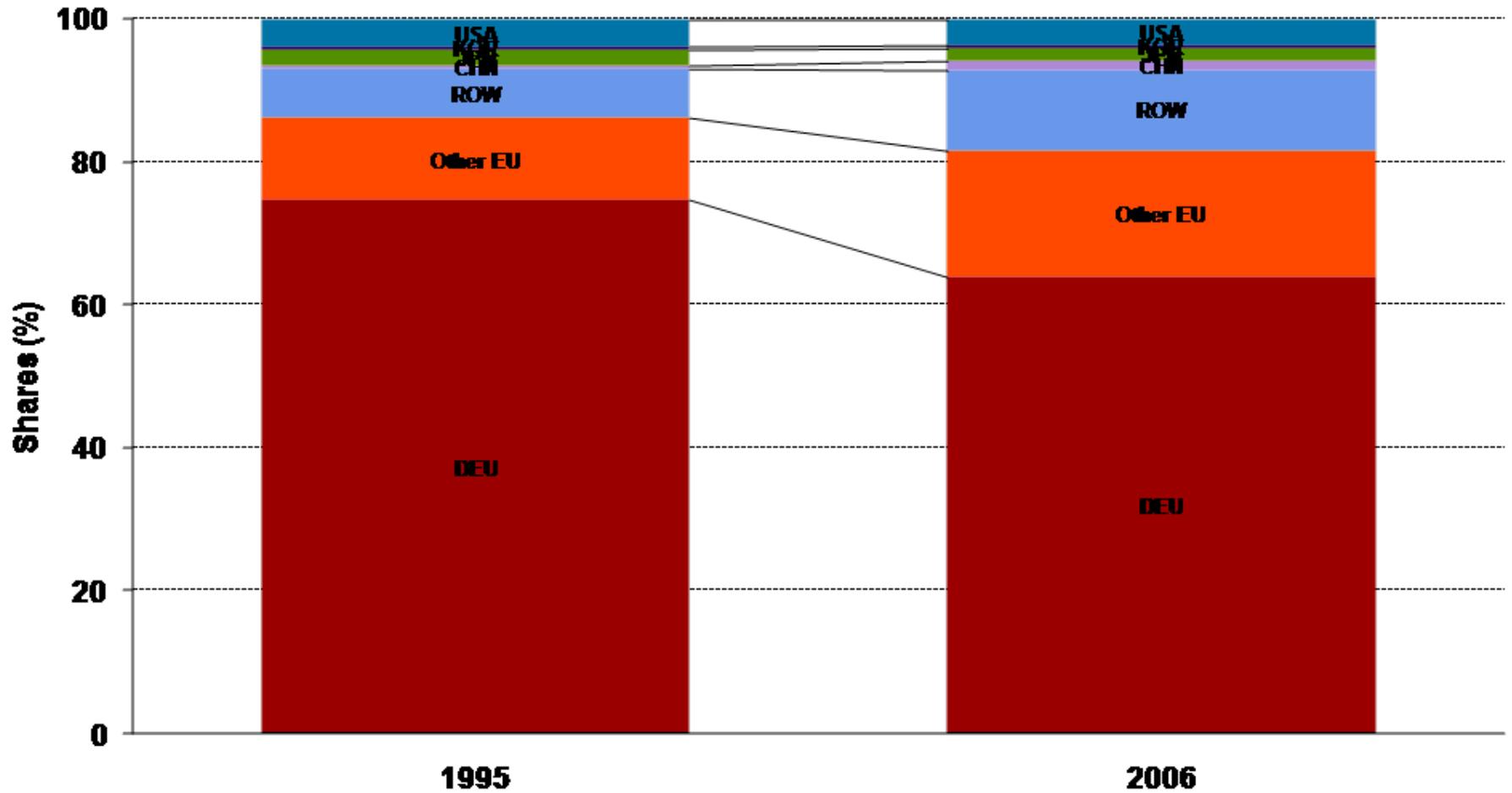
Database outline

- Consistent time-series of international input-output tables with breakdown of use:
    - Domestically produced
    - Imported (by partner country)

- Factor inputs: labor (low-, medium-, and high-skilled) and capital.
- Environmental indicators (energy use, GHG emissions, water use, etc.)

- Period from 1995 to 2006 (will be updated until 2009):
    - 27 EU countries and 13 other major countries
    - 35 industries and 59 products

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World input-output table
(3 regions, industry-by-industry type)

		Country A Intermediate *Industry*	Country B Intermediate *Industry*	Rest of World Intermediate *Industry*	Country A Final domestic	Country B Final domestic	Rest of World Final domestic	Total
Country A	*Industry*	Intermediate use of domestic output	Intermediate use by B of exports from A	Intermediate use by RoW of exports from A	Final use of domestic output	Final use by B of exports from A	Final use by RoW of exports from A	Output in A
Country B	*Industry*	Intermediate use by A of exports from B	Intermediate use of domestic output	Intermediate use by RoW of exports from B	Final use by A of exports from B	Final use of domestic output	Final use by RoW of exports from B	Output in B
Rest of World (RoW)	*Industry*	Intermediate use by A of exports from RoW	Intermediate use by B of exports from RoW	Intermediate use of domestic output	Final use by A of exports from RoW	Final use by B of exports from RoW	Final use of domestic output	Output in RoW
		Value added	Value added	Value added				
		Output in A	Output in B	Output in RoW				

List of Countries

- **EU-27**
- **Plus 13 non-EU**:

- Canada
- United States
- Brazil
- Mexico
- Turkey
- Russia

- China
- India
- Japan
- South Korea
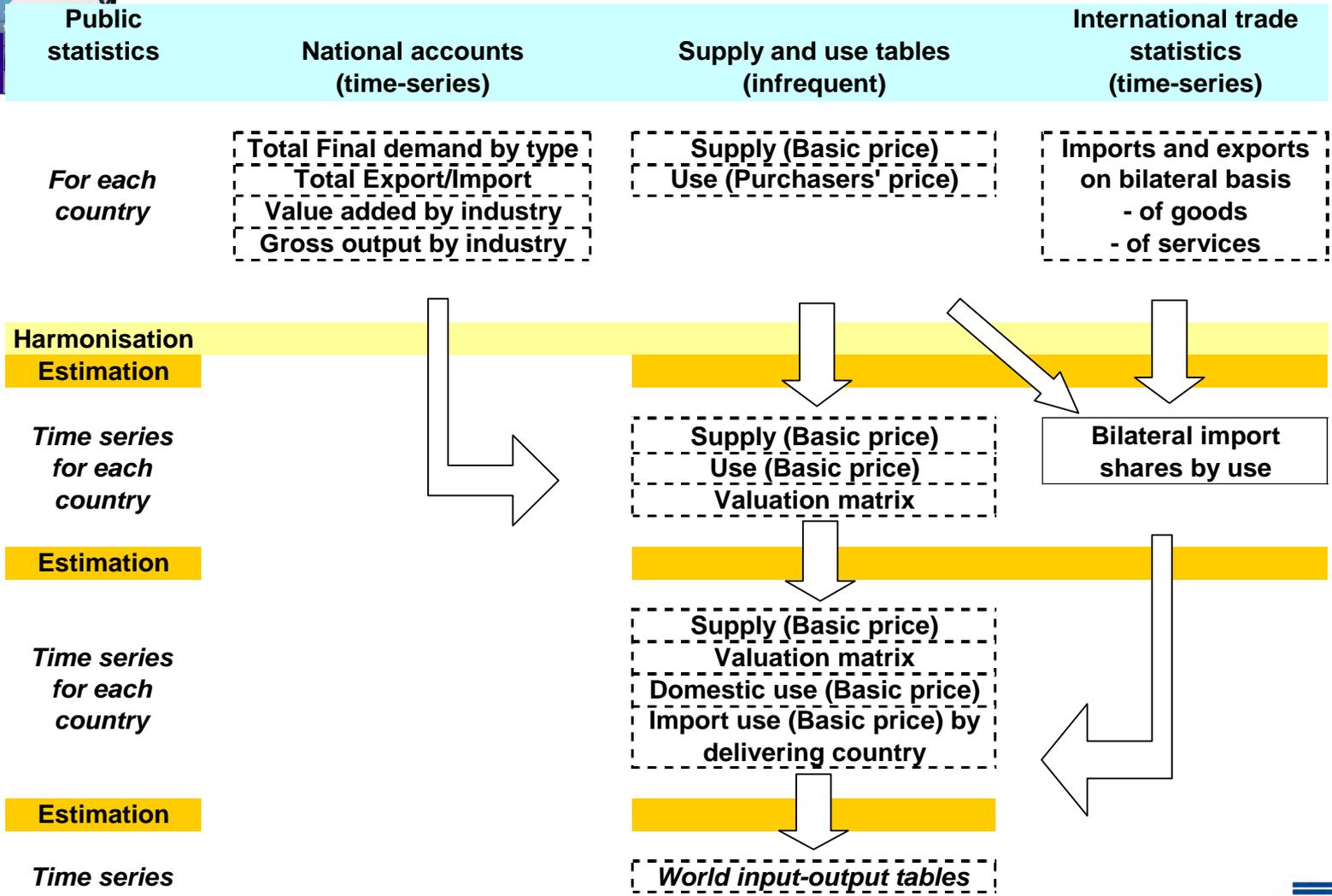- Taiwan
- Indonesia
- Australia

