Slicing Up Global Value Chains

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Background

- Global fragmentation process has pervasive effects on distribution of income both within and across countries
- Raising concerns in advanced nations (decline of manufacturing) and demands active industrial policies and trade protection
- At same time product case studies suggest that advanced nations still capture large parts of the value chain as compensation for high-skilled activities (design, branding, logistics, finance etc.)
- Can we measure the division of income in global value chains?

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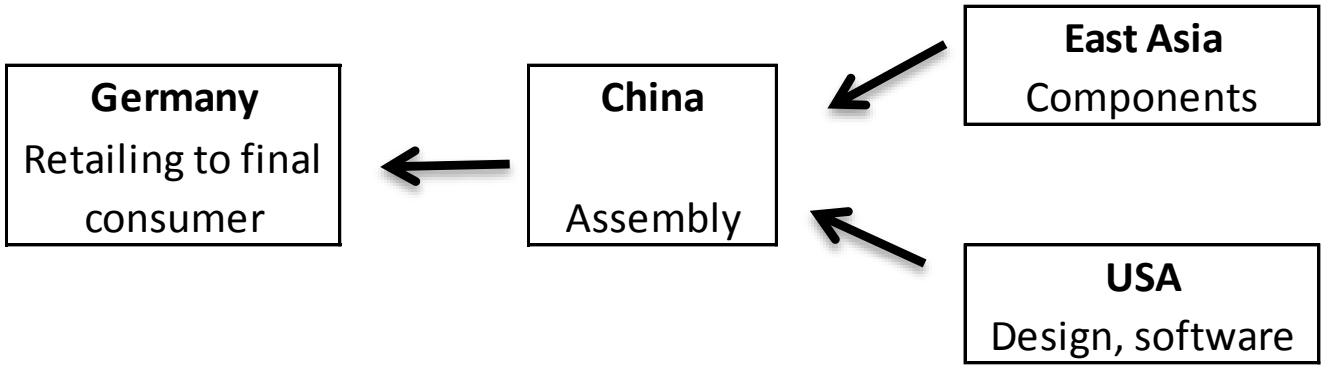
Slicing up global value chains: a simple illustration



- The *value of the product* paid by the German consumer can be split up into the *value added by production factors* in China, East Asia and the USA.

- This value added is income for all production factors (labour and capital) that are *directly* and *indirectly* needed in the production of the good or service

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Slicing Global value chains

- So by definition, the expenditure price of a product is the sum of all value added during the production process

Challenges in measuring this

- Global production typically consists of a network of networks and is not unilinear
- Statistical data to trace the flows

This is tried in the WIOD (World Input-Output Database) project

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WIOD (World Input-Output Database) project

- 3 year project (2009-21012) financed by the European Commission to (a.o.) compile a database that can measure the impact of international trade patterns on income distributions.

- Based on large network of research institutes inside and outside Europe and in cooperation with OECD

- Linked into the EU KLEMS and World KLEMS initiatives to make international comparisons of productivity

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WIOD-project approach

- Country-industry-factor perspective: e.g. how much value does low-skilled labour in Mexico add in the global manufacturing of electrical machinery?

- Relying on *input-output techniques* to measure the *direct* and *indirect* inputs into production (K):

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

with F factor inputs (direct only), B the matrix of intermediate inputs, $(I-B)^{-1}$ the so-called Leontief inverse and C final expenditure

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World Input-Output Database

- **World Input-Output Table (WIOT):**
  - each use (intermediate and final) is broken down into Domestically produced and Imported (by partner country)
  - Based on benchmark national supply and use tables extended with National Accounts time-series. These are linked using international trade statistics on goods and services
- **Socio-Economic Accounts:**

Quantities and prices of capital and labour (low-, medium-, and high-skilled) use by industry and country

- **Period from 1995 to 2009:**
  - 27 EU countries and 13 other major countries incl. US, China, India, Brazil, Russia, Mexico, overall covering more than 85% of world GDP
  - 35 industries and 59 products

