Slicing Up Global Value Chains

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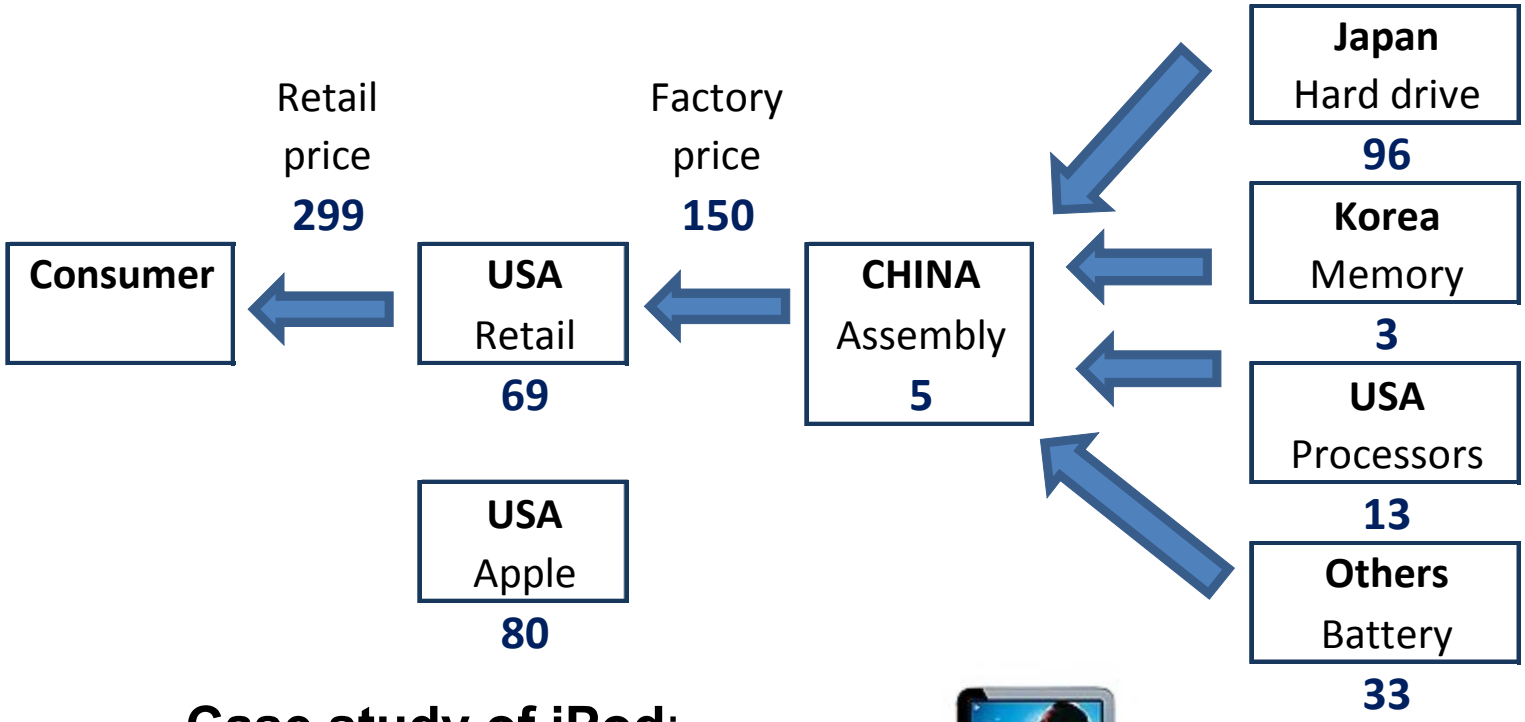
Global Production Networks imply a global value distribution



Case study of iPod: (Dedrick, Kraemer and Linden, 2010)

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This presentation

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

- **MAIN ISSUES**:
- Measure the share of foreign value added in domestic production for final consumption
- Trends in value added contribution of various production factors (types of labour and capital) in various regions

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WIOD-project approach

- The production value of a *final* product is the sum of all value added during the production process
  - Direct contribution by domestic production factors in the sector of final production
  - Indirect contribution by factors in other domestic sectors through intermediate inputs
  - Contribution of foreign factors through imports of intermediate inputs
- Relying on *input-output techniques* to measure the *direct* and *indirect* inputs into production
- Country-industry perspective requires construction of a World Input-Output Database (WIOD)
- Present some **preliminary** results

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Factor content of final demand

Define number of countries N, industries G and Factors F

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

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

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

$$\mathbf{K = AC}$$

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

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Database outline

- World Input-Output Table (WIOT): for each user, supply is broken down into:
  - Domestically produced
  - Imported (by partner country)
- Period from 1995 to 2006:
  - 27 EU countries and 13 other major countries (USA, JAP, BRA, RUS, IND, CHN, IDN, KOR, MEX, TAI, THA, AUS, and CAN) overall covering over 85% of world GDP
  - 35 industries and 59 products
- Factor inputs by industry: labour (low-, medium-, and high-skilled) and capital.

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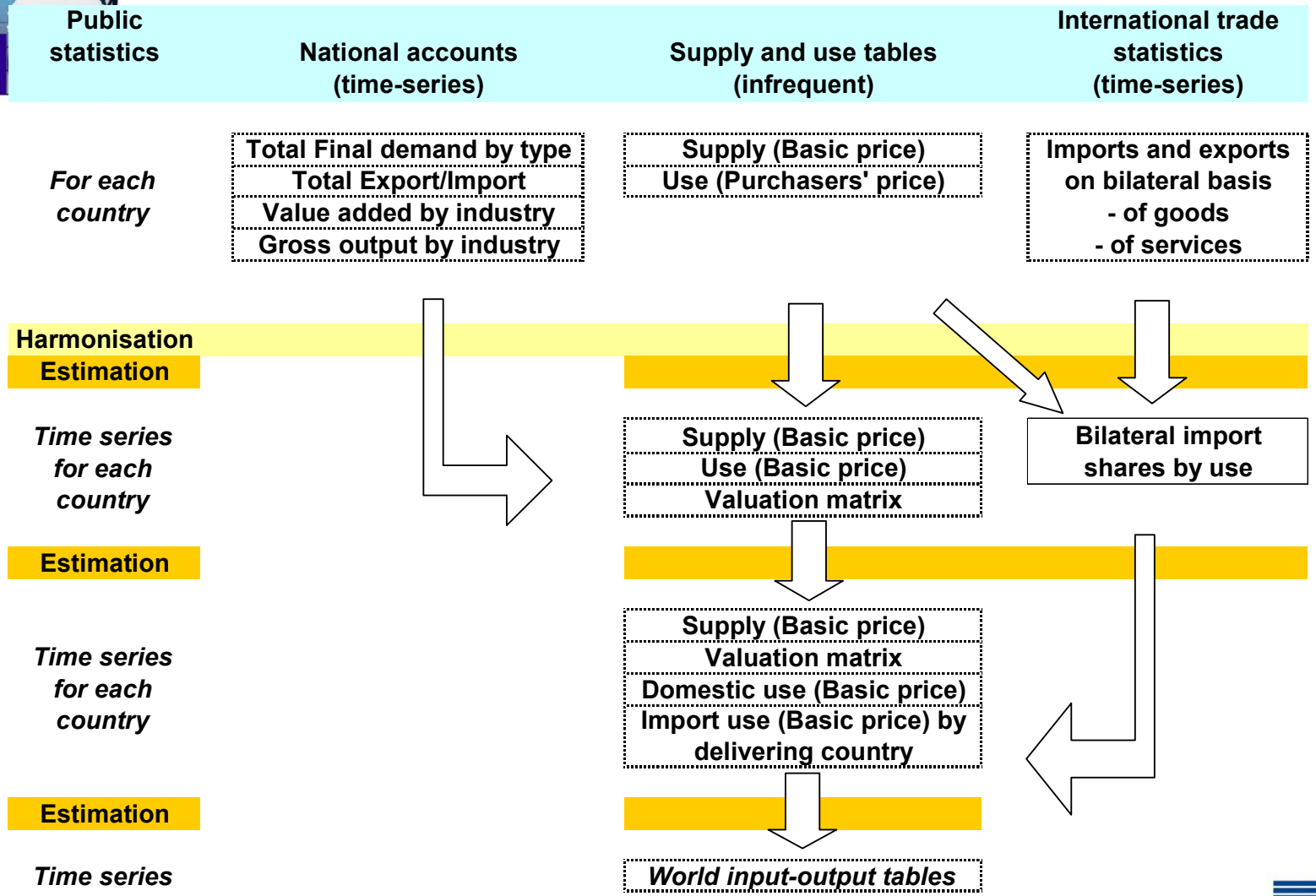
Dataflows and construction steps in WIOT