Selection of non-EU countries based on:
a) availability of SUTs of decent quality;
b) economic importance

Countries cover about 85% of World GDP

Dataflows and construction steps in WIOD

Public statistics	National accounts (time-series)	Supply and use tables (infrequent)	International trade statistics (time-series)
For each country	Total Final demand by type Total Export/Import Value added by industry Gross output by industry	Supply (Basic price) Use (Purchasers' price)	Imports and exports on bilateral basis - of goods - of services

Harmonisation

Estimation

Time series for each country		Supply (Basic price) Use (Basic price) Valuation matrix	Bilateral import shares by use

Estimation

Time series for each country		Supply (Basic price) Valuation matrix Domestic use (Basic price) Import use (Basic price) by delivering country	

Estimation

Time series		*World input-output tables*	

WIOD: What is Specific?

- *Time-series* benchmarked on National Accounts data

- National *supply and use* tables as the basis

- Intensified focus on *trade in services*

- Improved allocation of imports to *use category* (Modified BEC)

- Both socio-economic satellite accounts (labour by skill; capital by type) and environmental satellite accounts (GHGs, energy use, etc.)

- Constant price tables and industry-level PPPs

- Based on official statistics with maximum of transparency

Factor content of final demand

Define number of countries as N, industries as G and factors as M

F   = **Direct** factor inputs per unit of gross output (MNxNG)
B   = Intermediate input coefficients (NGxNG)
(I-B)$^{-1}$ = Leontief inverse of world IO table (NGxNG)
Then factor inputs required per unit of *final demand* are given by

$$A = F(I-B)^{-1}$$

A   = **Direct and indirect** factor inputs per *unit* of final demand (MNxNG)

$$K = AC$$

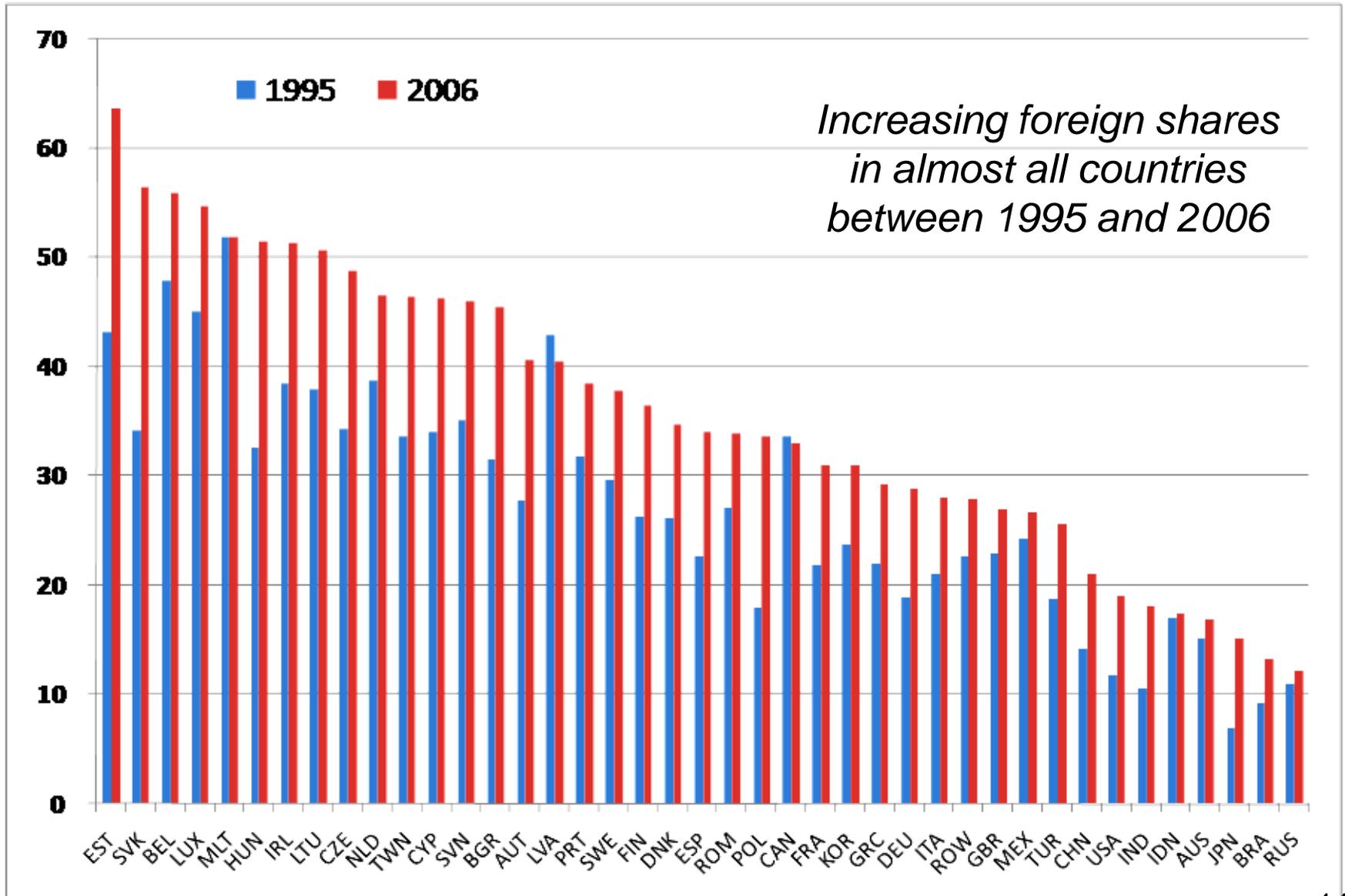**C**   = Diagonal matrix with final demand levels (NGxNG),
K   = total amount of factor inputs attributed to each final demand level (MNxNG)