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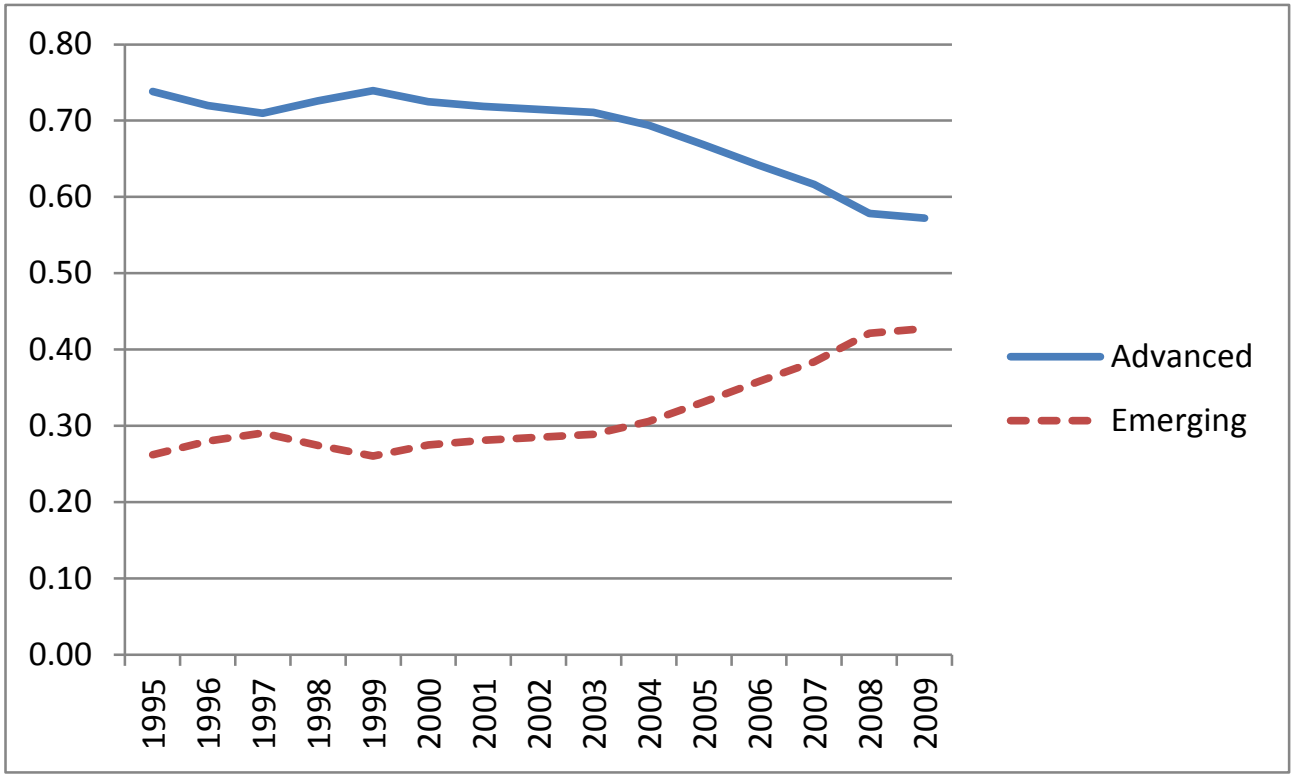
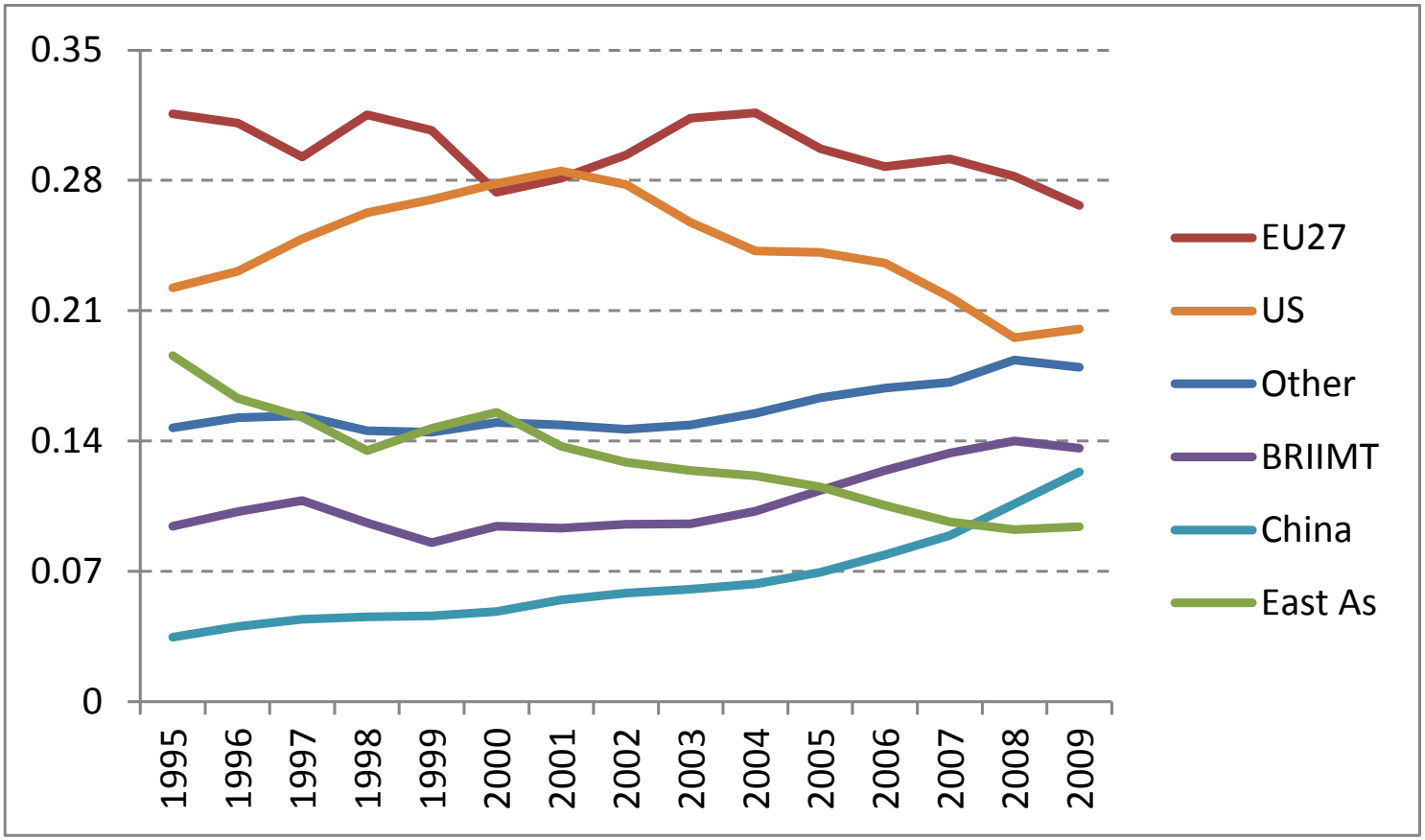
Factor income earned in global manufacturing (shares in world income), 1995-2009



Note: Advanced includes EU-15, Japan, Korea, Taiwan, Australia, Canada and the U.S. Emerging includes all other countries in the world. National currencies converted to US$ with official exchange rates. In purchasers' prices. World income is equal to world expenditures on manufacturing products.

Factor income earned in global manufacturing (shares in world income), 1995-2009



Note: East Asia includes Japan, South Korea and Taiwan.
BRIIMT includes Brazil, Russia, Indian, Indonesia, Mexico and Turkey.
EU includes all European countries that have joined the European Union. Rest includes all other countries in the world