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Key Construction Steps (I)

- Country-specific correspondence tables for products and industries (non-EU countries)
- Benchmark National SUTs in line with National Accounts aggregate totals: SUTRAS (Temurshoev and Timmer, *PapRegSci*, 2011)
- Projected National SUTs in line with National Accounts (SUTRAS)
- National SUTs both in basic prices and purchasers' prices
  - Estimation of valuation matrices needed (net tax and margins)

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Key Construction Steps (II)

- Split between use of domestic products and imported products based on:
  - Broad End-Use Categories (modified, at very detailed level, 5000 goods)
  - Imports by product in the supply table
- Split of imported use by country-of-origin (plus RoW) based on import shares from UNCOMTRADE (by end use)
- Bilateral trade in services assembled from OECD, Eurostat, IMF and WTO (originally in BoP codes)

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Key Construction Steps (III)

- Socio-economic indicators mainly from EU KLEMS (plus WORLD KLEMS project)
- Annually, for 35 industries from 1995 to 2008:
  - Value added in current and constant prices
  - Employment (including self-employed) by educational attainment (low, medium, and high-skilled), and capital stocks
  - Agriculture, ±15 manufacturing sectors, ± 15 services sectors
- Help and cooperation with:
  - Teams from: Latin America KLEMS, Russia KLEMS, India KLEMS, and China KLEMS. Overall leadership of World KLEMS by Dale Jorgenson, Bart van Ark, and Marcel Timmer

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				

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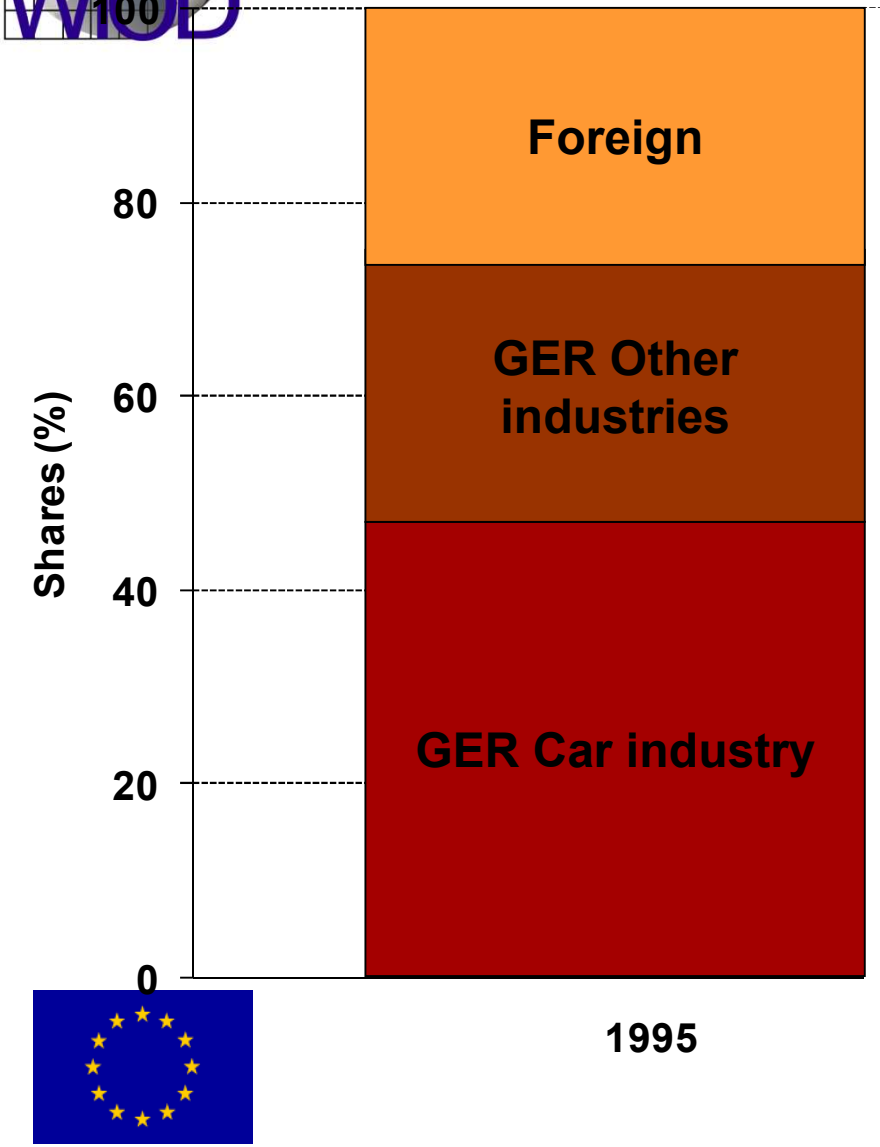
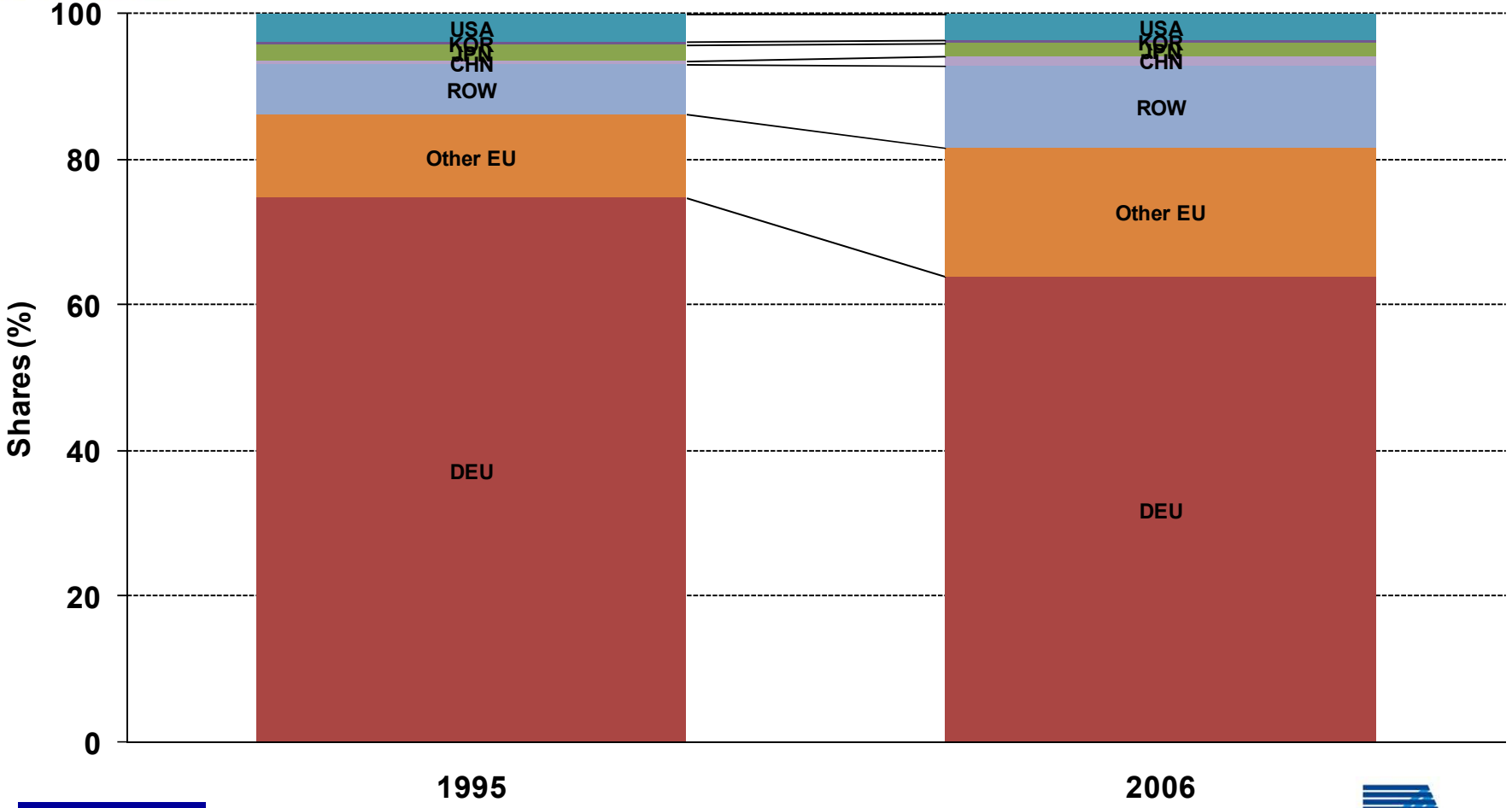
An illustration:
Who contributed value
to a car produced in Germany?