Share of foreign value added in domestic final manufacturing output (in %), 2006
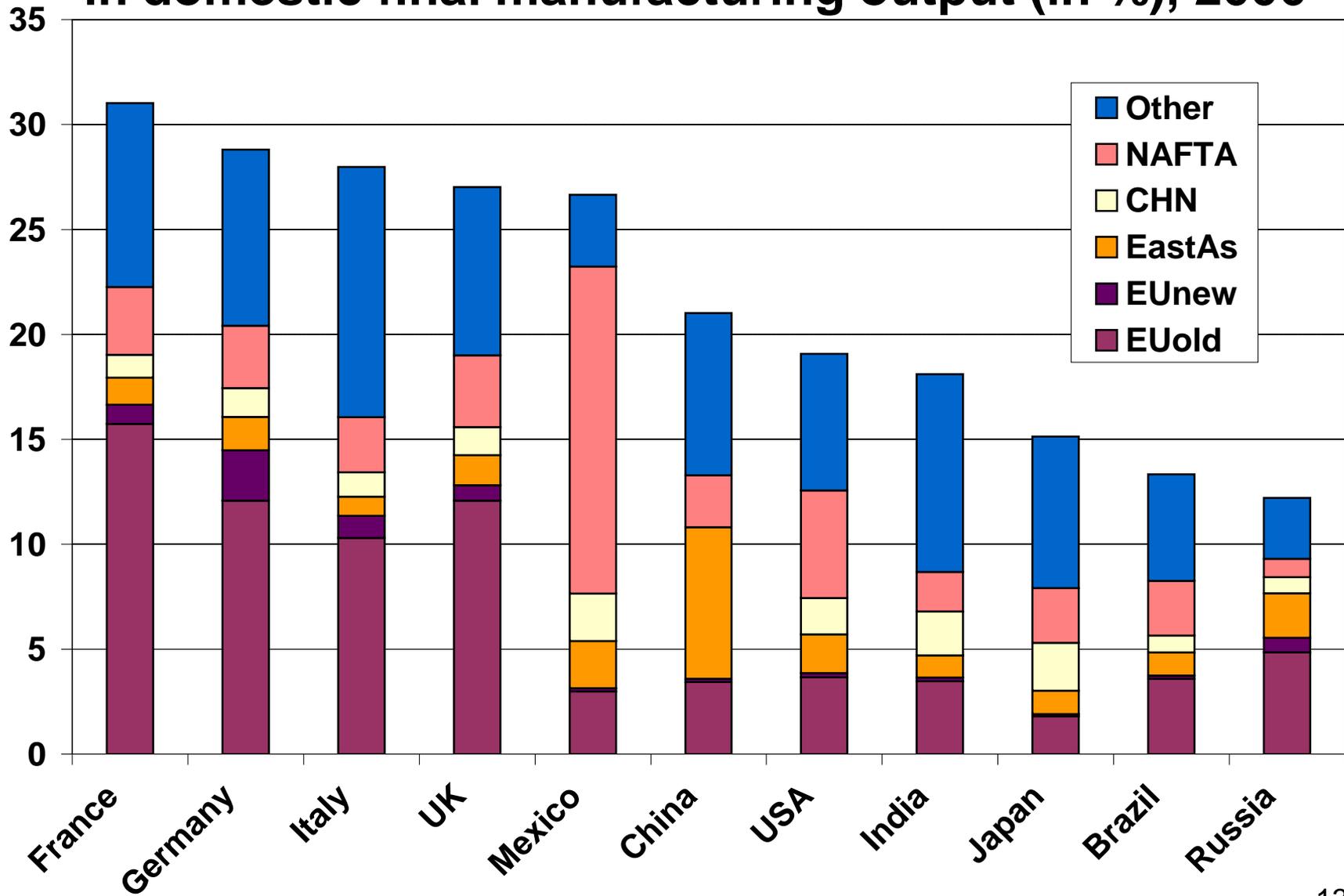
Share of foreign value added
in domestic manufacturing final output (in %)

Legend: ■ 1995 ■ 2006

*Increasing foreign shares
in almost all countries
between 1995 and 2006*

Countries (x-axis): EST, SVK, BEL, LUX, MLT, HUN, IRL, LTU, CZE, NLD, TWN, CYP, SVN, BGR, AUT, LVA, PRT, SWE, FIN, DNK, ESP, ROM, POL, CAN, FRA, KOR, GRC, DEU, ITA, ROW, GBR, MEX, TUR, CHN, USA, IND, IDN, AUS, JPN, BRA, RUS

Foreign share in Chinese manufacturing final output

ISIC rev.3 code	Industry name	Foreign 1995 (% share)	Foreign 2006 (% share)	Total value 2006 (mil US$)
30t33	Electrical and Optical Equipment	19.1	32.1	254,400
15t16	Food, Beverages and Tobacco	8.3	10.2	191,399
29	Machinery, Nec	13.5	22.3	188,934
17t18	Textiles and Textile Products	16.8	16.4	153,067
34t35	Transport Equipment	15.2	22.8	120,025
36t37	Manufacturing, Nec; Recycling	13.3	13.6	56,792
	Total manufacturing	14.2	21.0	1,104,709

Note: The last two columns indicate the value of final demand for Chinese manufacturing output. The first two columns indicate the share of foreign value added in these values. In million current US$, using exchange rates for currency conversion. Sorted by 2006 value.

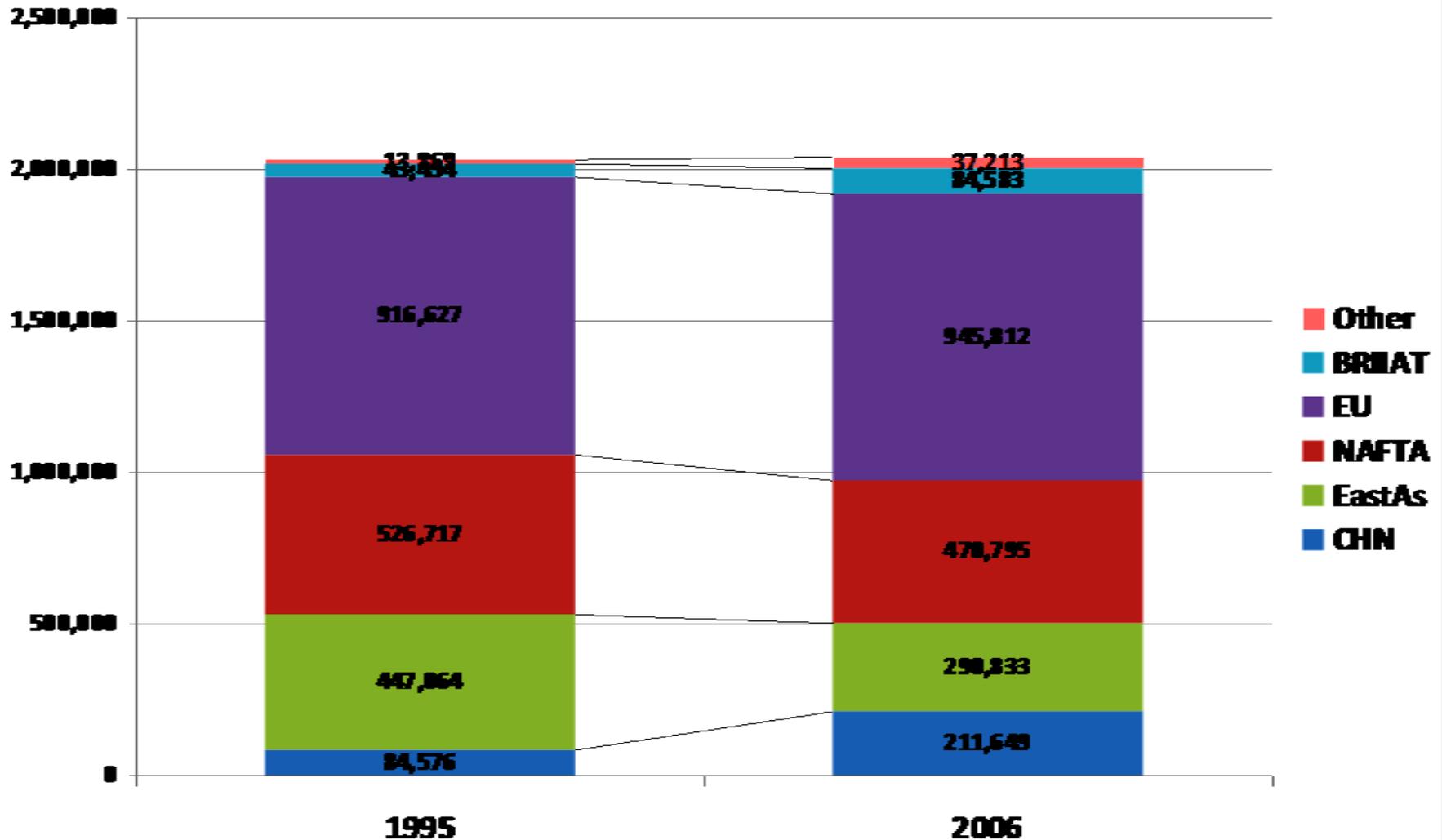Source: Calculations based on World Input-Output Database.

