A new framework for resource productivity: a case in South Korea

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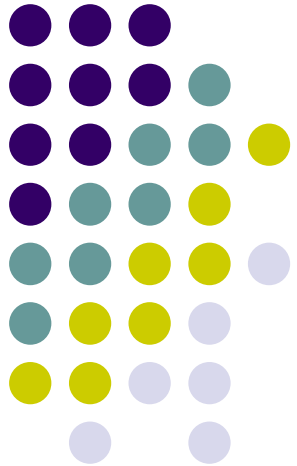
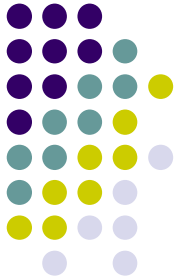


Introduction

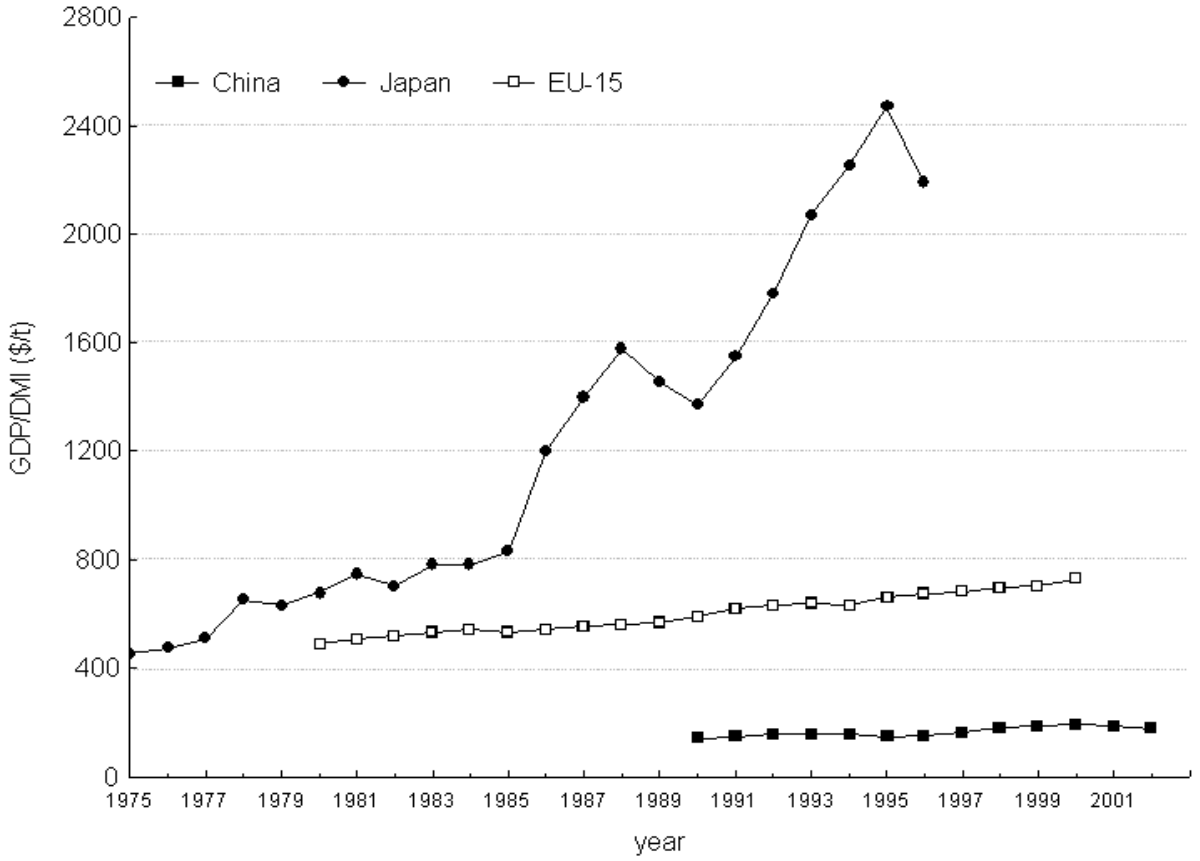


- MFA / resources productivity projects
  - European Commission:
    - FORWAST
    - EXIOPOL
  - South Korea:
    - Industry-level Material Flow Analysis
    - Feasibility study for national resources account
  - USA:
    - Vision study -- Resources Conservation and Recycling Act (US EPA)