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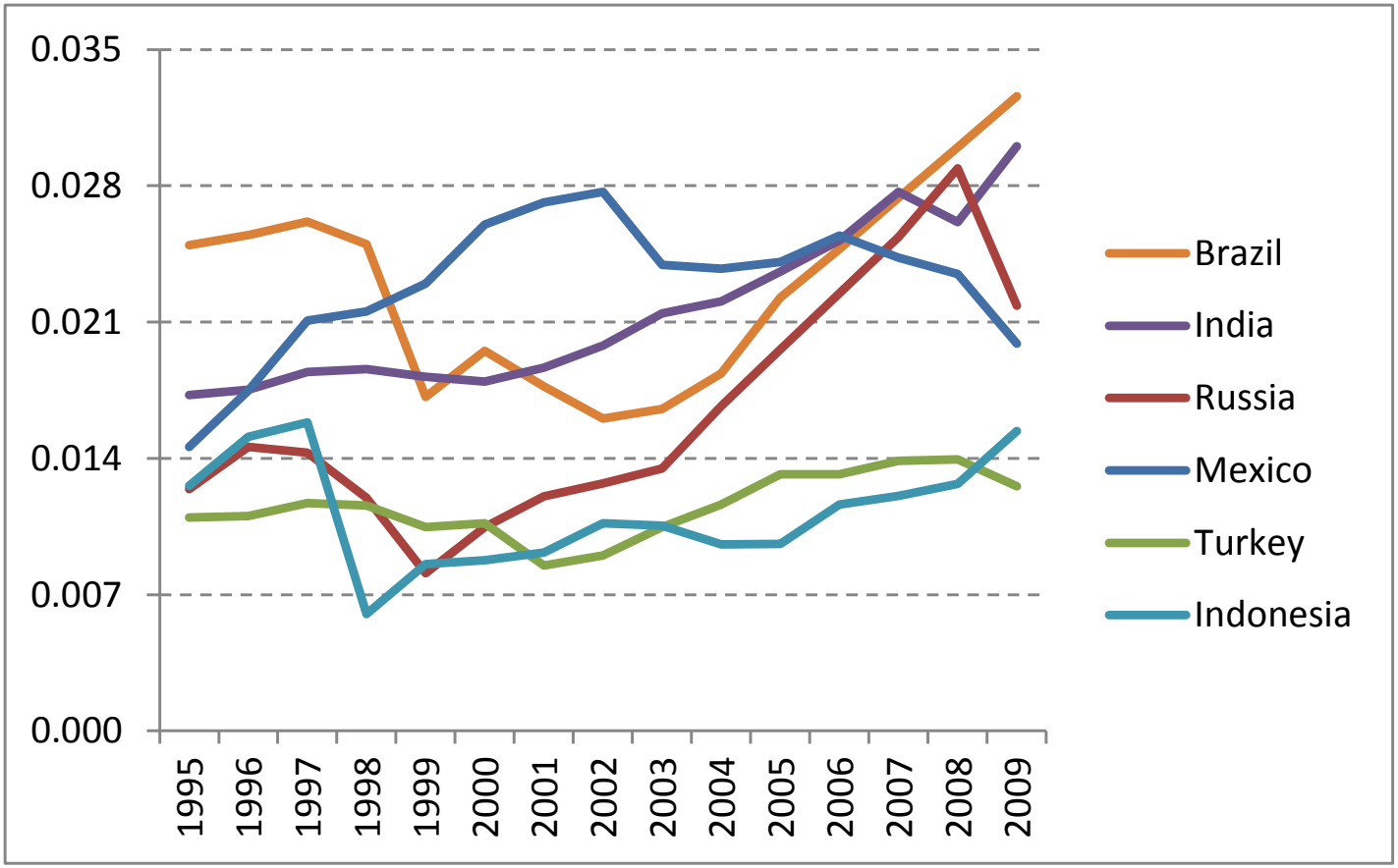
Factor income earned in global manufacturing (shares in world income), 1995-2009



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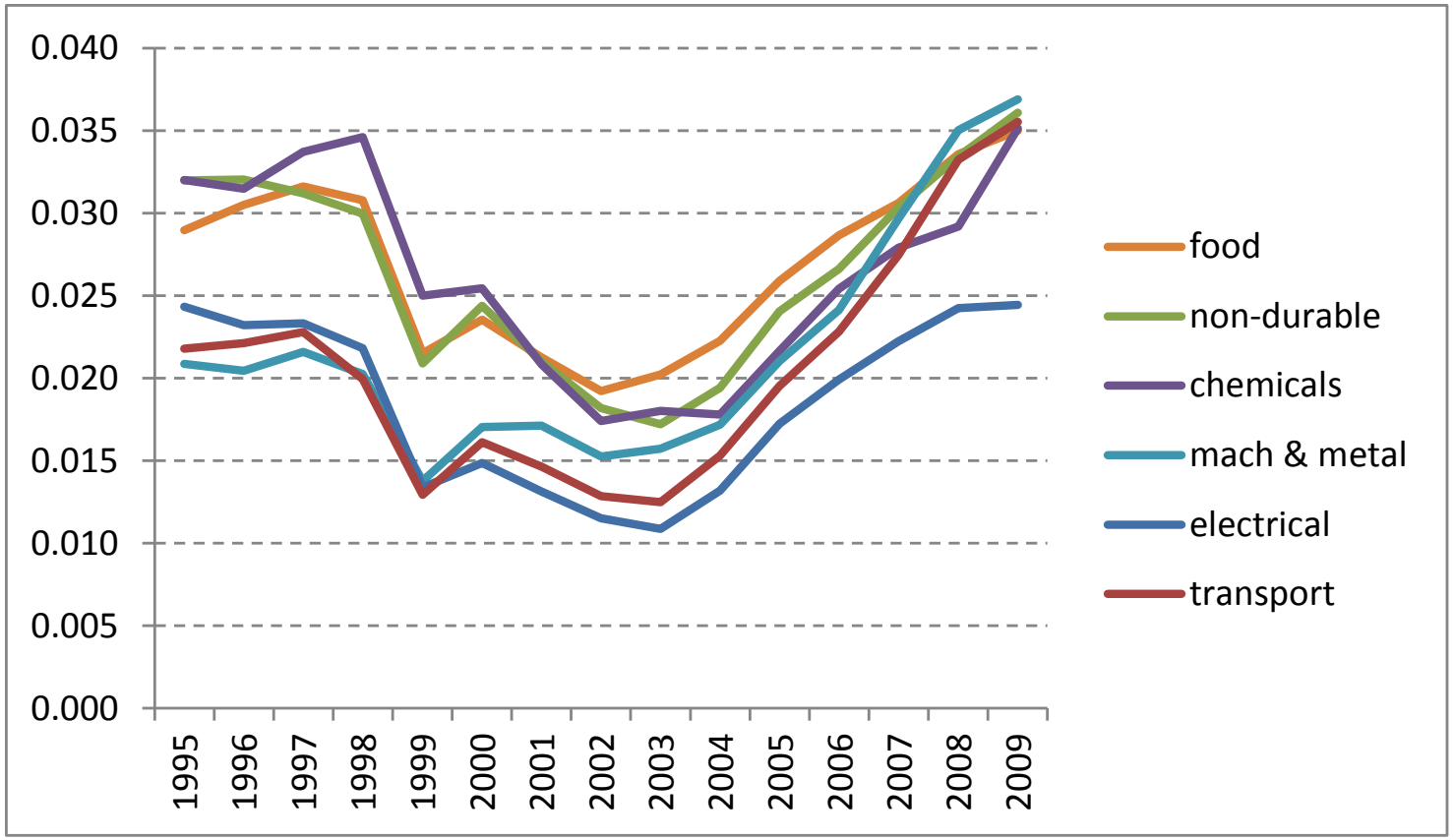
Factor income earned in global manufacturing of products (by group, shares in world income), BRAZIL, 1995-2009