Contribution to world manufacturing final output
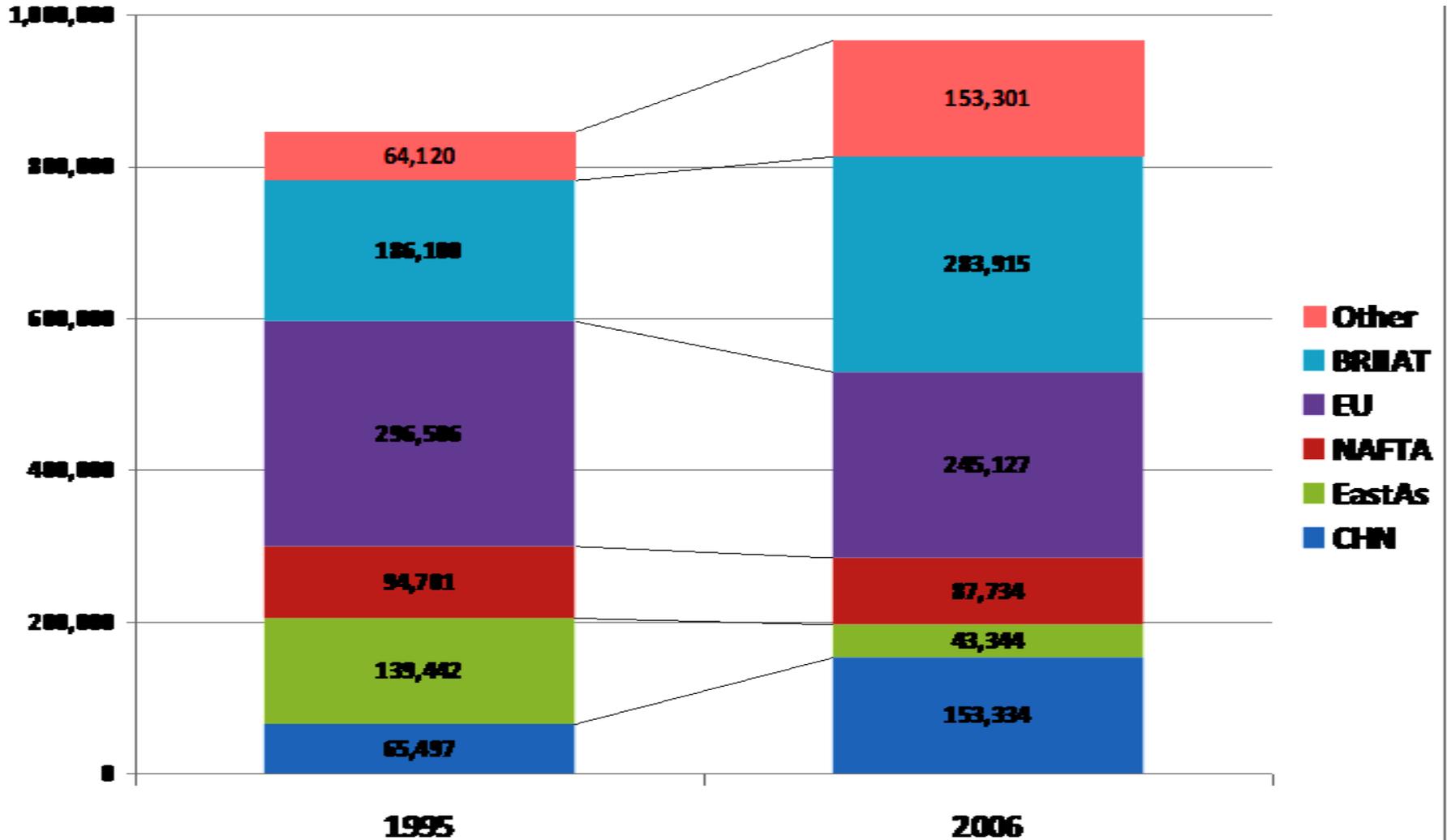## High-skilled (college graduate and above)
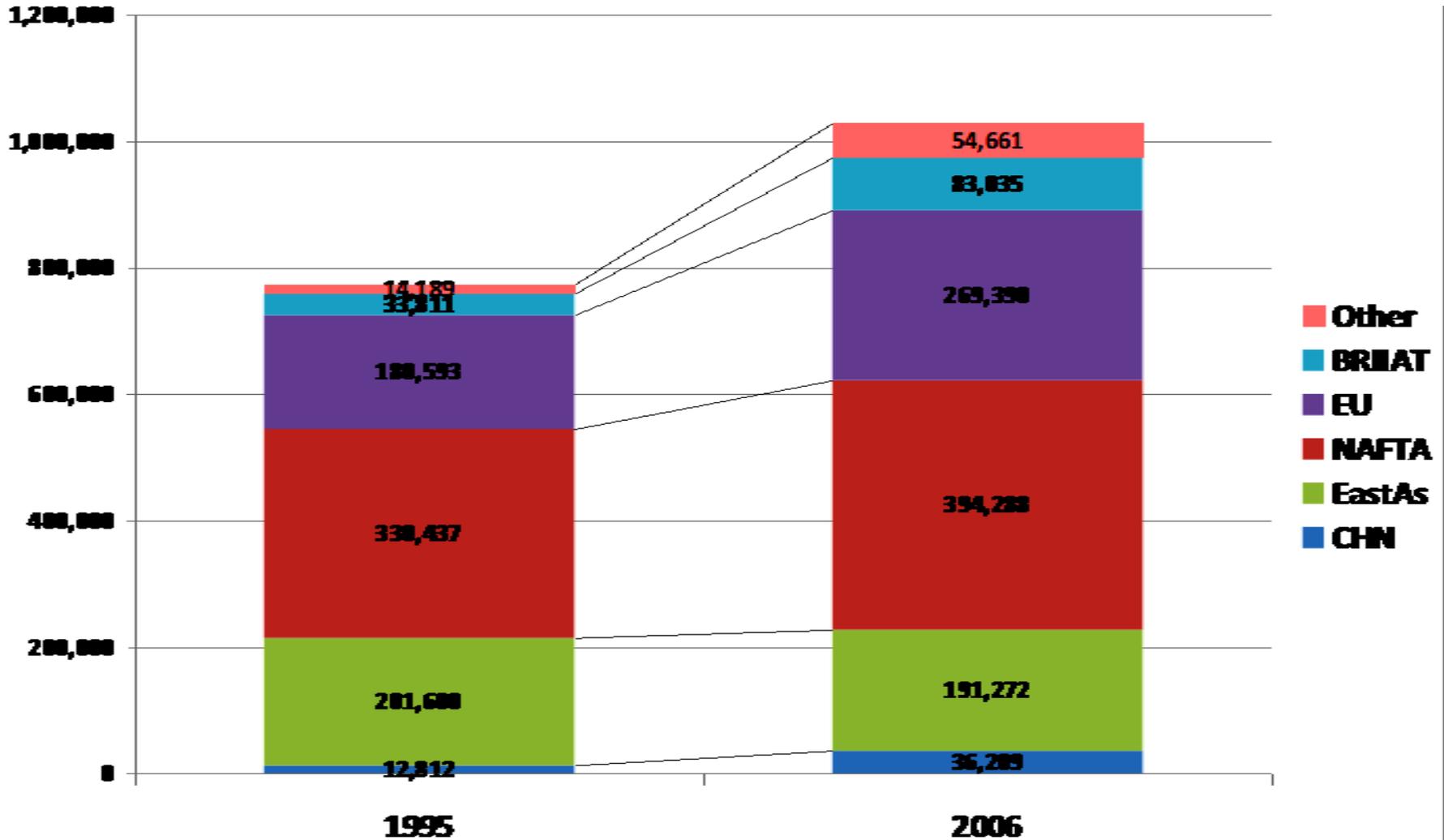
Units: millions of 1995 US$, at market exchange rates