Introduction

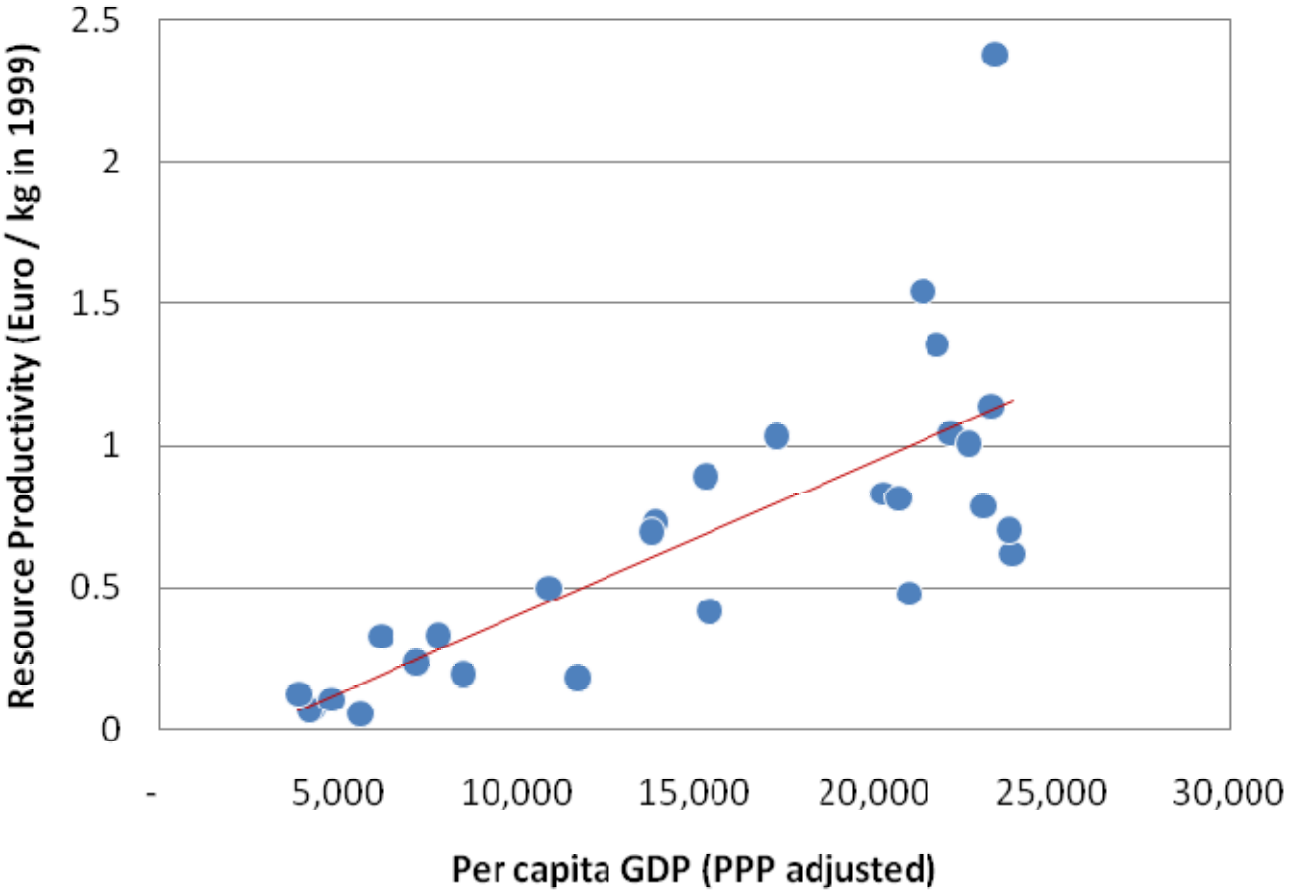
- Often subtle but important differences in perspectives and strategies for resources productivity.
- Interpretation and communication of resource productivity figures with policy makers require a caution.
  - Global life-cycle
  - Competitive impact
- Example: Int'l comparison of EW-MFA results

Temptation of quick international comparison



Xu and Zhang (2007): Journal of Industrial Ecology

“Economic growth is the way to improve Resource Productivity”

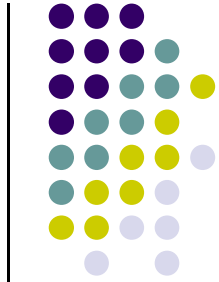


Source: GDP/DMI data for the EU15: Eurostat online database (accessed in 2008); GDP/DMI data for candidate countries: EEA (2004); GDP/DMI for Japan: NIES (2007); GDP per capita-PPP data: CIA (2000).

Perspectives on resource productivity

- The case of the Ministry of Industry, South Korea
  - Competitiveness of South Korean Industry's resource-productivity
  - Resilient economic structure against potential price hikes or material scarcity crisis.
  - Reducing environmental impacts of resources use throughout the life-cycle.