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



- Foreign countries capture share due to delivery of intermediate inputs
- But also in other German industries that deliver intermediate inputs to car industry
- German share is partly due to factor inputs deployed in car industry

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



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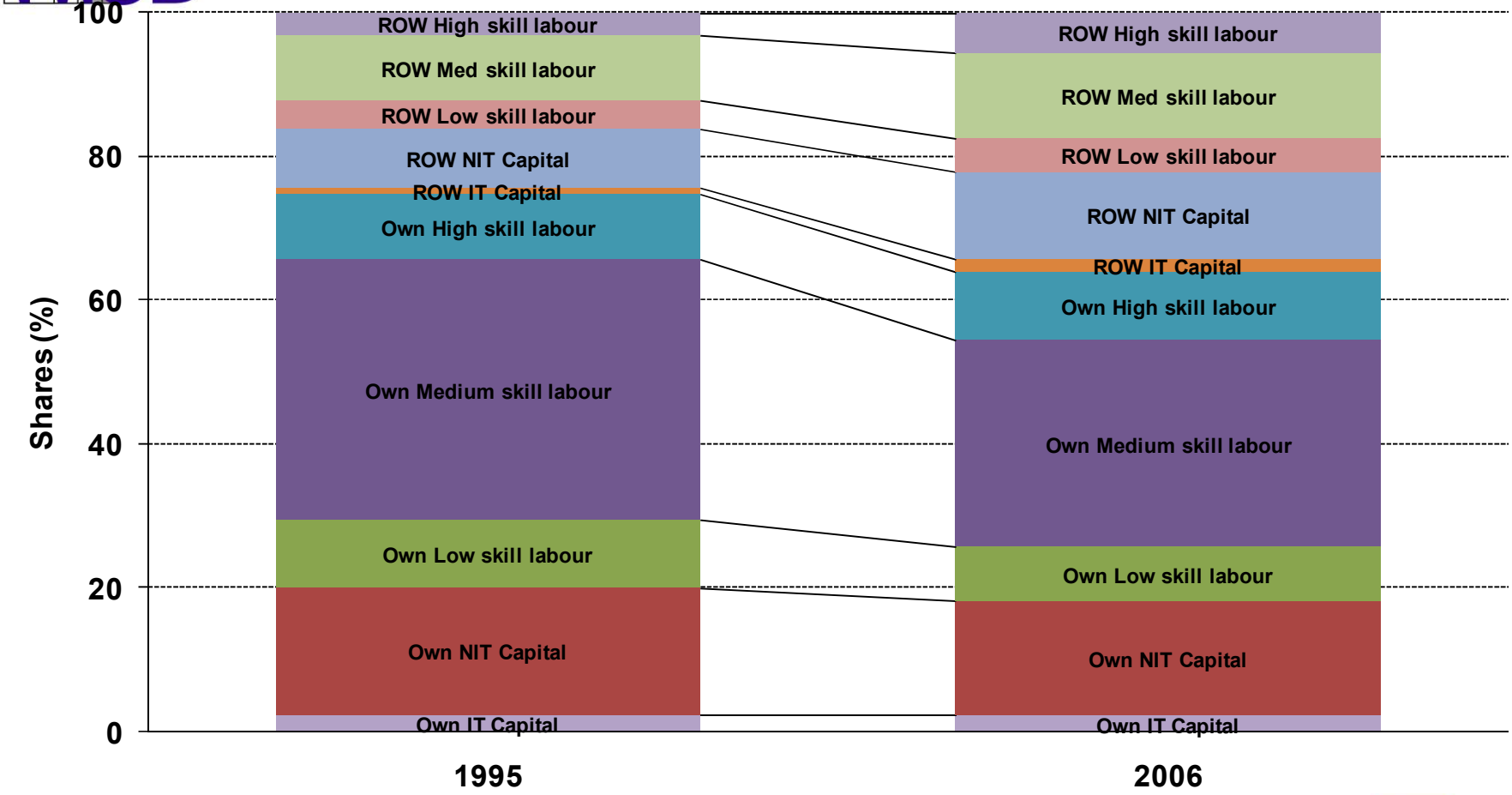
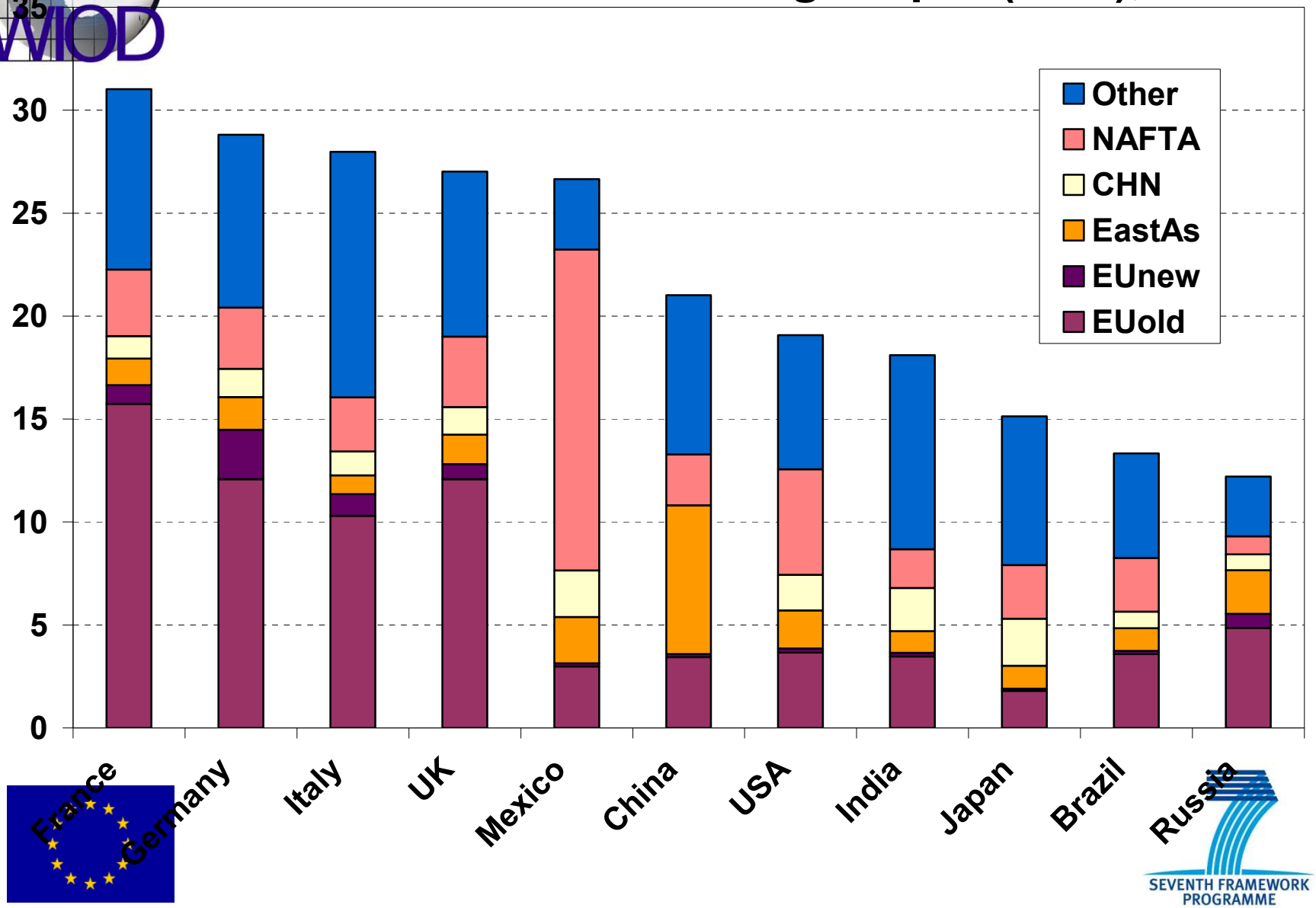