Note: Food manufacturing products (produced in ISIC rev.3 industries 15 & 16), Non-durable products (17, 18, 19, 36, 37); Chemical products (23-26), Machinery & metal products (27-29); Electrical machinery products (30-33); Transport equipment (34, 35)

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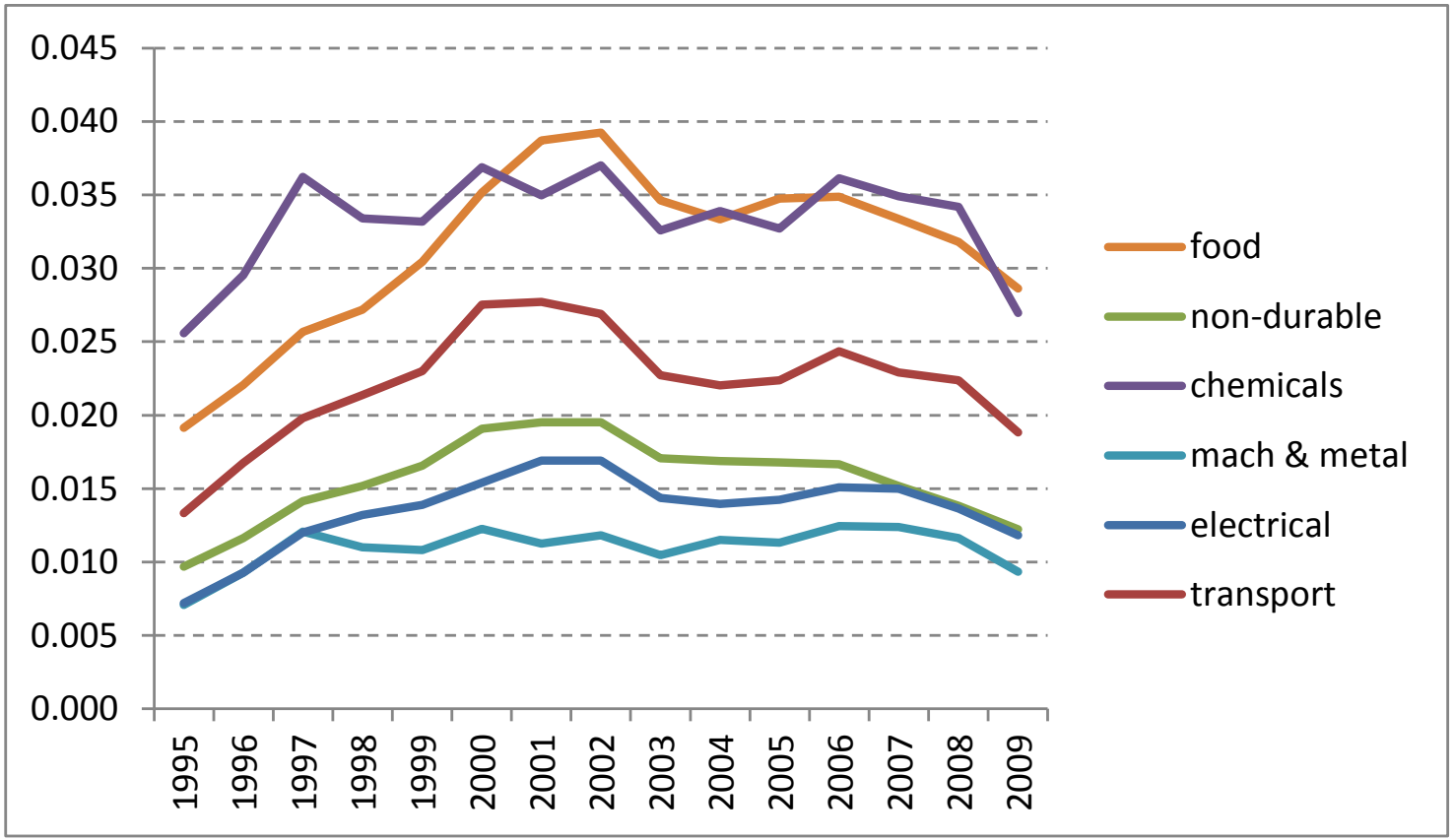
Factor income earned in global manufacturing of products (by group, shares in world income), MEXICO, 1995-2009



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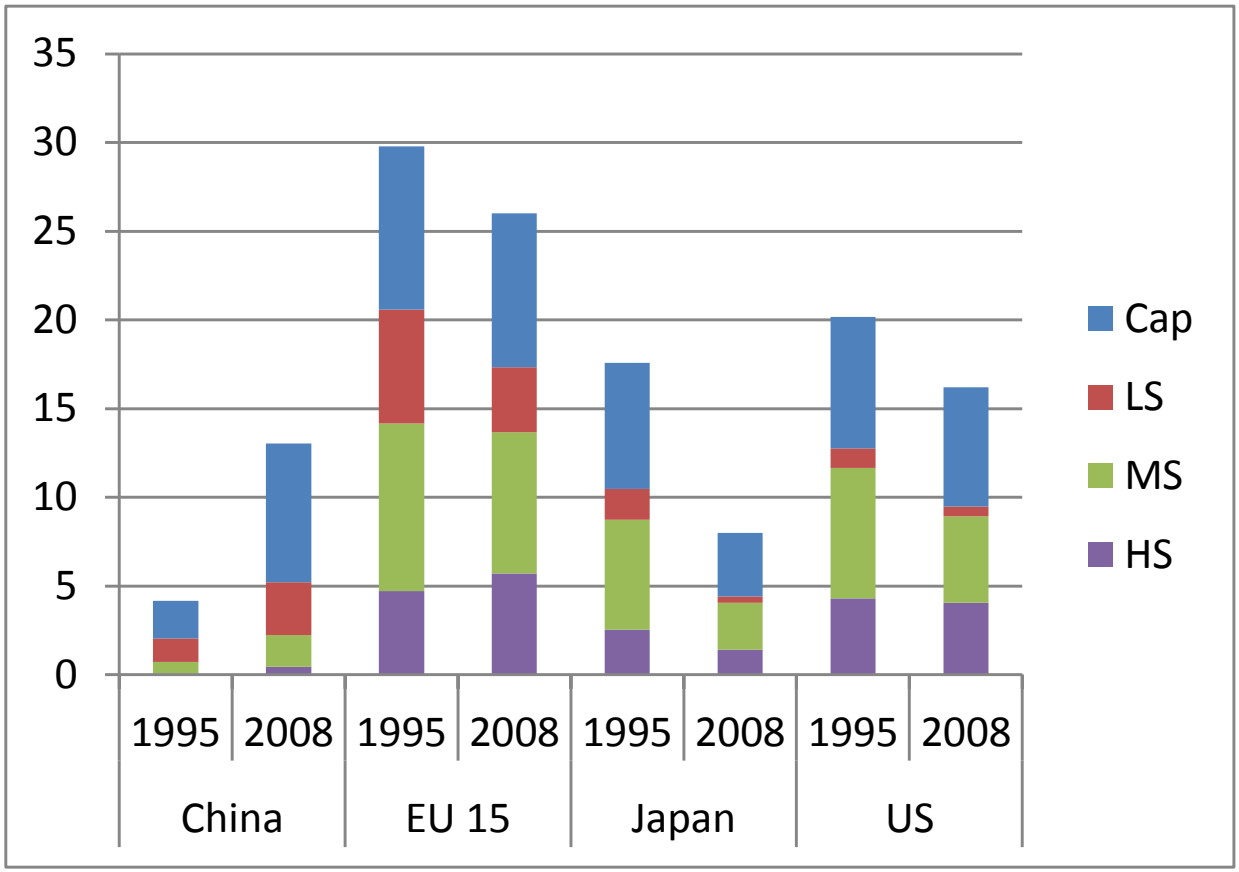
Income earned in global manufacturing by production factor and country (% shares in world income), 1995 and 2008.