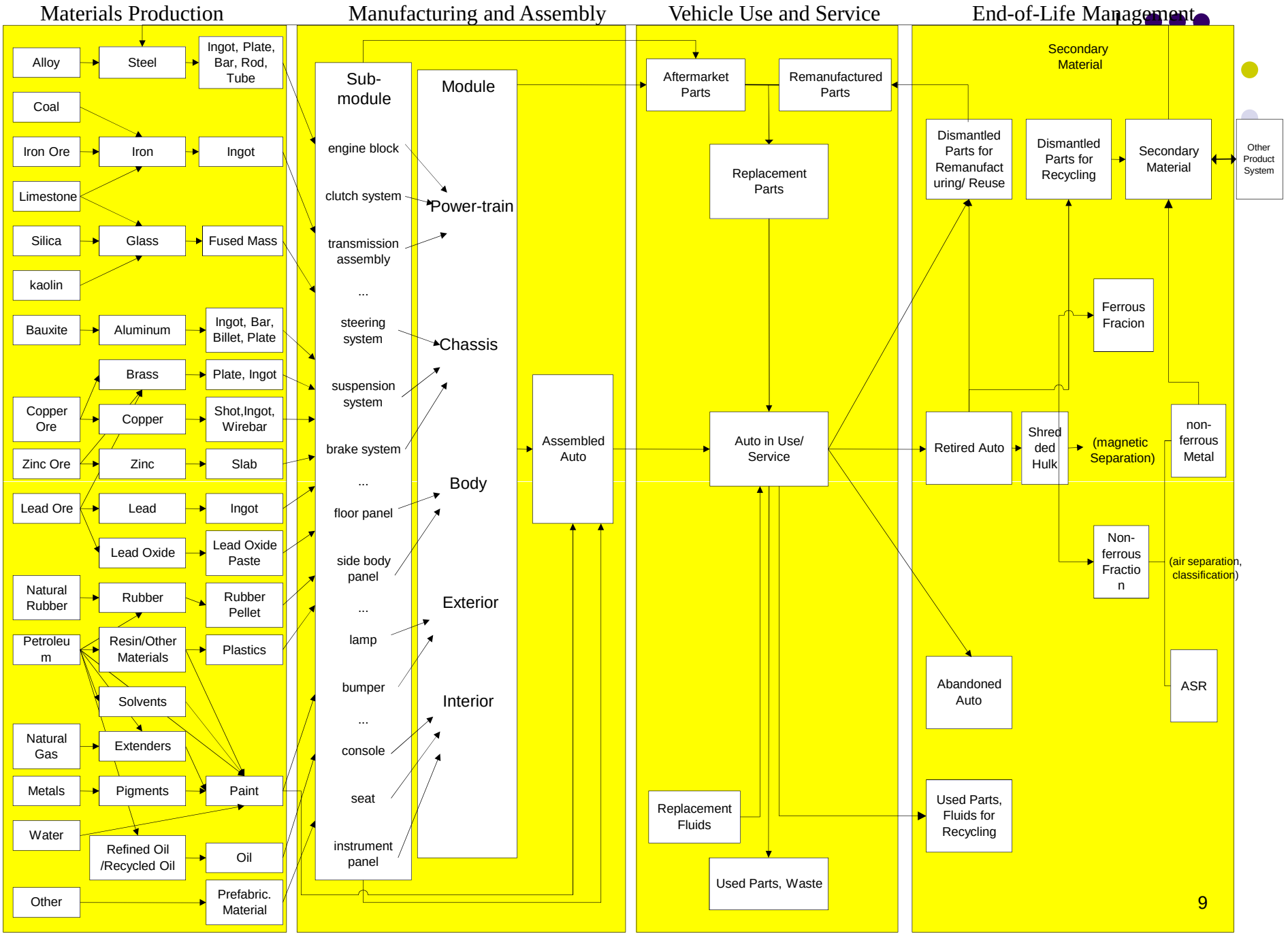
Analytical framework



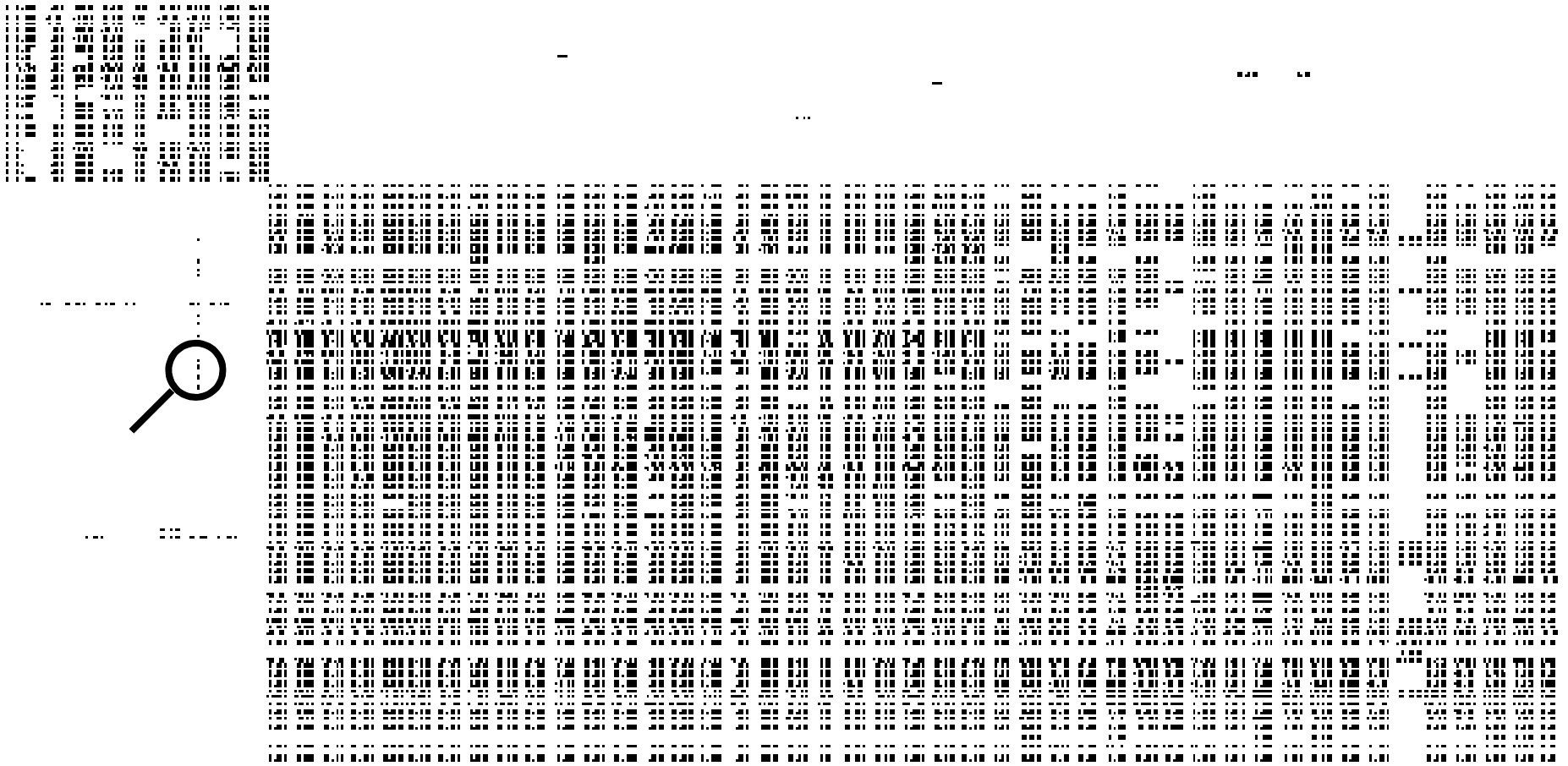
- EW-MFA has limited applicability in this case.
- 3 Key industry sectors are selected (1st year)
  - Petroleum refinery
  - Automotive
  - Liquid Cristal Display (LCD)
- Hybrid IO-MFA framework
  - Methodological / accounting framework well established and practiced since 1990s (CBS).
  - Combination of process information and national accounts.

