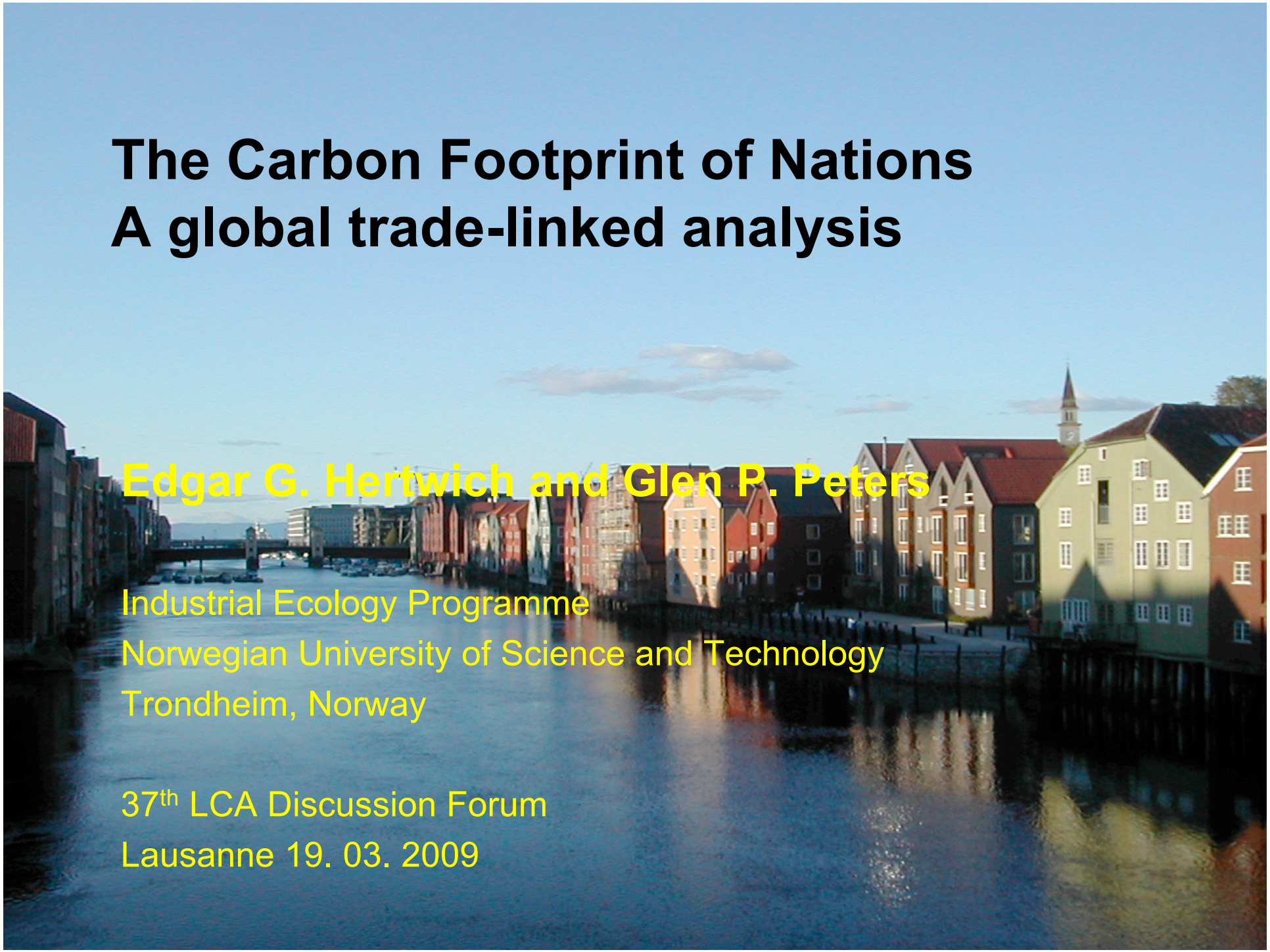

The Carbon Footprint of Nations
A global trade-linked analysis

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Norwegian University of Science and Technology
Trondheim, Norway