Which regions contributed value to final goods manufactured in a country?

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



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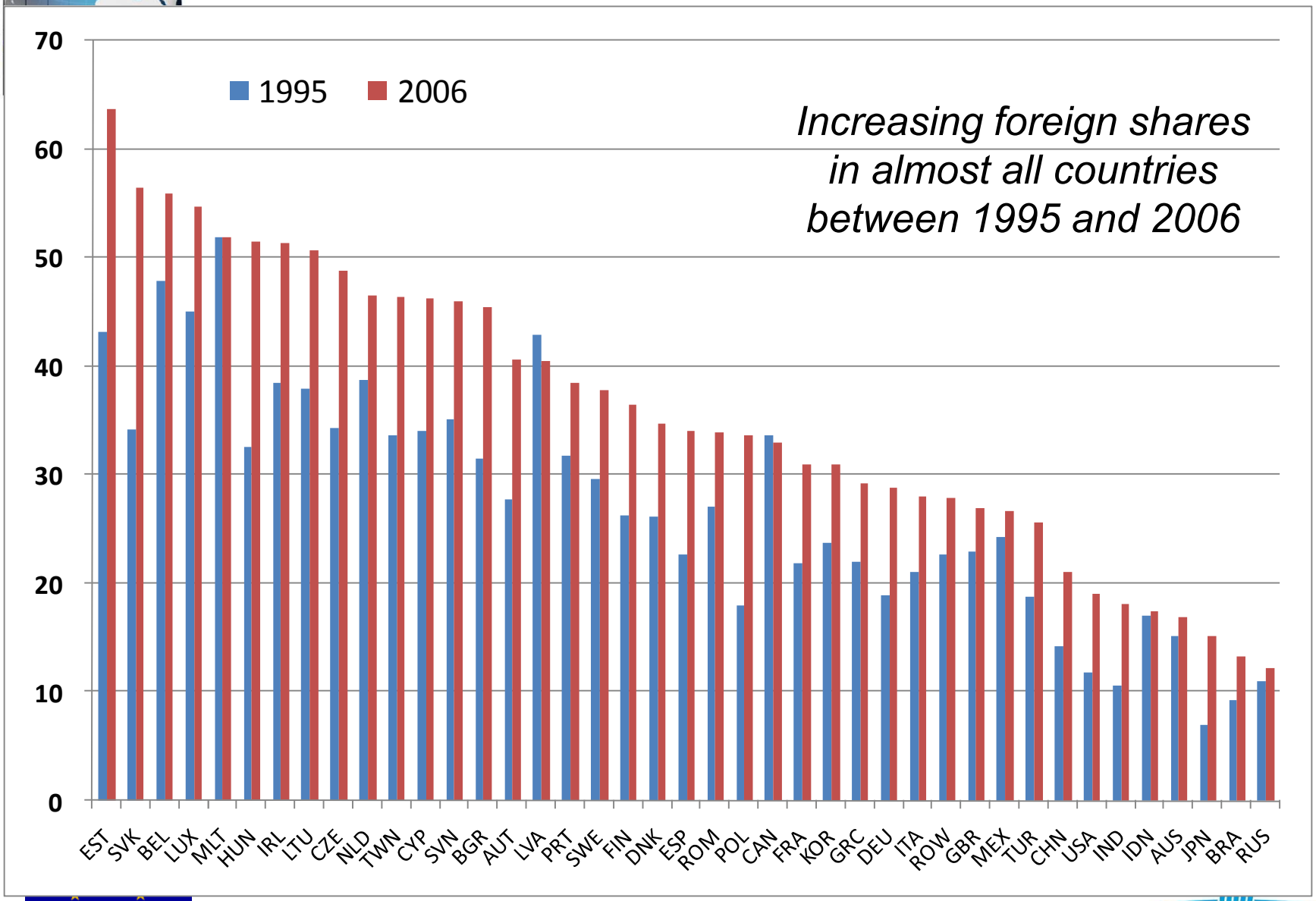
Share of foreign value added in domestic manufacturing final output (in %)