Analytical framework (cont'd)

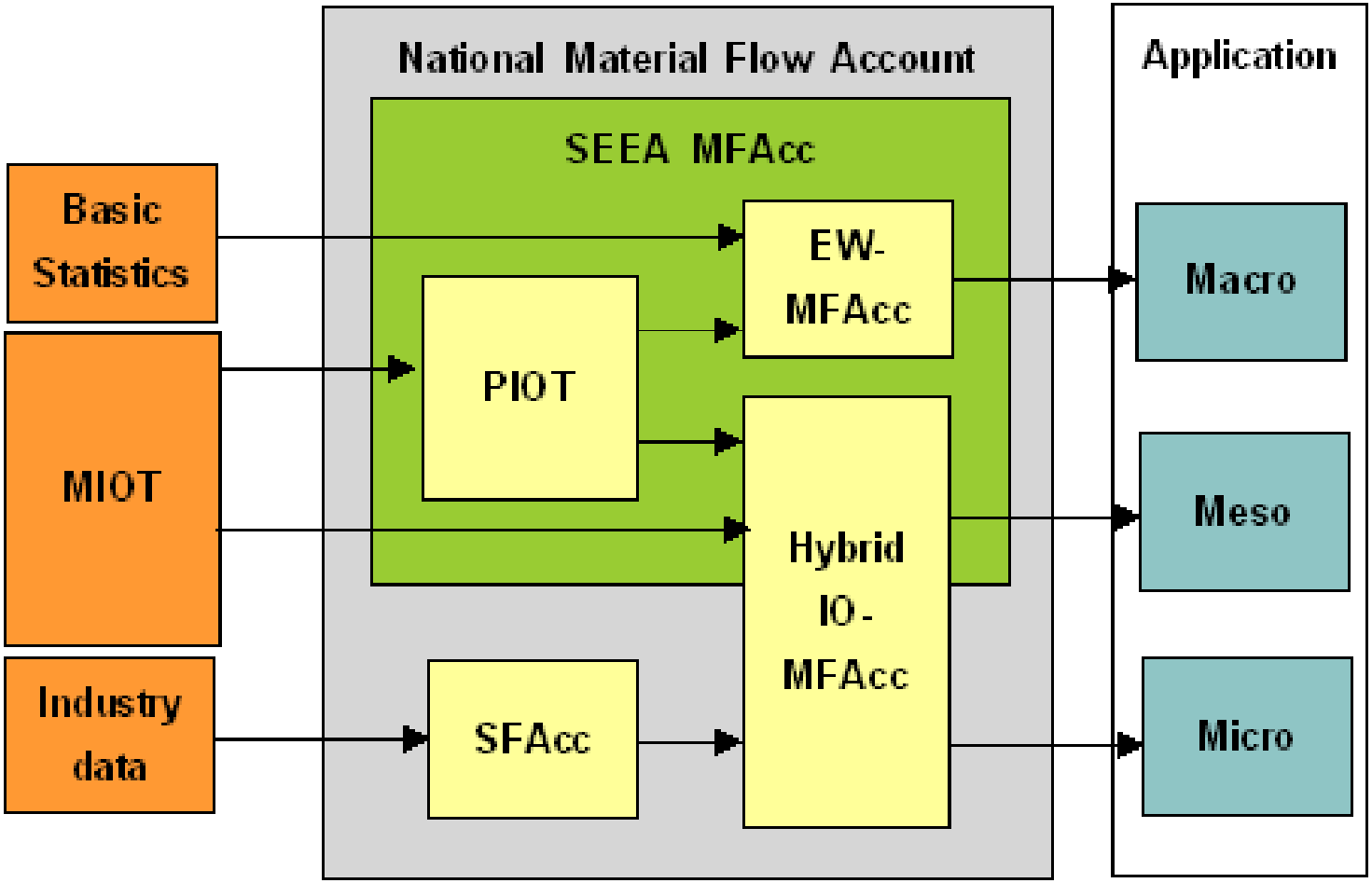
- Key resources identified for each industry
- Material flows are tracked down
  - Along the supply-chain .
  - Regardless of the national border.
  - Ex) Indium
- Material-specific characterization
  - Commonly practiced in LCA
  - E.g., 1kg Pt has different resource-base implication compared to 1kg gravel.


Materials Production
Manufacturing and Assembly
Vehicle Use and Service
End-of-Life Management
Alloy
Steel
Ingot, Plate, Bar, Rod, Tube
Coal
Iron Ore
Iron
Ingot
Limestone
Silica
Glass
Fused Mass
kaolin
Bauxite
Aluminum
Ingot, Bar, Billet, Plate
Brass
Plate, Ingot
Copper Ore
Copper
Shot,Ingot, Wirebar
Zinc Ore
Zinc
Slab
Lead Ore
Lead
Ingot
Lead Oxide
Lead Oxide Paste
Natural Rubber
Rubber
Rubber Pellet
Petroleum
Resin/Other Materials
Plastics
Solvents
Natural Gas
Extenders
Metals
Pigments
Paint
Water
Refined Oil /Recycled Oil
Oil
Other
Prefabric. Material
Sub-module
engine block
clutch system
transmission assembly
...
steering system
suspension system
brake system
...
floor panel
side body panel
...
lamp
bumper
...
console
seat
instrument panel
Module
Power-train
Chassis
Body
Exterior
Interior
Assembled Auto
Aftermarket Parts
Remanufactured Parts
Replacement Parts
Auto in Use/ Service
Replacement Fluids
Used Parts, Waste
Secondary Material
Dismantled Parts for Remanufacturing/ Reuse
Dismantled Parts for Recycling
Secondary Material
Other Product System
Ferrous Fracion
Retired Auto
Shredded Hulk
(magnetic Separation)
non-ferrous Metal
Non-ferrous Fraction
(air separation, classification)
ASR
Abandoned Auto
Used Parts, Fluids for Recycling