Note: CAP is for capital (physical, intangible and natural resources); LS is low-skilled; MS is medium-skilled and HS is high-skilled labour

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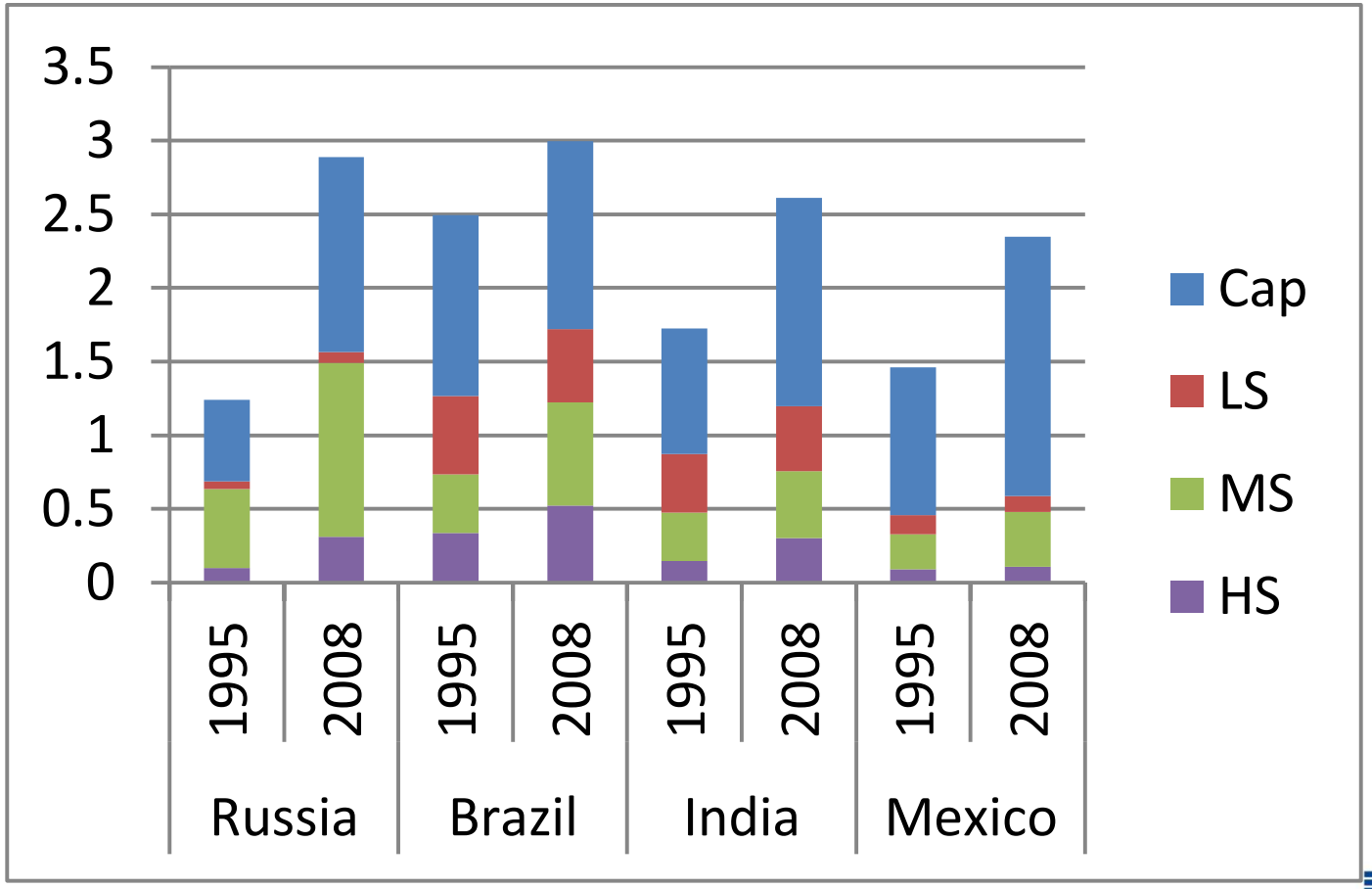
Income earned in global manufacturing by production factor and country (% shares in world income), 1995 and 2008.