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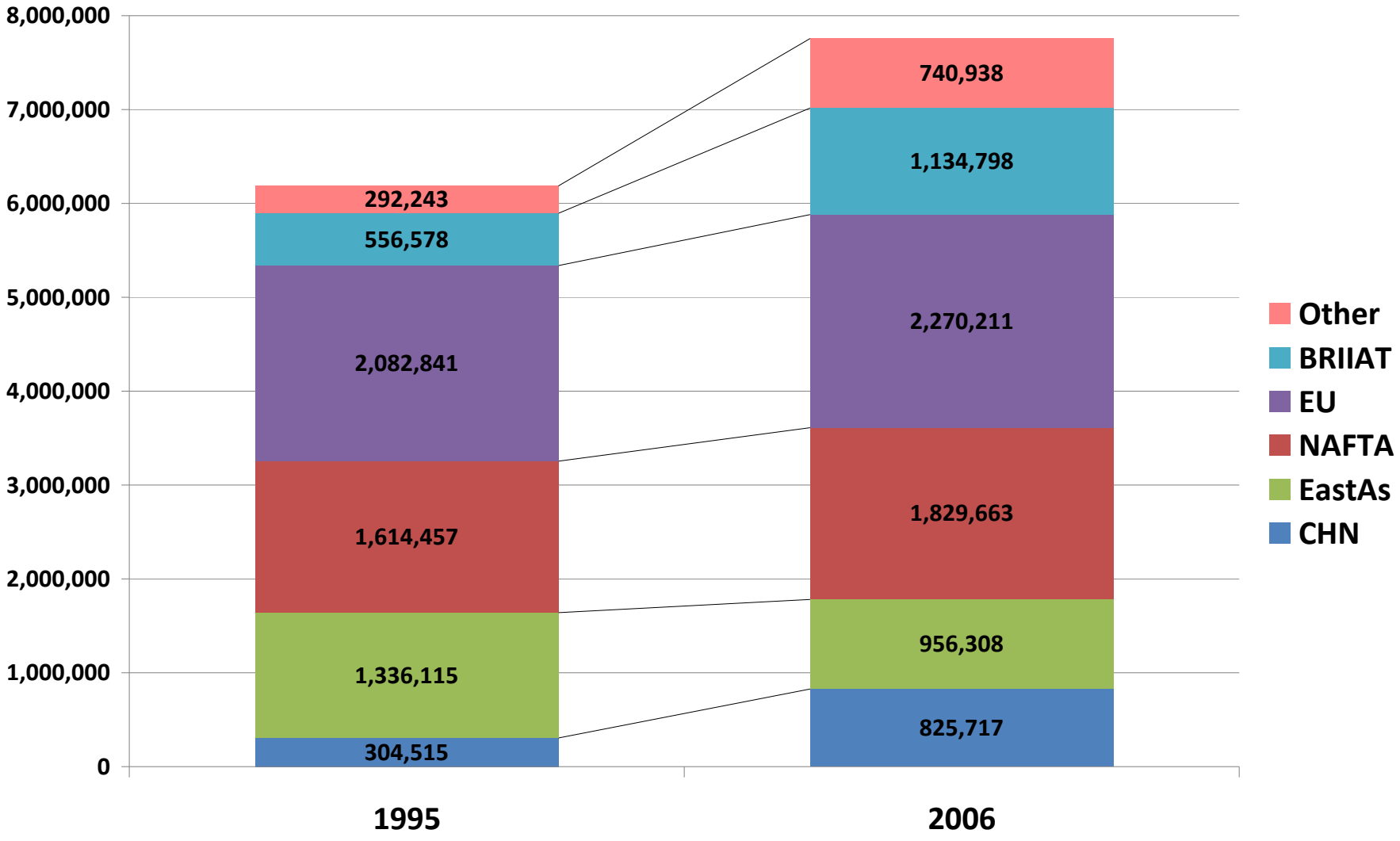
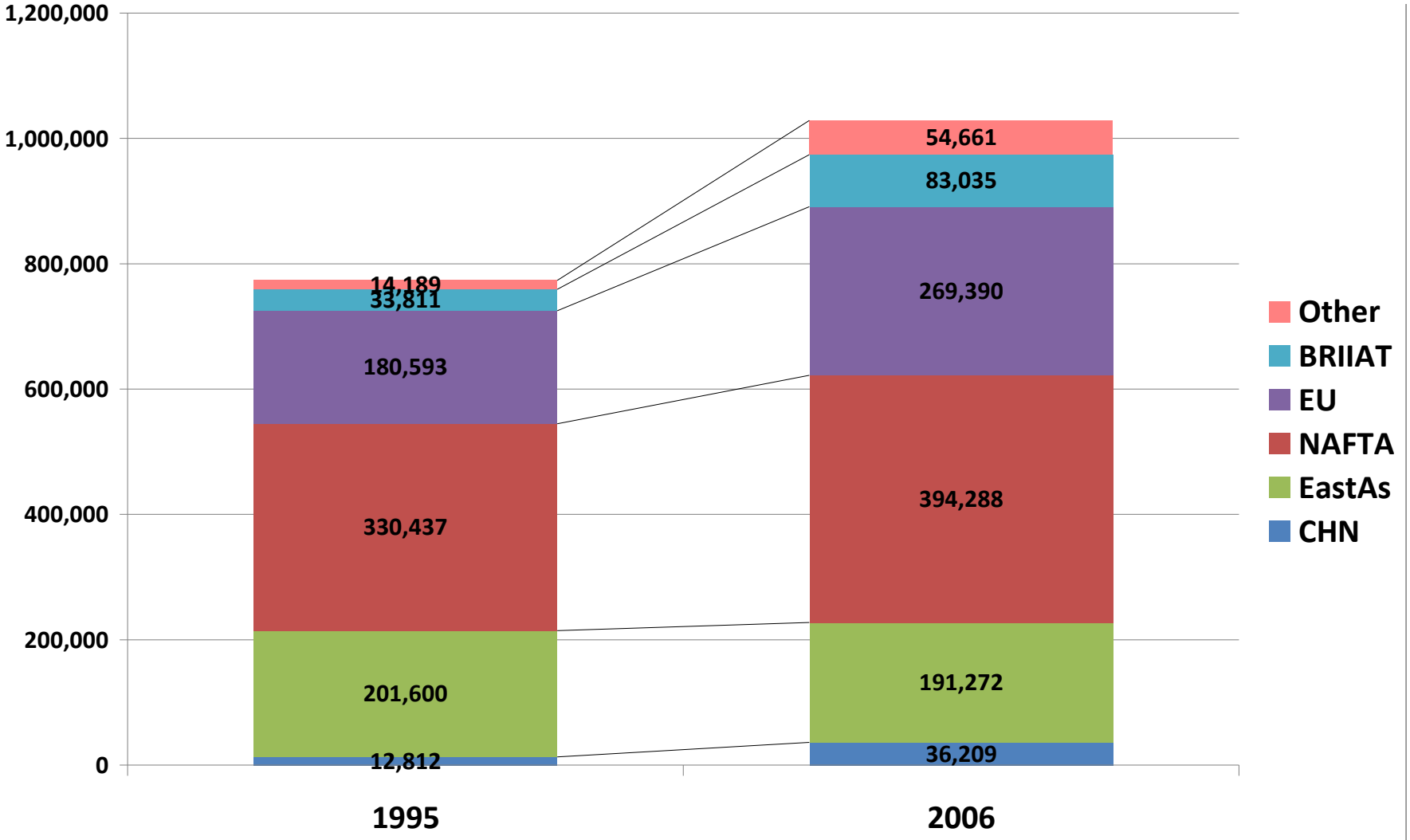
How much do production factors
in various regions
contributed to the *global* production
of final manufacturing goods?

Value added contribution of regions to world manufacturing final output (in mil 1995 US$)



Contribution to world manufacturing final output
High-skilled (college graduate and above)