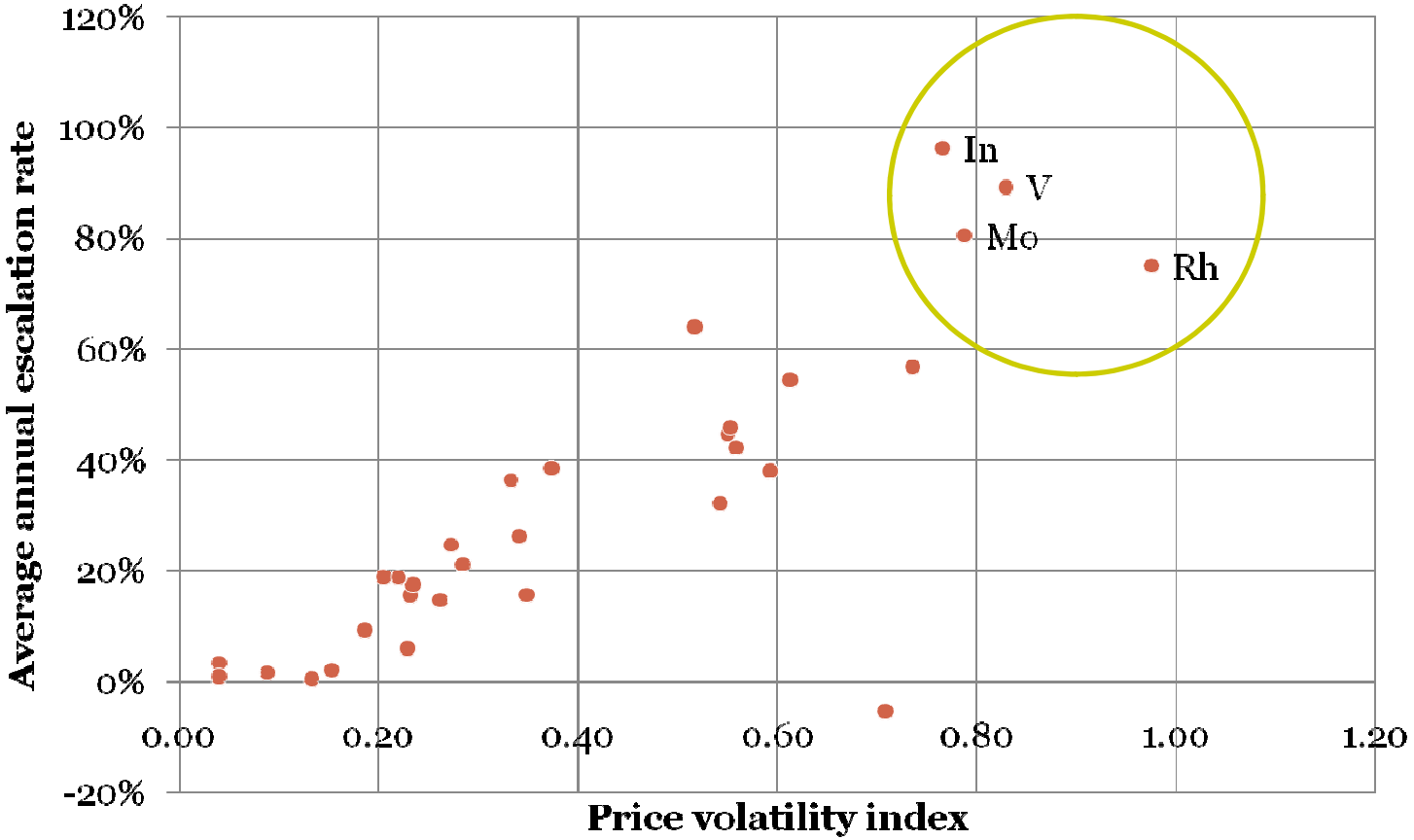
Basic Structure of a hybrid account



Accounting framework



Price volatility of resources



Supply-security index

Rank	Symbol	Name	Supply Security index	Major producers with low credit rating
1	Co	Cobalt	32%	Zambia, Congo
2	Hg	Mercury	65%	China
3	Ni	Nickel	66%	New Caledonia, Cuba, Dominican Republic, Zimbabwe
4	Sn	Tin	67%	Indonesia, Peru, Bolivia, Brazil
5	Ti	Titanium	67%	Sierra Leone
6	Cr	Chromium	70%	South Africa, Kazakhstan, India
7	Pt	Platinum	70%	South Africa, Russia, Zimbabwe, Colombia
8	Al	Aluminum	71%	Guinea, Jamaica, India, Russia, Venezuela, Kazakhstan, Suriname
9	Mn	Manganese	72%	South Africa, Gabon, Ukraine
10	Pd	Palladium	73%	Russia, South Africa, Zimbabwe

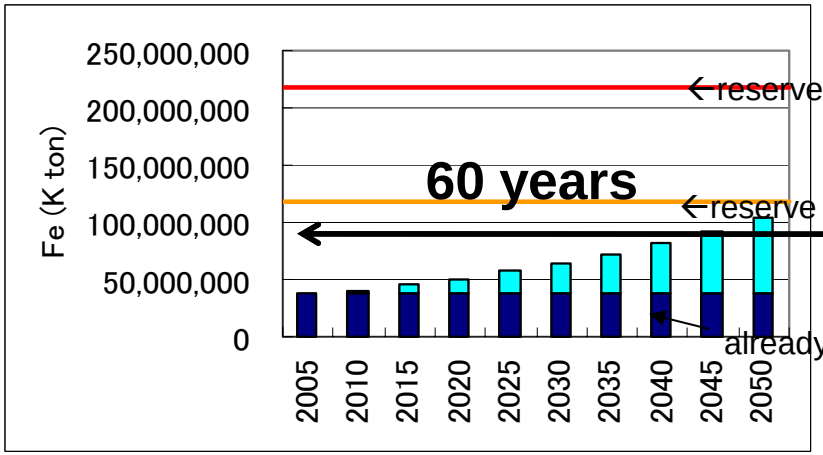
Own calculation. S&P country credit rating in 2008 applied to ore producing countries. AAA: 1; AA: 0.9; … D or SD: 1