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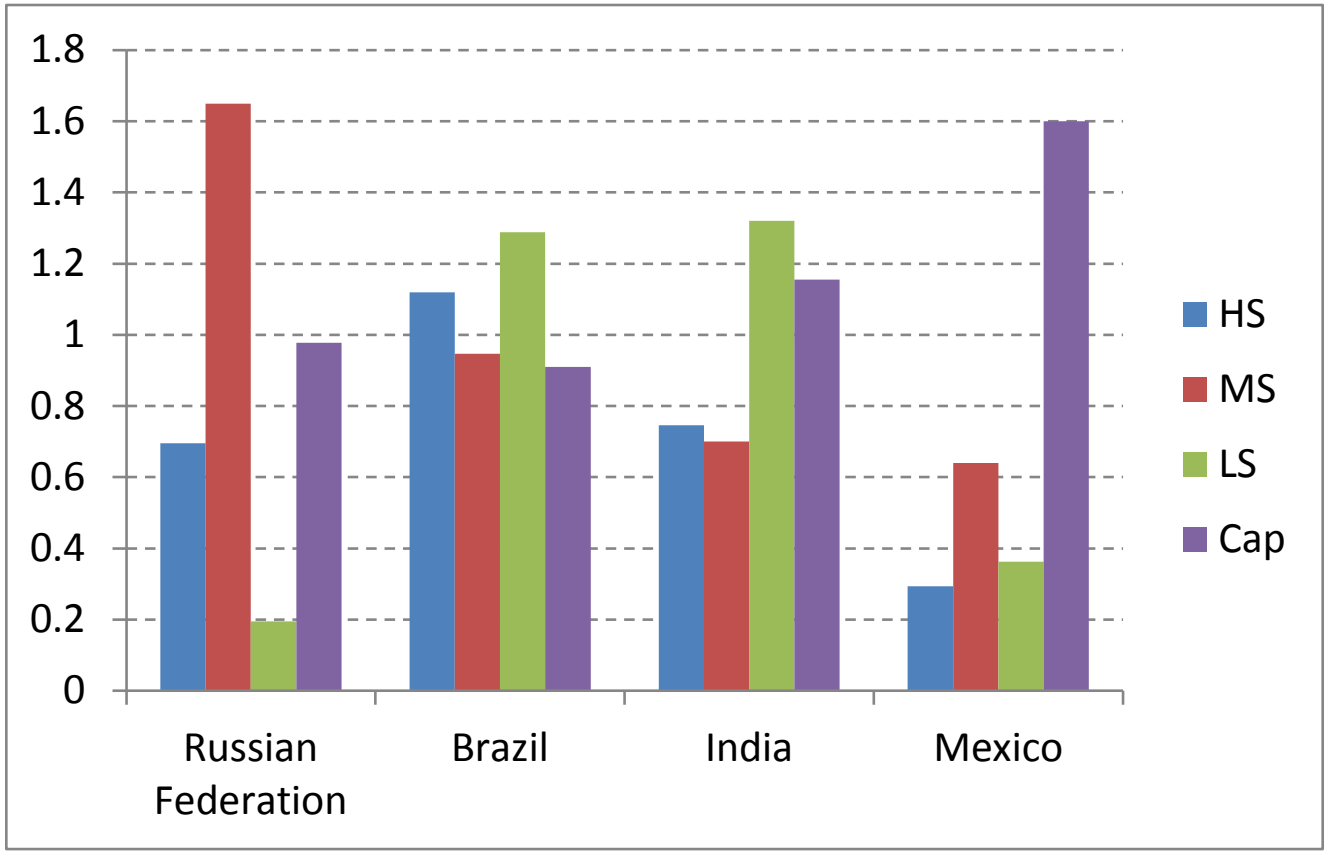
Revealed comparative advantage index of factors in global manufacturing production, 2008.



Note: Index calculated as (Fij/sumi Fij)/(sumj Fij / sum ij Fij) where Fij is the value added contribution of factor I in country j to global manufacturing. An index higher than 1 indicates that a factor in a country contributes more relative to the contribution of this factor in other countries.

Concluding remarks

- New indicator of competitiveness of countries, focused on “tasks and activities” rather than goods
- Between 1995 and 2009, redistribution of income generated in global manufacturing production
  - Sharp drop in shares advanced regions
    - in particular for East Asia
    - EU and NAFTA maintain shares for high-skilled labour and capital
    - Increasing contributions from services sectors

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Concluding remarks

- Share of emerging countries in global manufacturing increased rapidly after 2003
  - China increased share from 4% (in 1995) to 13% in 2008, in particular in low-skilled and capital
  - Other emerging countries increased share as well, in particular for capital

- WIOD database
  - WIOD Data made publicly available (for free) 16 April 2012.
  - Includes additional accounts for 10 pollutants (e.g. greenhouse gas emissions by industry and country)
  - More information on WIOD project at www.wiod.org

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Additional material

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)

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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)

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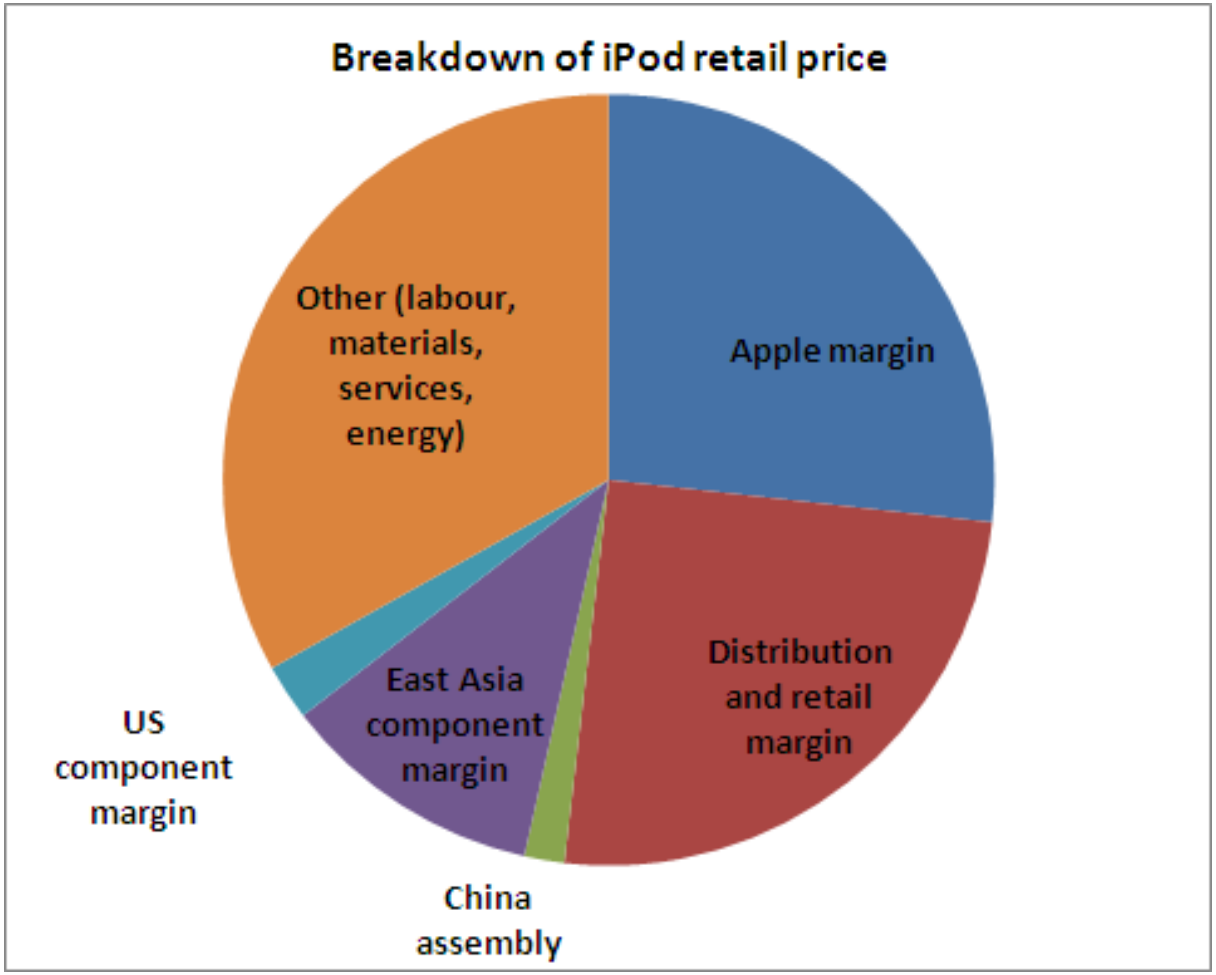
Slicing the iPod value chain