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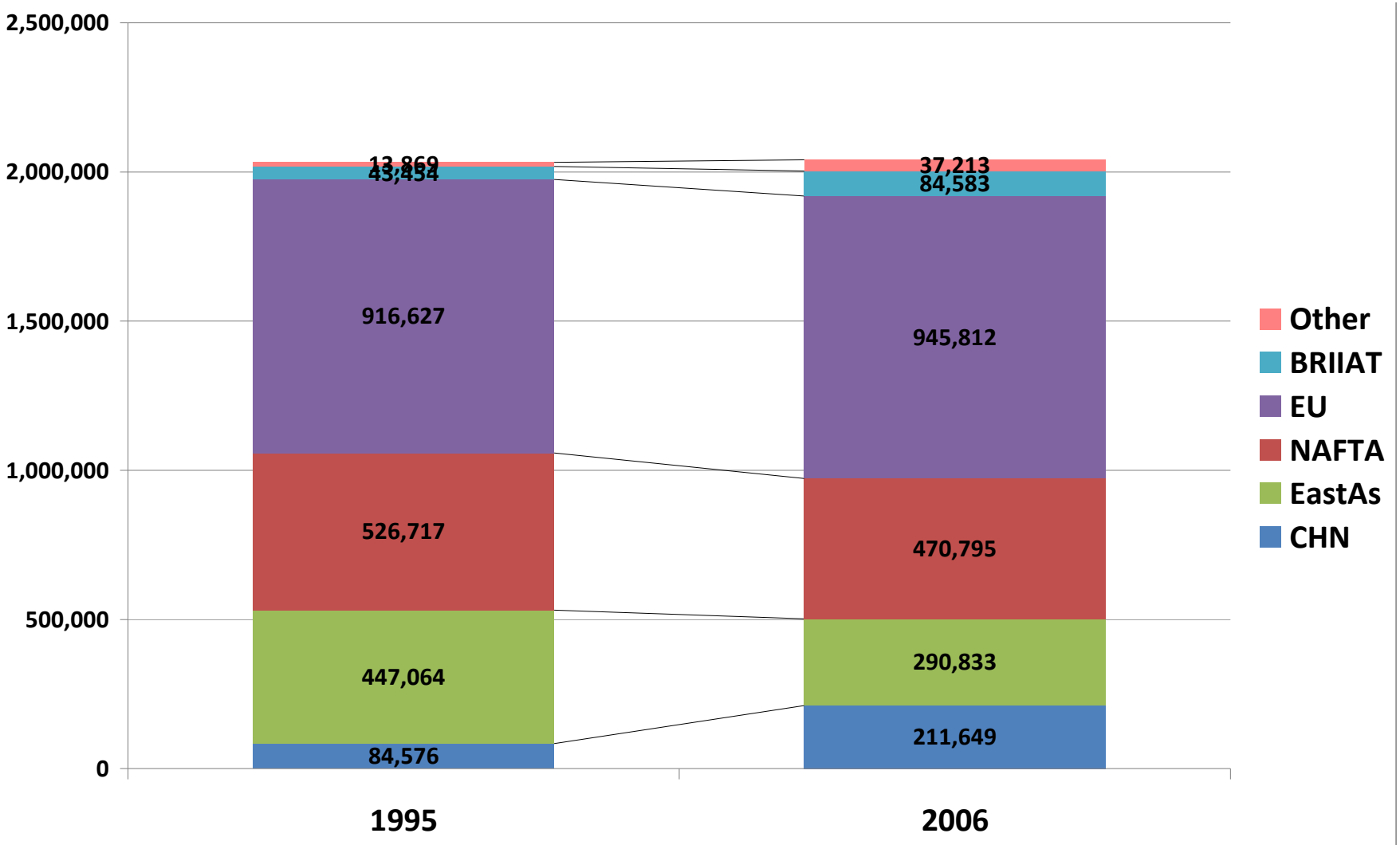
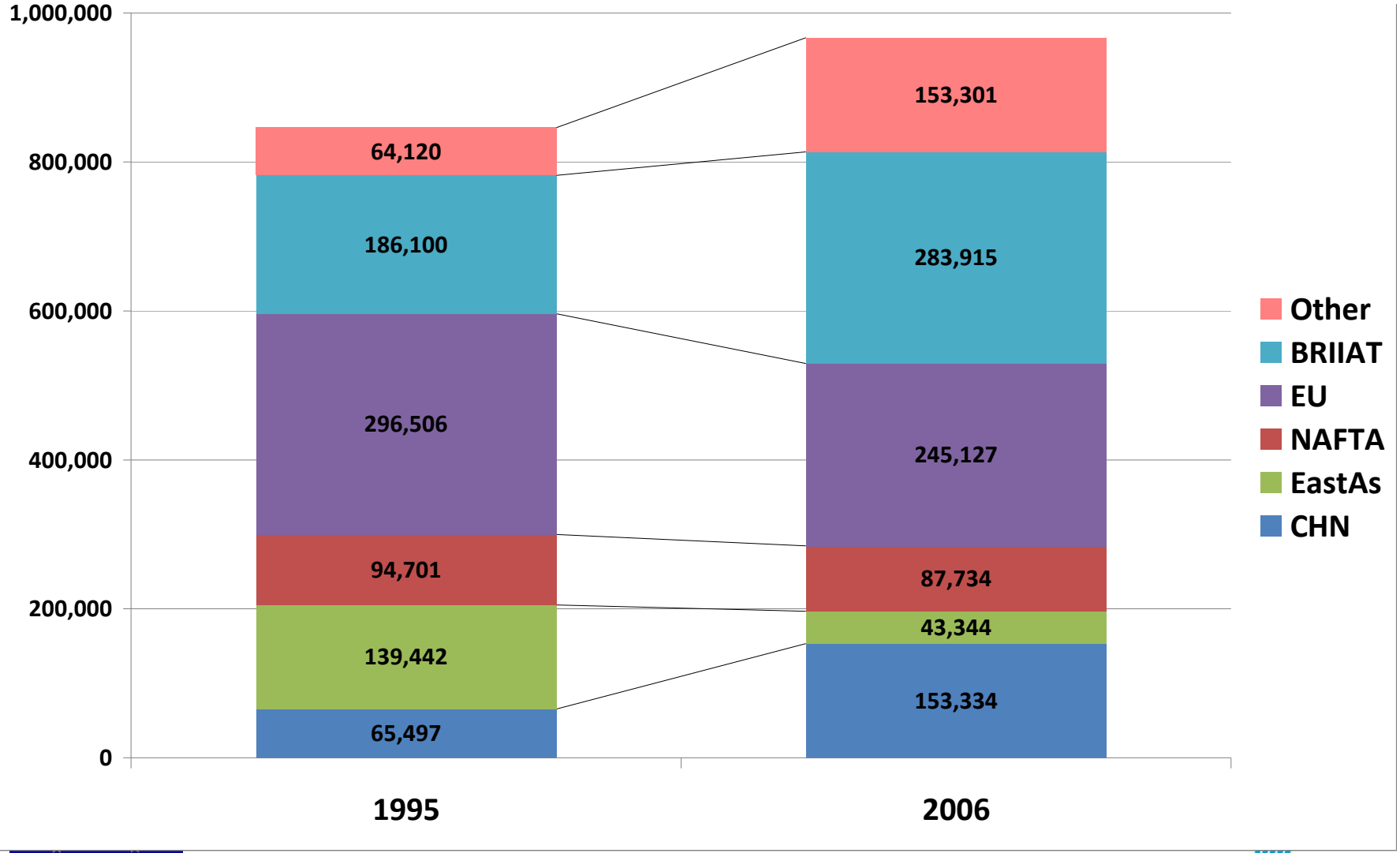
Contribution to world manufacturing final output
Medium-skilled (secondary schooling)



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



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How much do production factors