Contribution to world manufacturing final output
Medium-skilled (secondary schooling)

Contribution to world manufacturing final output
Low-skilled (below secondary)

Concluding remarks

- So far only some initial forensics
    - Between 1995 and 2006, increasing foreign shares in manufacturing output of 38 out of 40 countries
- Redistribution of income generated in global manufacturing production
    - Away from Japan towards China
    - EU and NAFTA maintain shares through increasing contributions of high-skilled labour (and capital)
- More information on WIOD project at www.wiod.org
- Data publicly available from 16 April 2012 onwards

Additional material

How much do production factors
in particular sectors
in various regions
contribute to the global production
of final manufacturing goods?

Contribution to world manufacturing final output originating from services sectors
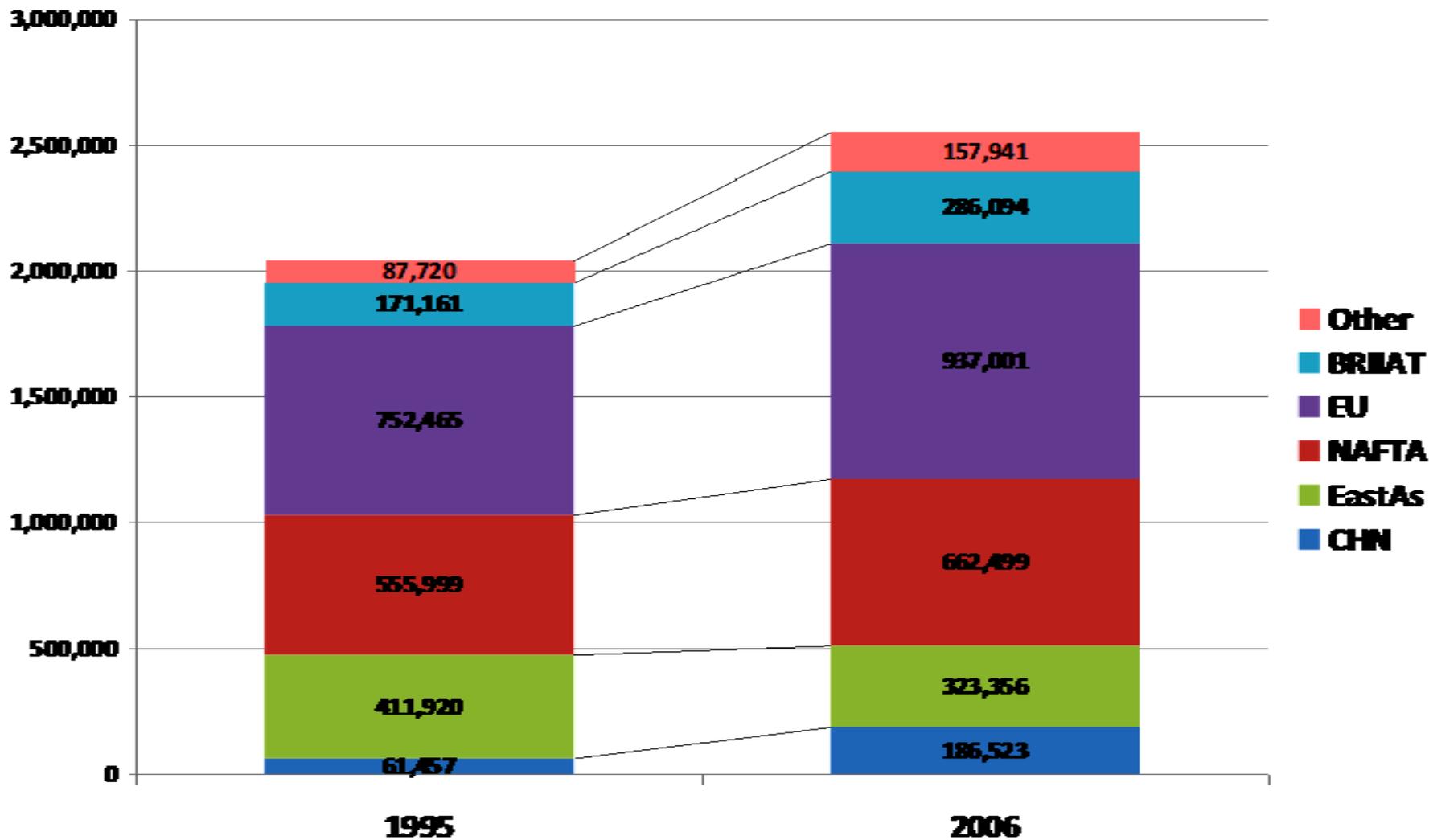
Contribution to world manufacturing final output originating from manufacturing sectors
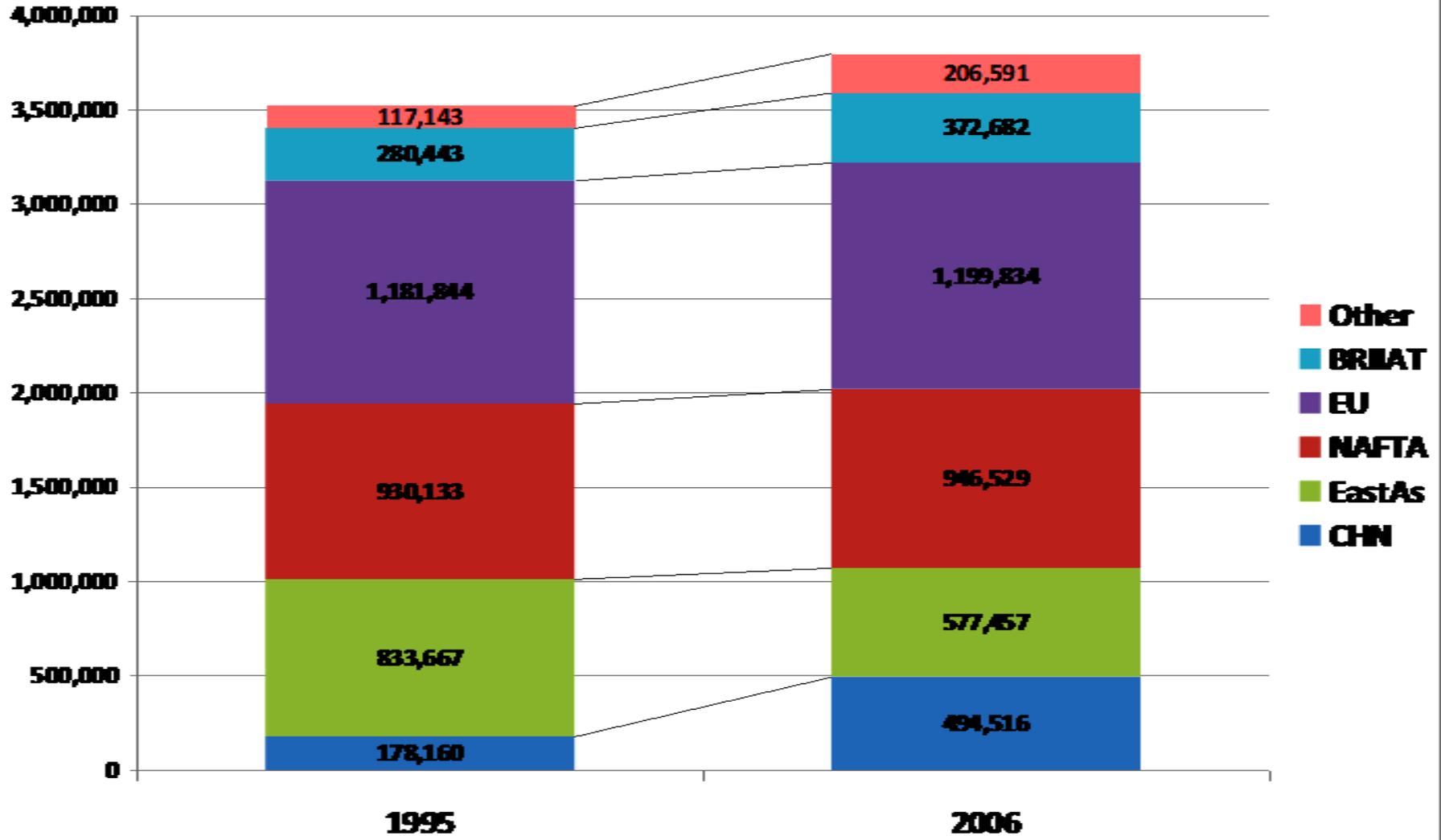
Contribution to world manufacturing final output originating from resource sectors
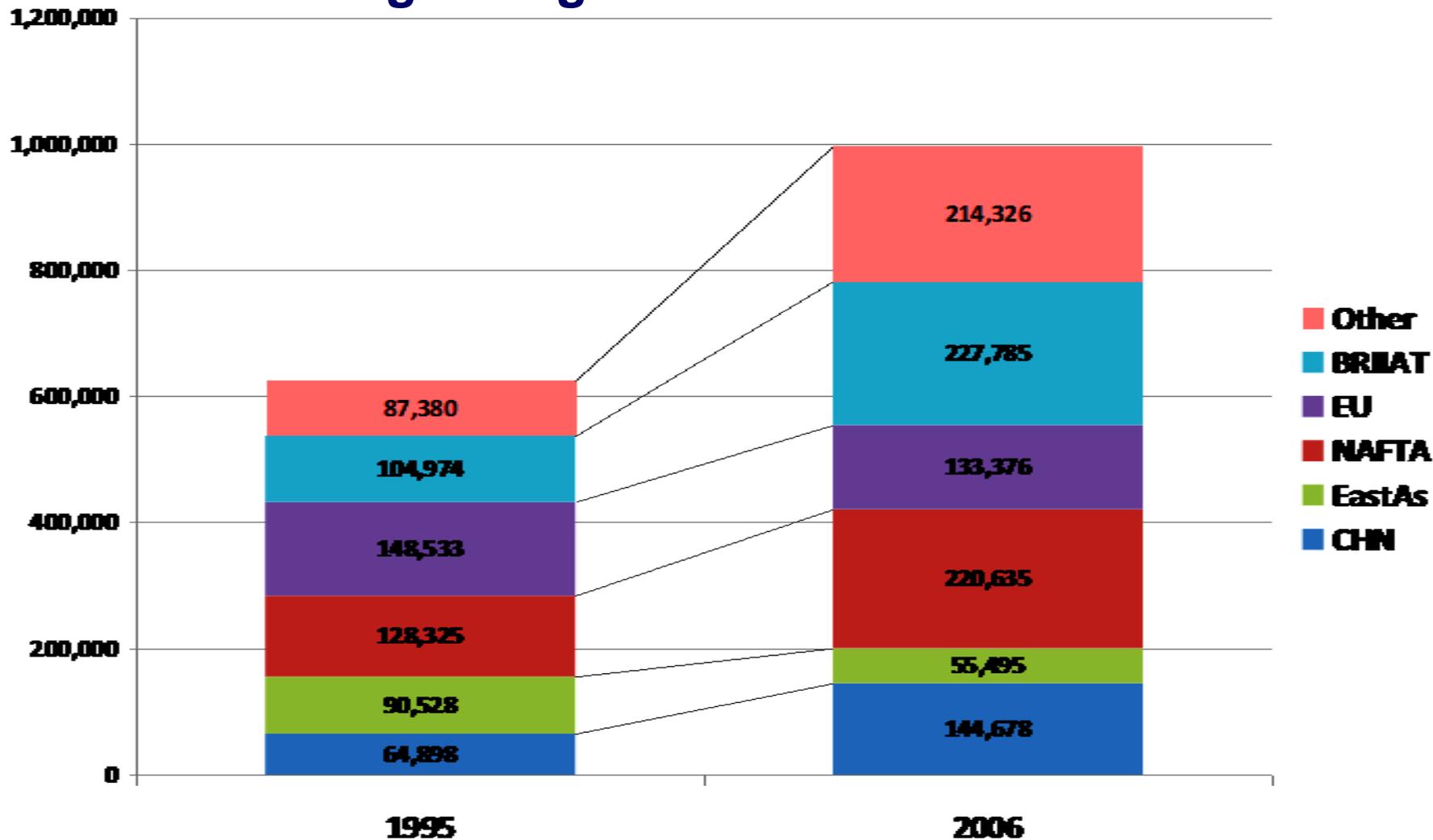
Share of foreign value added in domestic final manufacturing output (in %), 2006