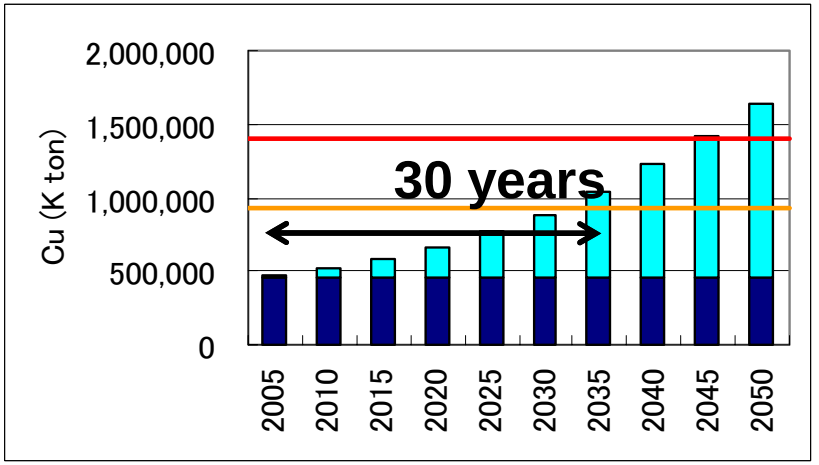
Top 10 characterization factors

Rank	Symbol	Name	Reserve year ^-1
1	Sr	Strontium	0.086
2	Ag	Silver	0.072
3	Sb	Antimony	0.064
4	Au	Gold	0.060
5	Pb	Lead	0.050
6	Zn	Zinc	0.045
7	Sn	Tin	0.045
8	Cr	Chromium	0.042
9	Cd	Cadmium	0.039
10	Hg	Mercury	0.032

Weighting factor example

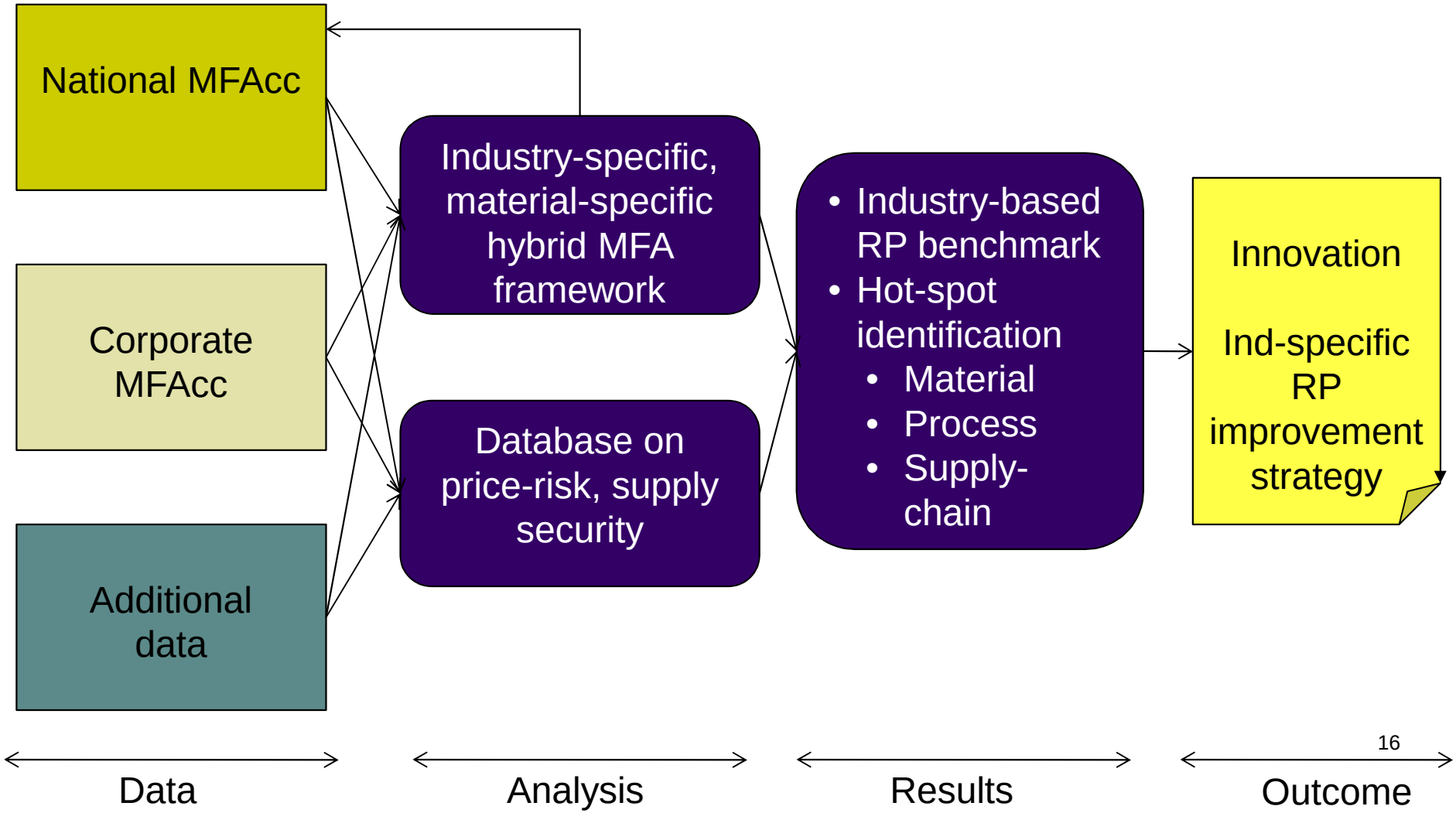
- According to the study by Dr. Halada, Cu has half of the reserve-year of Fe.
- Extraction of 1kg Cu can be considered to be equivalent to extraction of 2kg of Fe in terms of its scarcity.