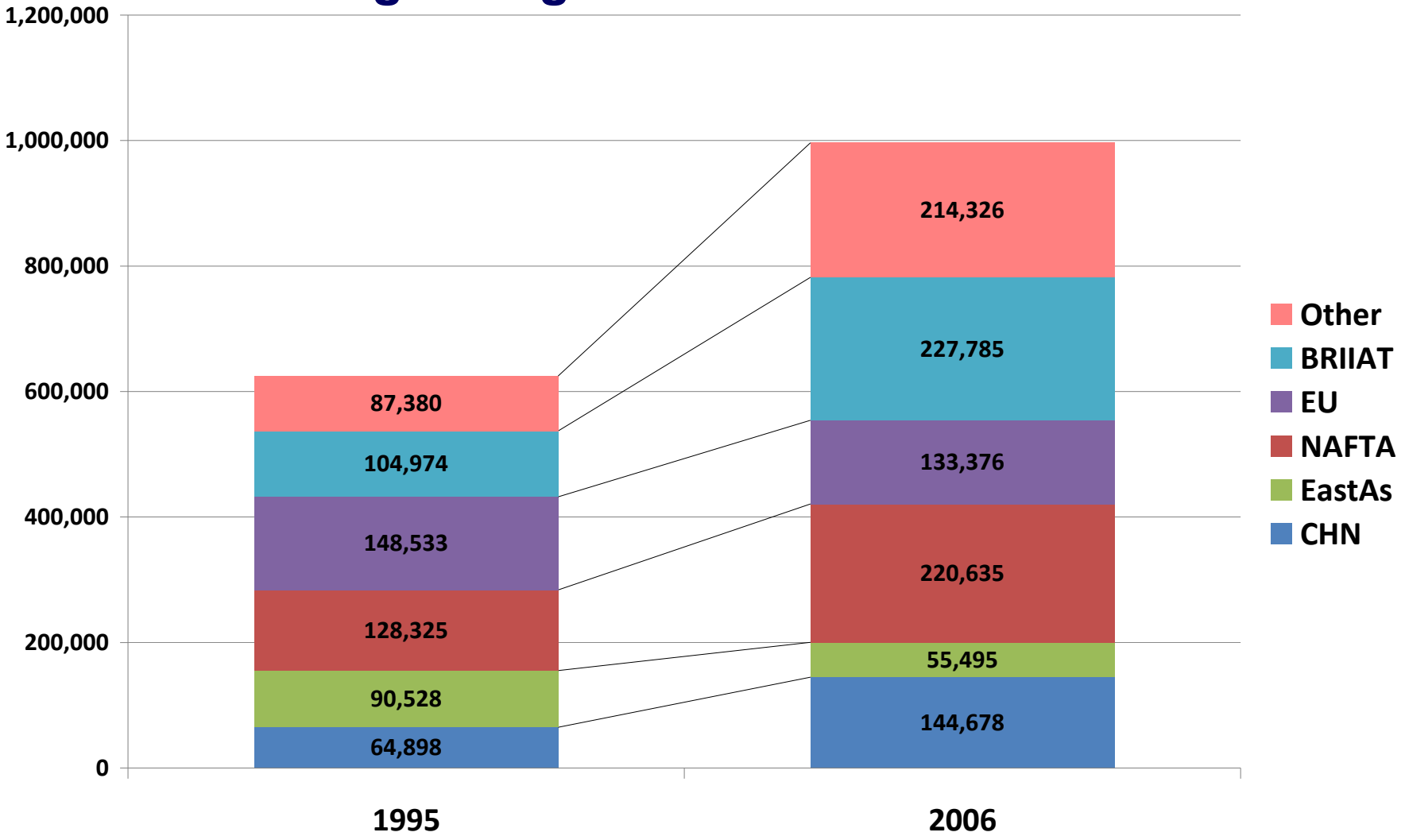
in particular sectors

in various regions

contributed to the global production

of final manufacturing goods?

Contribution to world manufacturing final output originating from resource sectors



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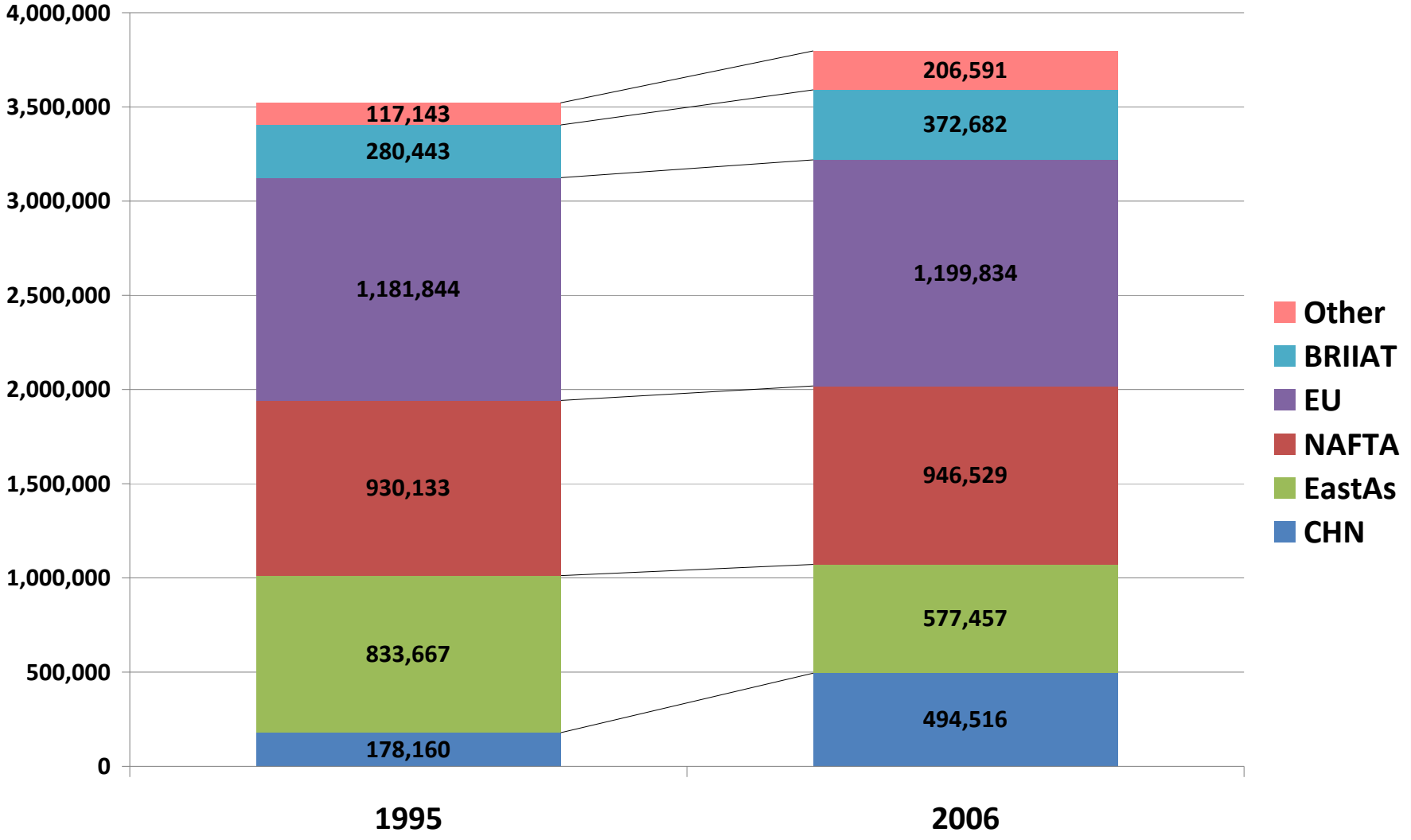
Contribution to world manufacturing final output originating from manufacturing sectors