Legend:
- 2006 EU
- 2006 China
- 2006 East Asia
- 2006 NAFTA
- 2006 Other

Categories: China, Japan, Germany, France, UK, Italy, Mexico, USA, India

SEVENTH FRAMEWORK PROGRAMME

Code	NACE	Description
		Columns in USE Table

Columns in USE Table

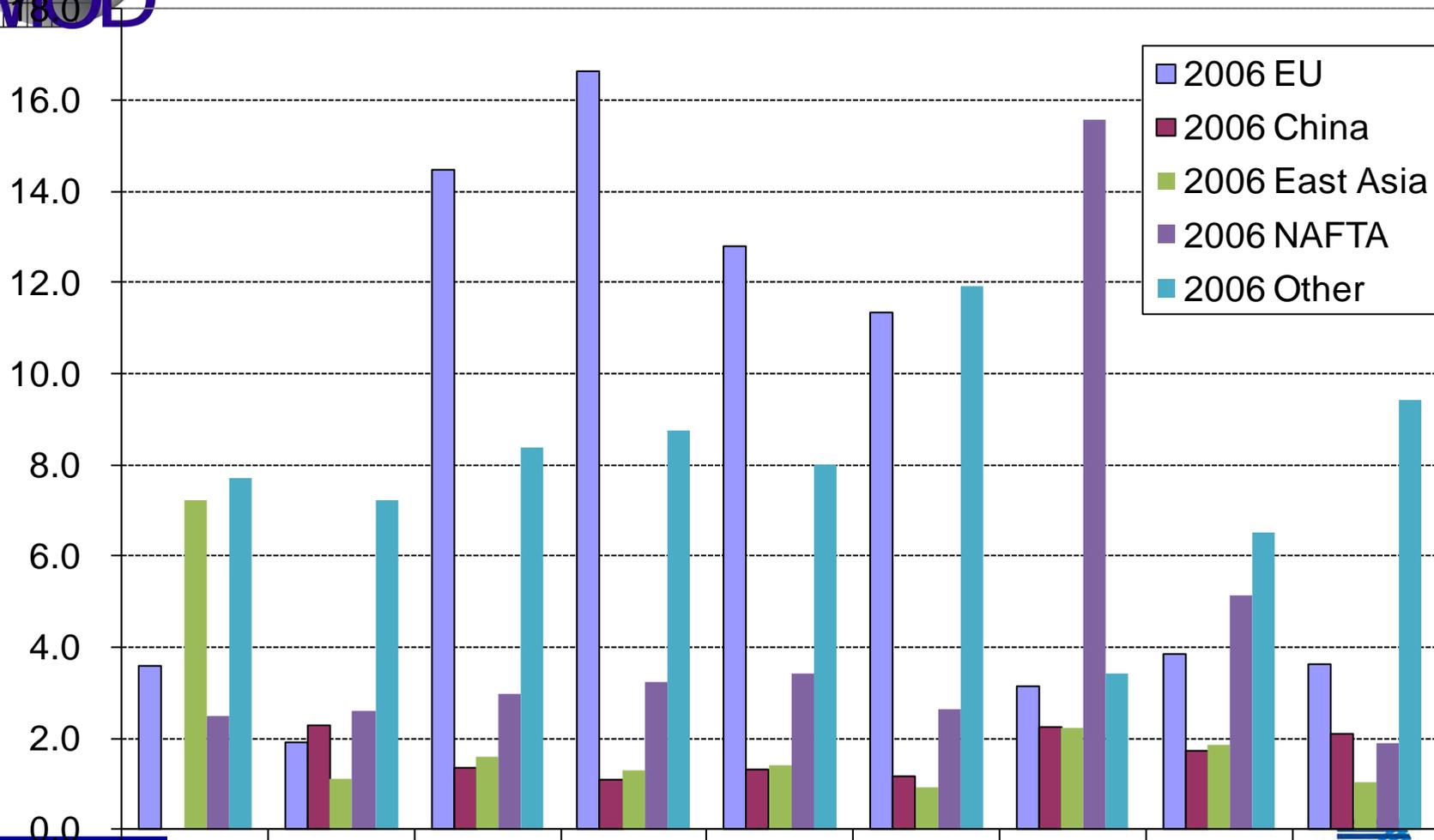| Code	NACE	Description
1	AtB	Agriculture, Hunting, Forestry and Fishing
2	C	Mining and Quarrying
3	15t16	Food, Beverages and Tobacco
4	17t18	Textiles and Textile Products
5	19	Leather, Leather and Footwear
6	20	Wood and Products of Wood and Cork
7	21t22	Pulp, Paper, Paper , Printing and Publishing
8	23	Coke, Refined Petroleum and Nuclear Fuel
9	24	Chemicals and Chemical Products
10	25	Rubber and Plastics
11	26	Other Non-Metallic Mineral
12	27t28	Basic Metals and Fabricated Metal
13	29	Machinery, Nec
14	30t33	Electrical and Optical Equipment
15	34t35	Transport Equipment
16	36t37	Manufacturing, Nec; Recycling
17	E	Electricity, Gas and Water Supply
18	F	Construction
19	50	Sale, Maintenance and Repair of Motor Vehicles Retail Sale of Fuel
20	51	Wholesale Trade and Commission Trade, Except of Motor Vehicles
21	52	Retail Trade, Except of Motor Vehicles ; Repair of Household Goods
22	H	Hotels and Restaurants
23	60	Inland Transport
24	61	Water Transport
25	62	Air Transport
26	63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
27	64	Post and Telecommunications
28	J	Financial Intermediation
29	70	Real Estate Activities
30	71t74	Renting of M&Eq and Other Business Activities
31	L	Public Admin and Defence; Compulsory Social Security
32	M	Education
33	N	Health and Social Work
34	O	Other Community, Social and Personal Services
35	P	Private Households with Employed Persons
36		Financial intermediation services indirectly measured (FISIM)
37		**Total**
38		Final consumption expenditure by households
39		Final consumption exp. by non-profit organisations serving households
40		Final consumption expenditure by government
41		**Final consumption expenditure**
42		Gross fixed capital formation
43		Changes in inventories and valuables
44		Gross capital formation
45		Exports
46		**Final uses at purchasers' prices**
47		**Total use at purchasers' prices**

Columns in Use table

SEVENTH FRAMEWORK PROGRAMME

Code	CPA	Description
1	1	Products of agriculture, hunting and related services
2	2	Products of forestry, logging and related services
3	5	Fish and other fishing products; services incidental of fishing
4	10	Coal and lignite; peat
5	11	Crude petroleum and natural gas; services incidental to oil and gas extraction excluding s
6	12	Uranium and thorium ores
7	13	Metal ores
8	14	Other mining and quarrying products
9	15	Food products and beverages
10	16	Tobacco products
11	17	Textiles
12	18	Wearing apparel; furs
13	19	Leather and leather products
14	20	Wood and products of wood and cork (except furniture); articles of straw and plaiting mate
15	21	Pulp, paper and paper products
16	22	Printed matter and recorded media
17	23	Coke, refined petroleum products and nuclear fuels
18	24	Chemicals, chemical products and man-made fibres
19	25	Rubber and plastic products
20	26	Other non-metallic mineral products
21	27	Basic metals
22	28	Fabricated metal products, except machinery and equipment
23	29	Machinery and equipment n.e.c.
24	30	Office machinery and computers
25	31	Electrical machinery and apparatus n.e.c.
26	32	Radio, television and communication equipment and apparatus
27	33	Medical, precision and optical instruments, watches and clocks
28	34	Motor vehicles, trailers and semi-trailers
29	35	Other transport equipment
30	36	Furniture; other manufactured goods n.e.c.
31	37	Secondary raw materials
32	40	Electrical energy, gas, steam and hot water
33	41	Collected and purified water, distribution services of water
34	45	Construction work

Rows in Use table (part 1)

35	50	Trade, maintenance and repair services of motor vehicles and motorcycles; retail sale of
36	51	Wholesale trade and commission trade services, except of motor vehicles and motorcycle
37	52	Retail trade services, except of motor vehicles and motorcycles; repair services of persor
38	55	Hotel and restaurant services
39	60	Land transport; transport via pipeline services
40	61	Water transport services
41	62	Air transport services
42	63	Supporting and auxiliary transport services; travel agency services
43	64	Post and telecommunication services
44	65	Financial intermediation services, except insurance and pension funding services
45	66	Insurance and pension funding services, except compulsory social security services
46	67	Services auxiliary to financial intermediation
47	70	Real estate services
48	71	Renting services of machinery and equipment without operator and of personal and house
49	72	Computer and related services
50	73	Research and development services
51	74	Other business services
52	75	Public administration and defence services; compulsory social security services
53	80	Education services
54	85	Health and social work services
55	90	Sewage and refuse disposal services, sanitation and similar services
56	91	Membership organisation services n.e.c.
57	92	Recreational, cultural and sporting services
58	93	Other services
59	95	Private households with employed persons
60		**Total**
61		Cif/ fob adjustments on exports
62		Direct purchases abroad by residents
63		Purchases on the domestic territory by non-residents
64		**Total intermediate consumption/final use at purchasers' prices**
65		Compensation of employees
66		Other net taxes on production
67		Operating surplus, gross
68		**Value added at basic prices**
69		**Output at basic prices**