Source: Halada, 2007

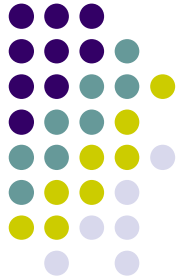
Overall picture



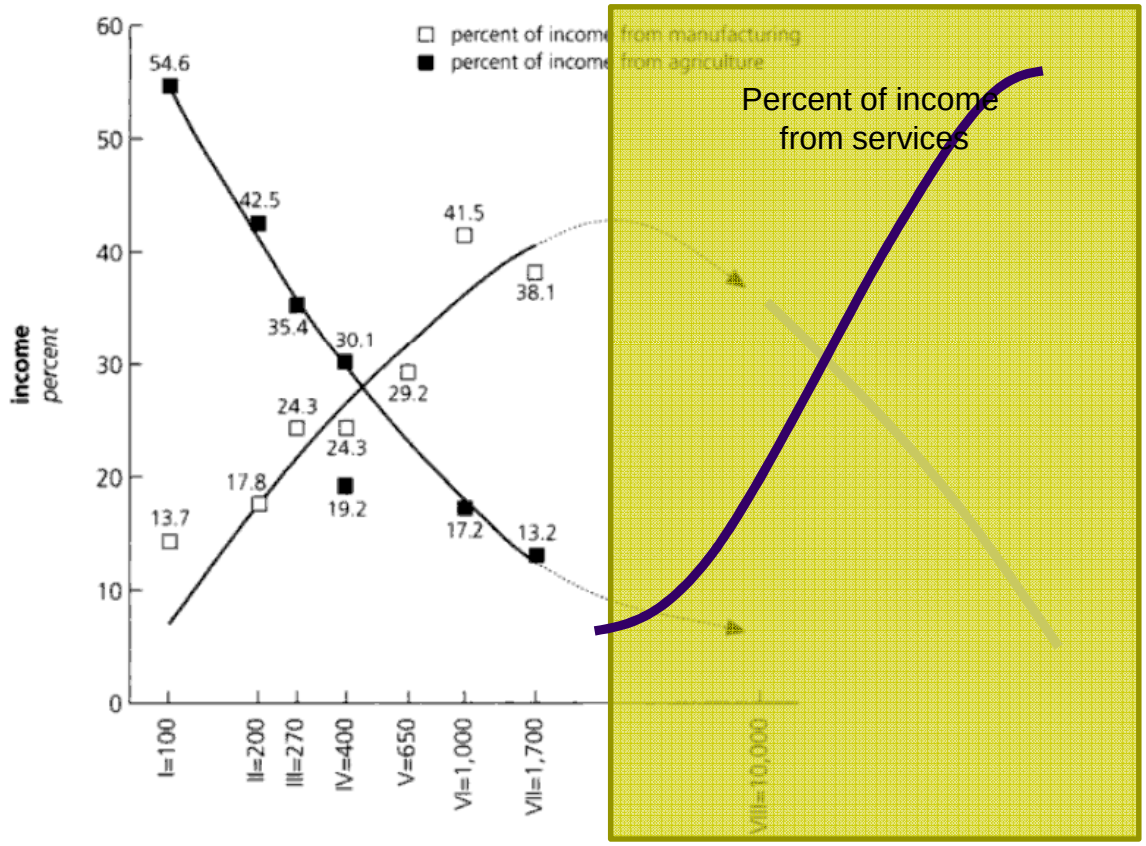
Summary

- Resource productivity figures across nations should be carefully interpreted.
- Trade liberalization and “global division of labor” make it increasingly difficult to interpret resource productivity figures based on DMI across nations.
- Especially, resource productivity discourse may need to take the socio-economic and historical trajectories of an economy into consideration.
- An industry-specific, material-specific approach that is based on hybrid IO-MFA and LC thinking is proposed.
- The project is at its early stage and comments / suggestions are welcomed.