(source: Dedrick, Kraemer and Linden, 2010**)**



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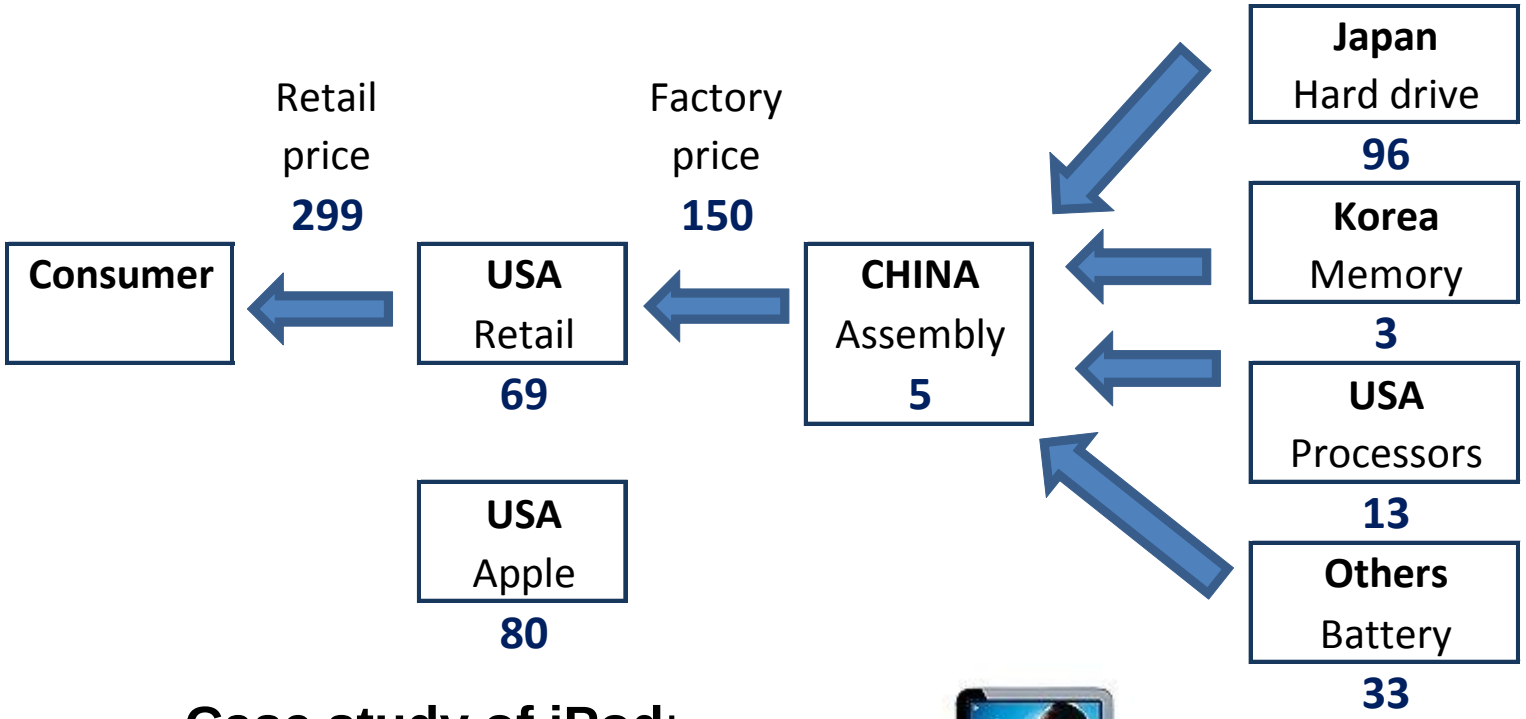
Global Production Networks imply a global value distribution