Rows in Use table (part 2)

SEVENTH FRAMEWORK PROGRAMME

Value added contribution of regions (in columns) to manufacturing final output value in countries (in rows)

	own country 1995	own country 2006	CHN 1995	CHN 2006	EastAs 1995	EastAs 2006	EUnew 1995	EUnew 2006	EUold 1995	EUold 2006	NAFTA 1995	NAFTA 2006	Other 1995	Other 2006	Total (mil US$) 1995	Total (mil US$) 2006
EST	56.8	36.3	0.4	4.1	1.6	4.3	1.7	4.0	25.2	26.2	3.7	3.7	10.6	21.4	1,057	3,017
SVK	65.8	43.6	0.2	2.1	0.9	3.8	8.0	7.4	14.7	24.4	1.3	2.3	9.1	16.4	5,770	19,277
BEL	52.1	44.0	0.5	1.9	2.4	2.5	0.7	1.4	33.3	32.9	7.2	5.7	3.8	11.5	71,978	110,051
LUX	54.9	45.3	0.2	1.0	1.1	1.8	0.4	1.1	37.0	39.9	3.4	3.5	3.0	7.4	2,248	6,073
MLT	48.1	48.2	0.7	2.0	2.2	2.5	0.7	0.9	36.7	31.6	4.1	4.4	7.6	10.4	756	1,155
HUN	67.4	48.6	0.2	3.4	1.0	4.7	2.1	3.8	19.3	25.4	1.4	3.7	8.7	10.5	15,662	36,472
IRL	61.5	48.7	0.5	2.5	2.7	2.5	0.3	0.5	21.7	12.6	9.5	27.2	3.9	6.1	26,916	72,485
LTU	62.1	49.3	0.1	1.2	0.6	1.1	1.1	5.0	13.8	13.4	1.5	1.4	20.8	28.6	1,644	6,799
CZE	65.6	51.2	0.2	2.6	0.9	3.6	4.0	4.3	20.2	24.3	1.6	2.7	7.4	11.2	15,856	45,849
NLD	61.3	53.5	0.5	1.9	2.1	2.8	0.5	0.9	17.2	20.1	11.3	6.6	7.0	14.3	96,820	152,719
TWN	66.3	53.6	1.2	6.6	12.4	13.9	0.2	0.5	6.1	5.0	9.1	7.4	4.7	13.1	87,417	95,430
CYP	65.9	53.7	0.7	1.0	2.5	0.9	1.2	0.6	19.2	10.9	3.2	1.6	7.3	31.2	795	2,468
SVN	64.8	54.0	0.3	1.1	1.2	1.6	2.5	3.3	22.7	28.6	2.3	2.1	6.3	9.4	5,503	8,189
BGR	68.5	54.6	0.2	1.7	0.5	1.3	1.3	2.3	12.5	25.5	1.2	2.6	15.8	12.0	4,153	8,809
AUT	72.3	59.3	0.2	1.1	1.1	1.3	1.5	3.2	15.4	22.3	2.0	2.7	7.6	10.0	51,237	69,937
LVA	57.0	59.5	0.1	1.1	0.7	0.9	3.2	5.4	20.9	16.8	1.5	1.6	16.5	14.8	878	3,331
PRT	68.2	61.5	0.2	0.9	1.6	1.0	0.3	0.7	18.2	22.5	4.8	2.2	6.7	11.3	30,916	40,111
SWE	70.4	62.1	0.2	1.5	1.4	3.0	0.7	1.7	19.4	18.4	2.5	3.9	5.4	9.3	52,440	84,850
FIN	73.7	63.6	0.3	2.1	2.5	3.2	0.6	1.3	11.4	13.0	6.3	3.2	5.3	13.5	23,779	39,645
DNK	73.8	65.2	0.3	1.3	1.0	1.7	0.7	1.4	16.5	18.4	1.8	3.2	5.8	8.7	35,732	49,021
ESP	77.3	66.0	0.2	1.2	1.1	1.1	0.3	0.9	12.8	16.4	2.8	2.6	5.4	11.8	143,673	227,359
ROM	73.0	66.1	0.3	1.2	0.7	1.1	1.1	2.2	14.5	14.8	1.5	1.9	8.9	12.7	11,286	33,156
POL	82.1	66.4	0.2	1.4	0.6	2.1	1.0	1.9	10.7	16.5	1.1	2.1	4.5	9.7	34,594	86,951
CAN	66.3	67.0	0.5	1.7	2.9	2.4	0.1	0.2	5.5	3.7	21.9	20.8	2.7	4.2	128,830	223,711
FRA	78.2	69.0	0.2	1.1	1.4	1.3	0.3	0.9	11.3	15.7	4.3	3.2	4.3	8.8	325,086	440,046
KOR	76.3	69.0	1.4	4.1	5.4	5.5	0.2	0.2	4.1	4.1	5.8	4.2	6.8	12.8	125,082	196,175
GRC	78.0	70.8	0.2	0.8	0.9	1.3	0.8	1.0	11.7	10.5	2.2	1.4	6.3	14.1	25,325	37,150
DEU	81.1	71.2	0.3	1.4	1.7	1.6	1.1	2.4	8.7	12.1	3.1	3.0	4.1	8.4	631,705	752,086
ITA	78.9	72.0	0.3	1.2	1.0	0.9	0.7	1.1	10.2	10.3	3.7	2.6	5.3	11.9	308,074	453,630
ROW	77.3	72.1	0.2	2.9	5.4	2.7	0.4	1.0	10.7	13.1	4.0	3.9	1.9	4.2	143,067	285,587
GBR	77.1	73.0	0.4	1.3	2.0	1.4	0.4	0.7	10.8	12.1	4.5	3.4	4.9	8.0	249,623	346,501
MEX	75.7	73.3	0.2	2.3	1.9	2.3	0.1	0.1	2.9	3.0	17.8	15.6	1.5	3.4	123,312	323,184
TUR	81.3	74.3	0.5	1.4	1.2	1.2	0.6	1.0	8.1	8.3	2.0	1.8	6.4	11.9	65,130	153,313
CHN	85.8	79.0	-	-	6.5	7.2	0.1	0.2	1.9	3.4	2.4	2.5	3.4	7.7	329,584	1,104,709
USA	88.2	80.9	0.3	1.7	2.5	1.9	0.1	0.2	3.7	3.7	2.5	5.1	2.7	6.5	1,352,719	1,869,388
IND	89.4	81.9	0.4	2.1	1.0	1.1	0.1	0.2	3.4	3.5	1.1	1.9	4.6	9.4	123,698	265,835
IDN	83.0	82.6	0.7	1.9	6.1	2.9	0.1	0.1	4.3	3.7	2.4	1.9	3.4	6.9	71,790	110,555
AUS	84.8	83.1	0.5	1.5	2.8	1.8	0.1	0.1	4.7	3.4	3.1	2.8	4.0	7.3	57,419	95,247
JPN	93.1	84.9	0.5	2.3	0.5	1.1	0.0	0.1	1.2	1.8	2.5	2.6	2.2	7.2	1,120,226	927,429
BRA	90.7	86.7	0.2	0.8	1.0	1.1	0.1	0.1	2.7	3.6	2.1	2.6	3.2	5.1	173,618	243,959
RUS	89.0	87.8	0.2	0.8	0.7	2.1	1.0	0.7	4.3	4.9	0.8	0.9	4.0	2.9	56,983	147,215