Thanks

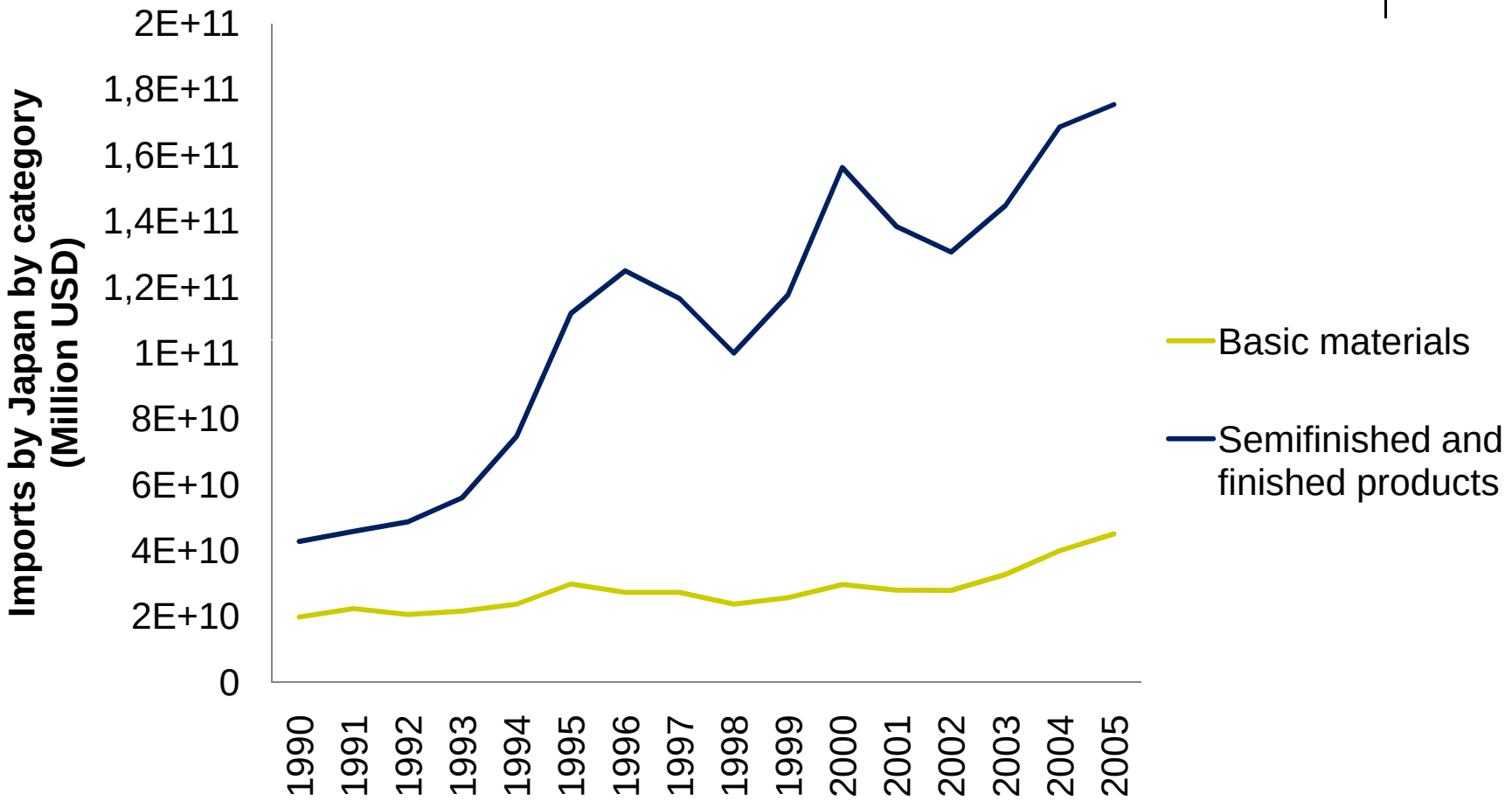


World-wide Economic Structural Change



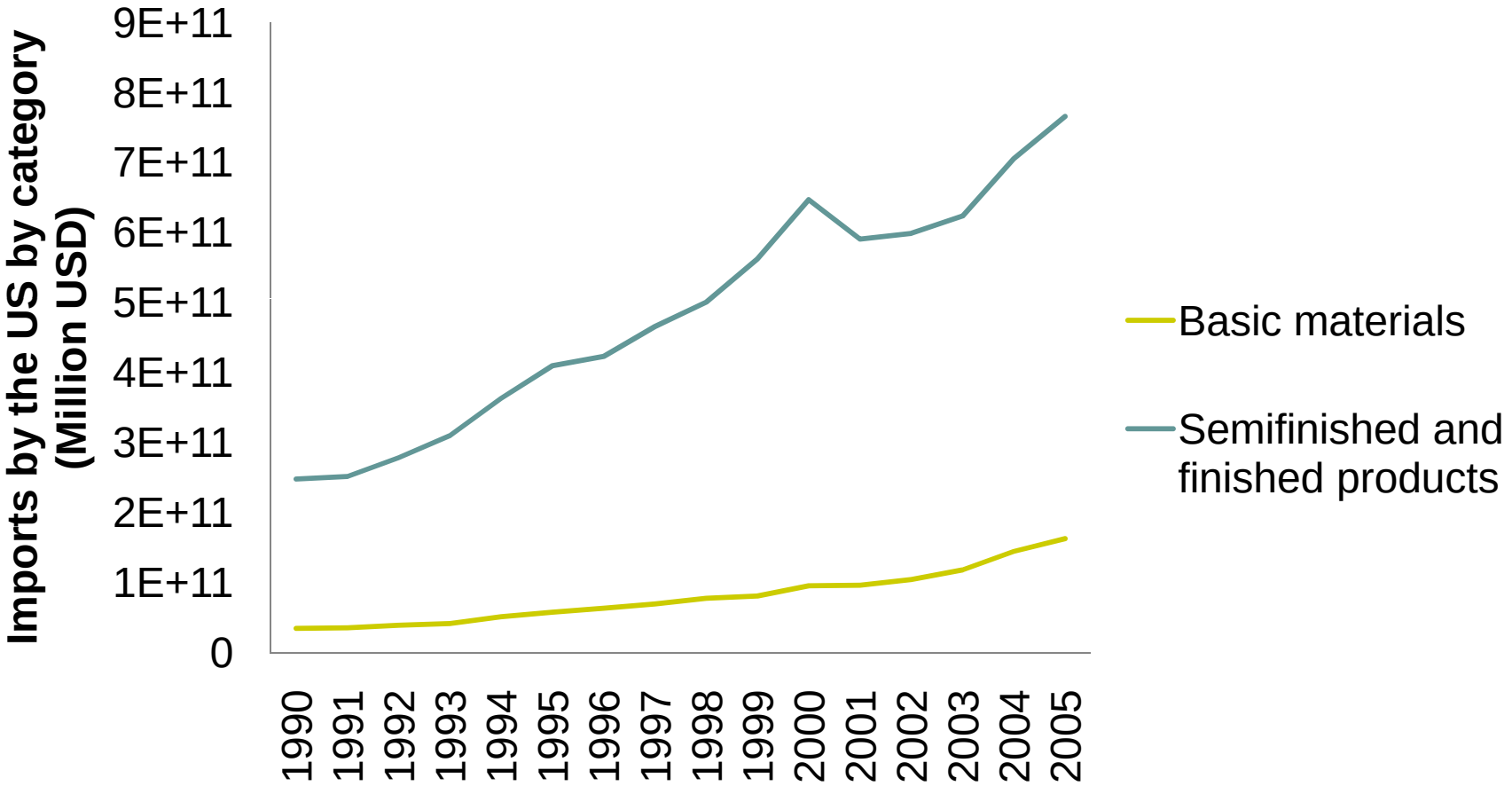
Simon Kuznets (1958)

Import trend – Japan



Source: WTO international trade statistics 2007: own grouping and aggregation (fuels excluded)

Import trend – U.S.



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