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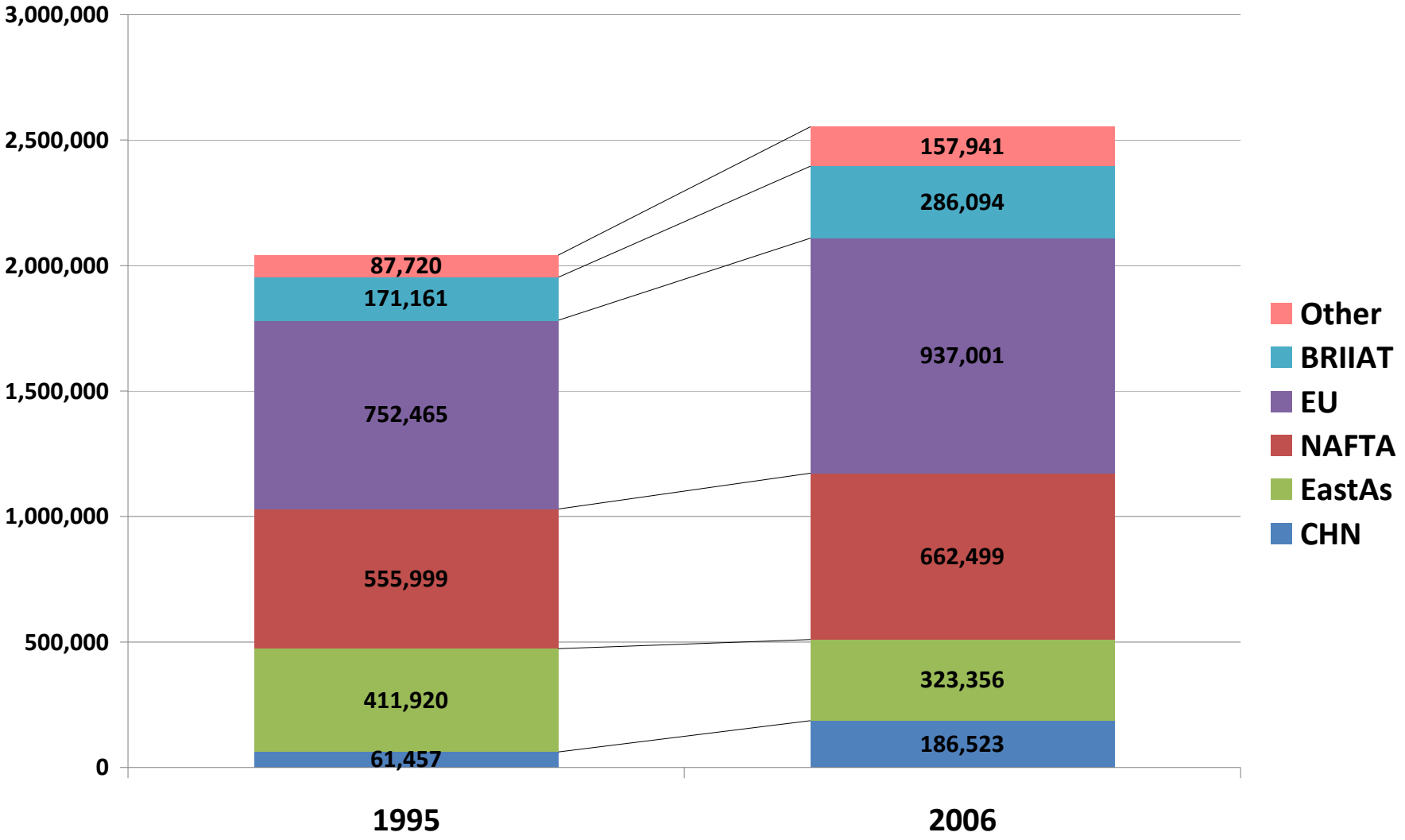
Contribution to world manufacturing final output originating from services sectors



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Concluding remarks

- Between 1995 and 2006, stronger integration of production both within and across regional trading blocs
- Redistribution of income generated in global manufacturing production
  - Mainly away from Japan towards China
  - EU and NAFTA maintain shares through increasing income for high-skilled labour and capital in services sectors
  - In China and other developing regions, income for medium-skilled labour and capital increased most.

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Concluding remarks

- So far only some initial forensics on imperfect data
  - Inconsistent trade data (export ≠ import)
  - Trade in services
  - Use-classification of imports
  - Import prices

- Data made publicly available April 2012.

- More information on WIOD project at www.wiod.org

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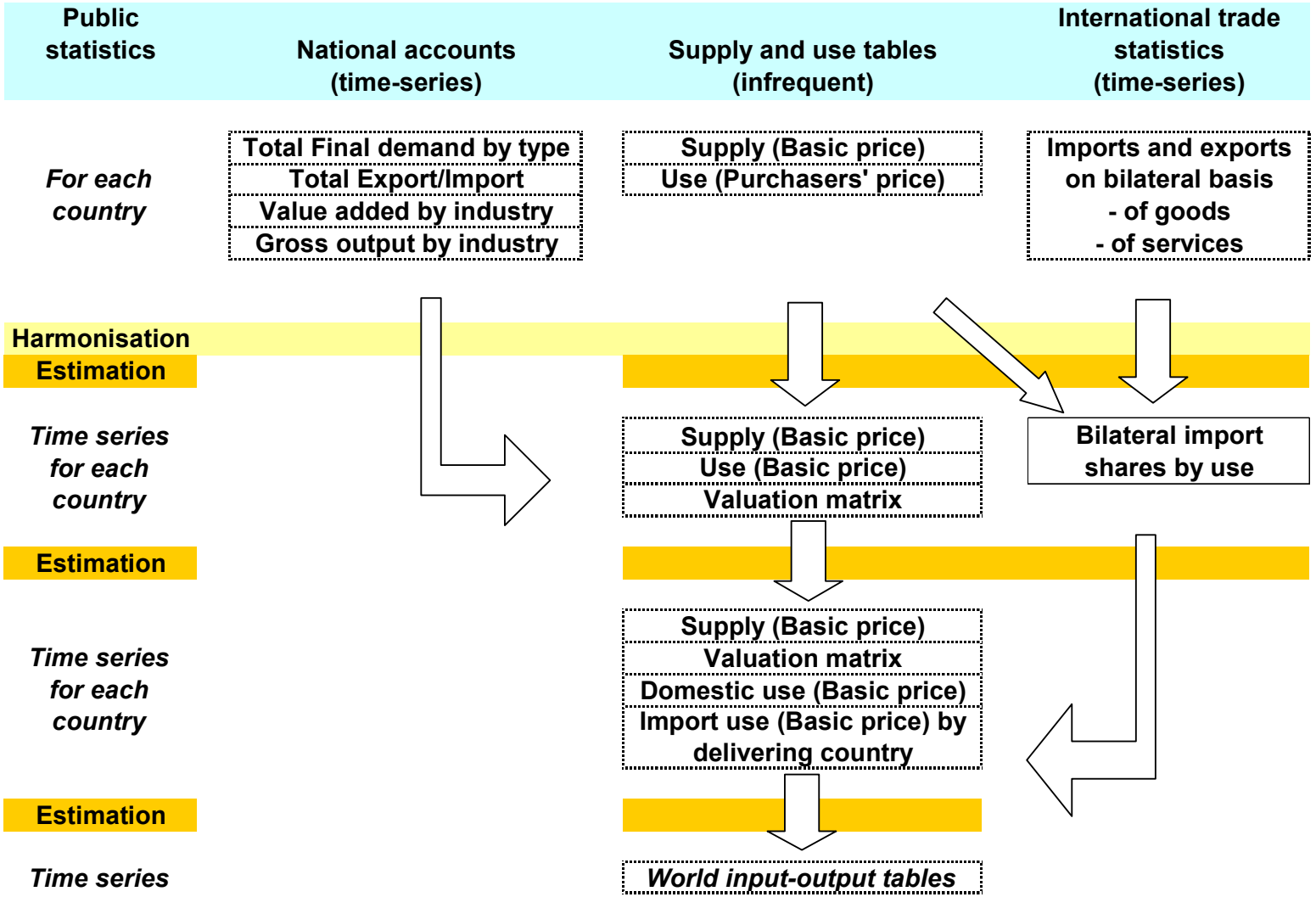
Additional material

Table 1 Foreign value added shares in manufacturing final output in regions (in %)

	China		EU		East Asia		NAFTA		Other	
	1995	2006	1995	2006	1995	2006	1995	2006	1995	2006
China	85.8	79.0	0.3	1.4	0.6	2.9	0.3	1.8	0.3	1.7
EU	2.0	3.6	89.2	83.2	1.8	2.6	3.9	3.8	5.7	6.8
East Asia	6.5	7.2	1.5	1.6	91.5	82.7	2.5	2.0	2.6	1.8
NAFTA	2.4	2.5	4.0	3.8	3.3	3.2	90.7	86.6	2.3	2.4
Other	3.4	7.7	5.0	10.0	2.8	8.6	2.6	5.9	89.0	87.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: Contributions of value added from regions (in rows) to manufacturing final output in regions (columns).
Source: Calculations based on World Input-Output Database, preliminary version February 2011.

Dataflows and construction steps in WIOT



List of Countries

- **EU-27**
- **plus13 non-EU**:

- Canada
- United States
- Brazil
- Mexico
- Turkey
- Russia
- China
- India
- Japan
- South Korea
- Taiwan
- Indonesia
- Australia

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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)

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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

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 a
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)