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

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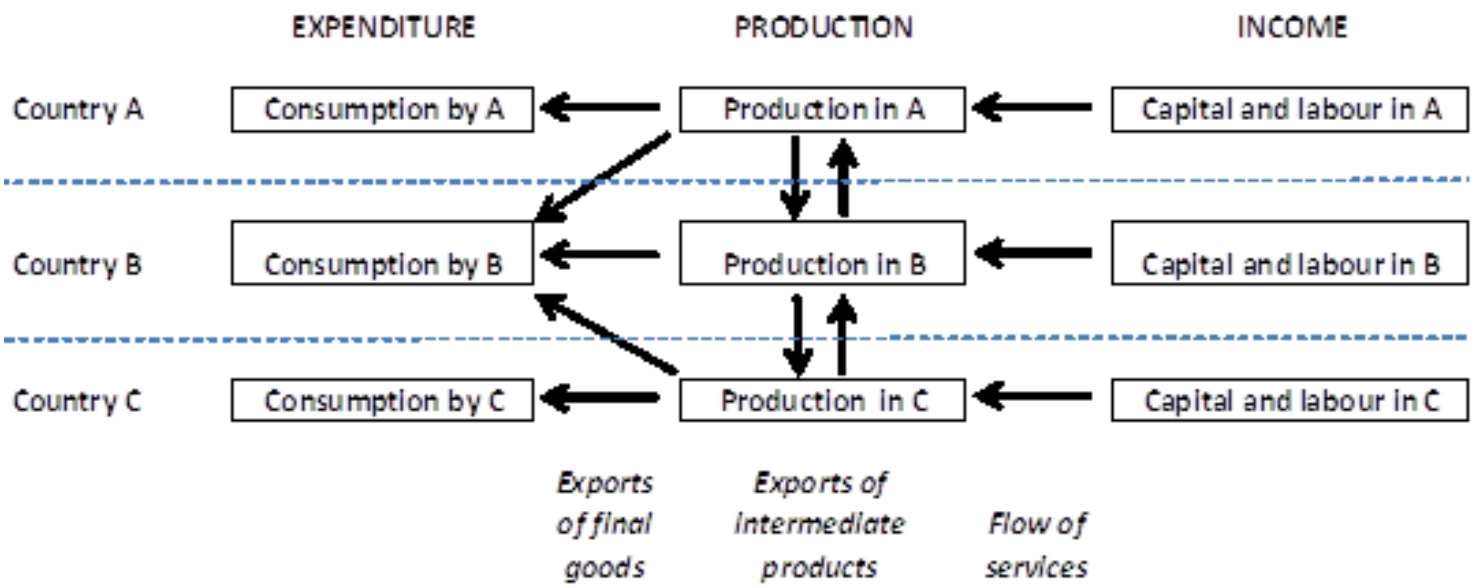
Links between consumption, production and income.



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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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Method: 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

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

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

$$\mathbf{K} = \mathbf{AC}$$

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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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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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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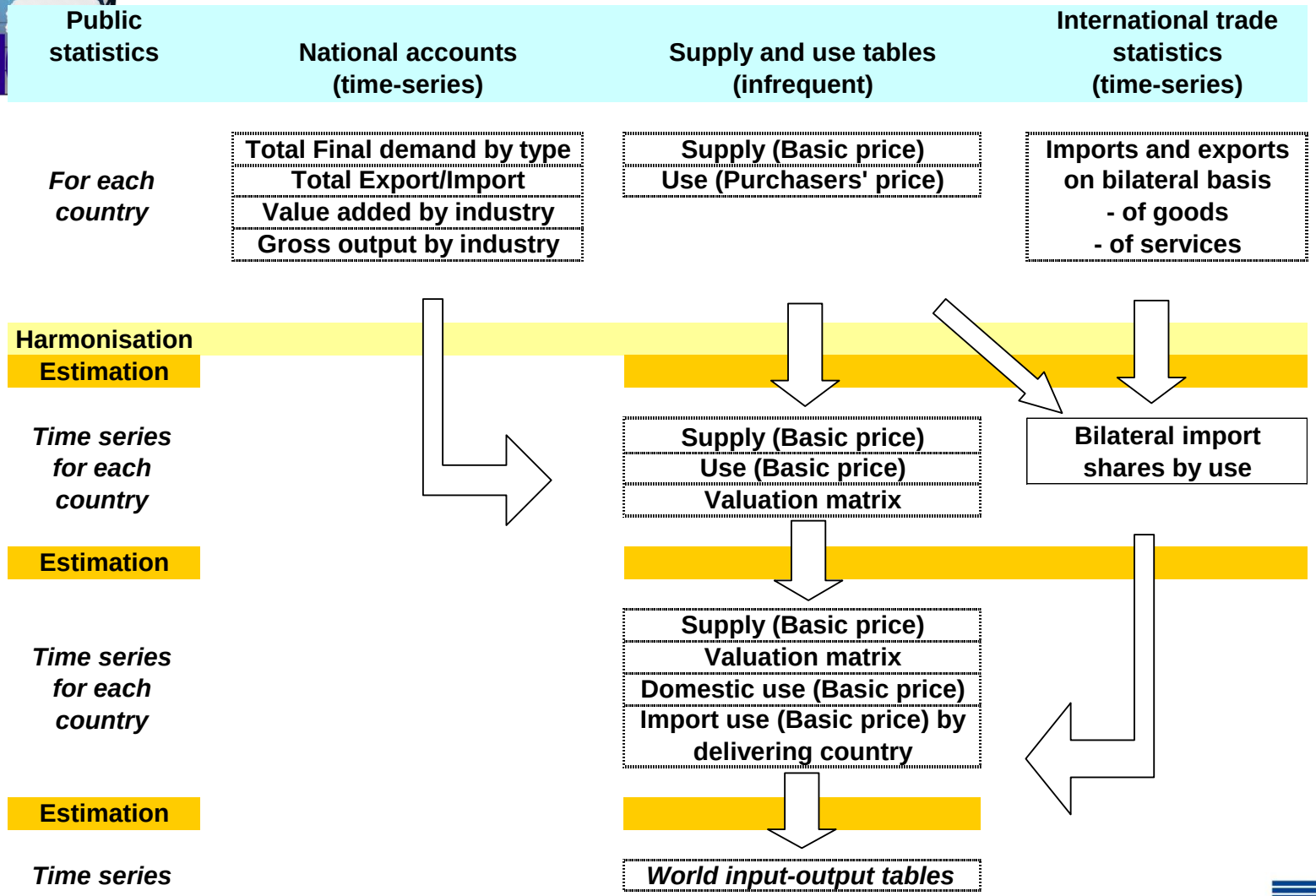
Dataflows and construction steps in WIOT



Sources and construction

- **World Input-Output Table (WIOT)**
  - Harmonising national supply and use tables (SUTs)
  - Estimating time-series of SUTs consistent with industry gross output and value added, and final demand categories from the National Accounts (based on SUT-RAS method, Temurshoev and Timmer 2011)
  - Breakdown of imports by partner country using (extended) BEC, based on HS 6-digit bilateral trade data from UN COMTRADE
  - Transform international SUTs into WIOT using “fixed product-sales structure”
- **Factor inputs**: value added shares taken from EU KLEMS database plus additional specific country sources (labour force, household surveys etc)

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