37th LCA Discussion Forum
Lausanne 19. 03. 2009

Overview

- Global Carbon Footprint:
  - How large?
  - Where? Why? Who?
  - Consumption cluster
- Carbon embodied trade; Carbon leakage
- Border Carbon Adjustments

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misa
miljøsystemanalyse
environmental systems analysis

First global assessment

- GTAP* database
  - 87 world regions
  - 57 sectors
  - For the year 2001
  - GHG emissions only

*Global Trade Analysis Project

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Full MRIO Model (1)

Mass balance as for total trade

$$x_r = A_{rr}x_r + y_{rr} + \sum_s e_{rs}$$

Step 1: Split exports between final demand and industry

$$e_{rs} = e^{ii}_{rs} + y_{rs}$$

Step 2: Split exports to industry in direct proportions

$$e^{ii}_{rs} = A_{rs}x_s$$

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Full MRIO Model (2)

- Full MRIO mass balance

$$x_r = A_{rr}x_r + y_{rr} + \sum_{s \neq r} A_{rs}x_s + \sum_{s \neq r} y_{rs}$$

Interindustry demand

Domestic demand

Export to industry

Export to final demand

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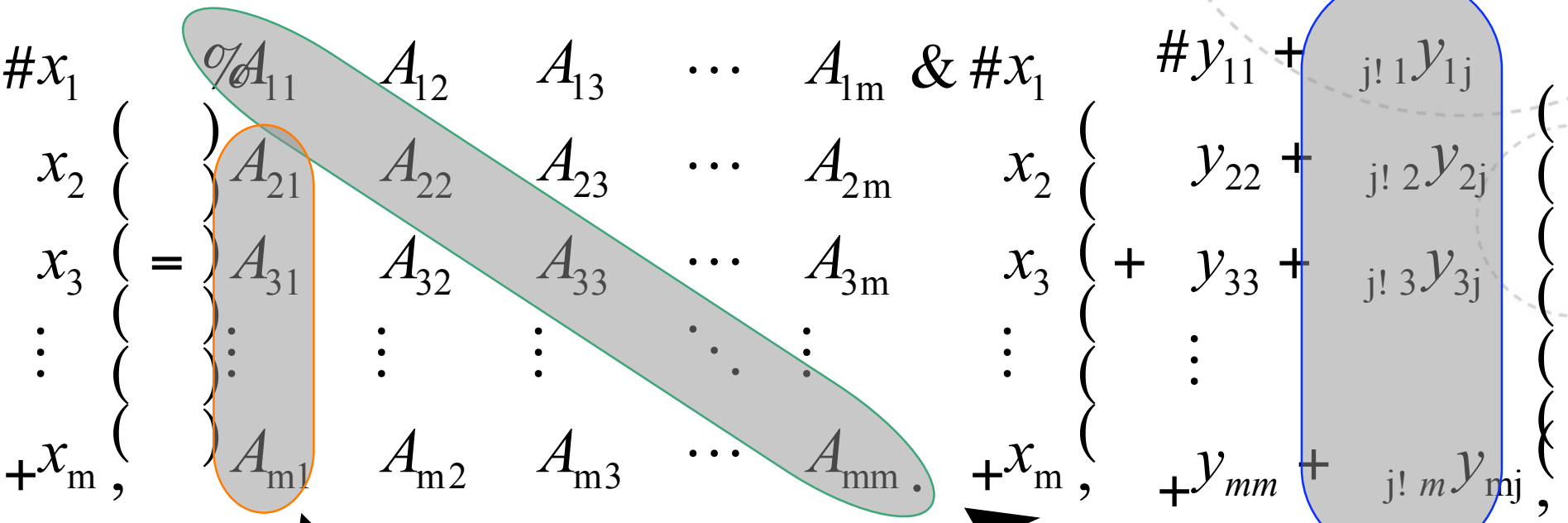
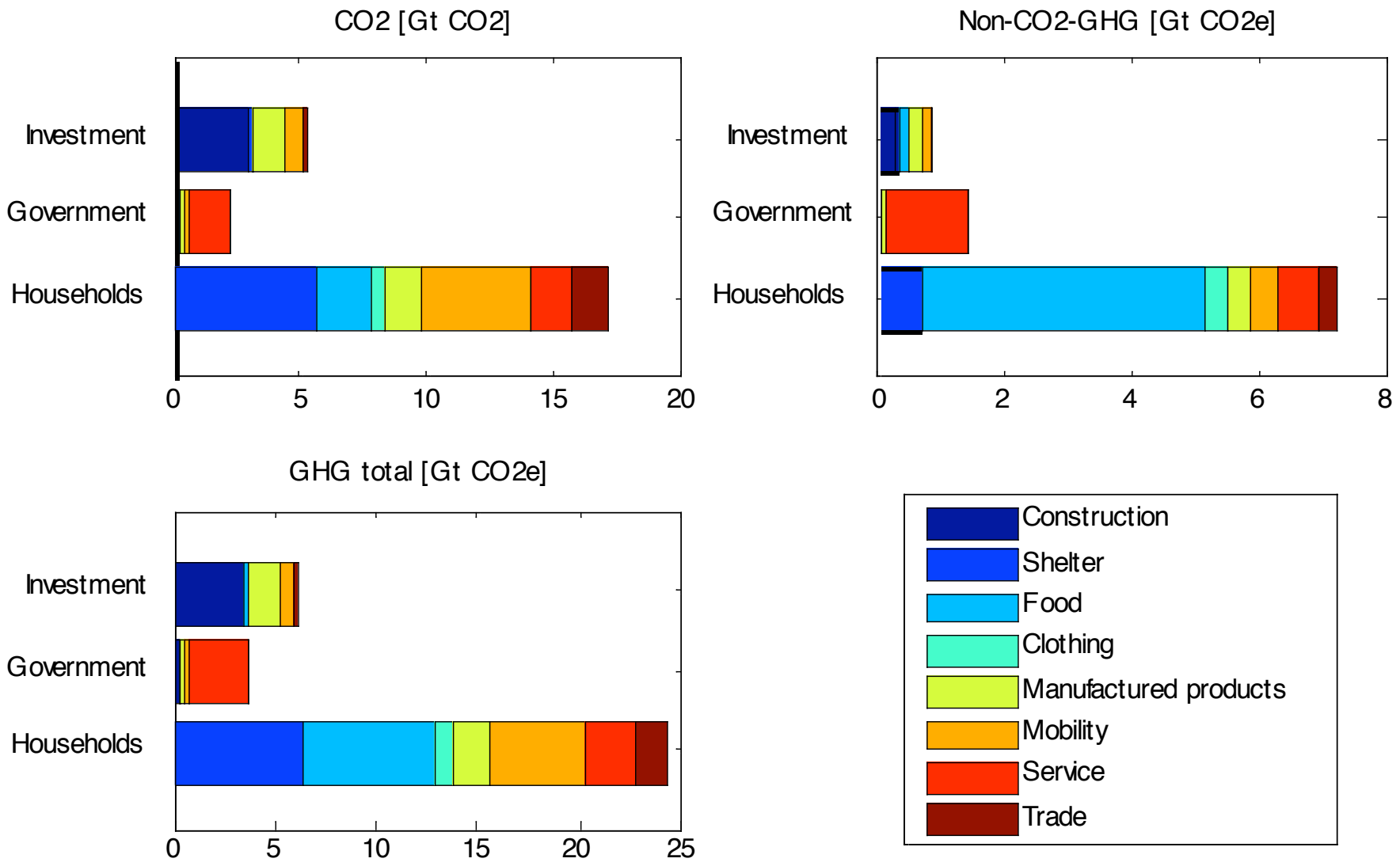
Full MRIO Model (3)





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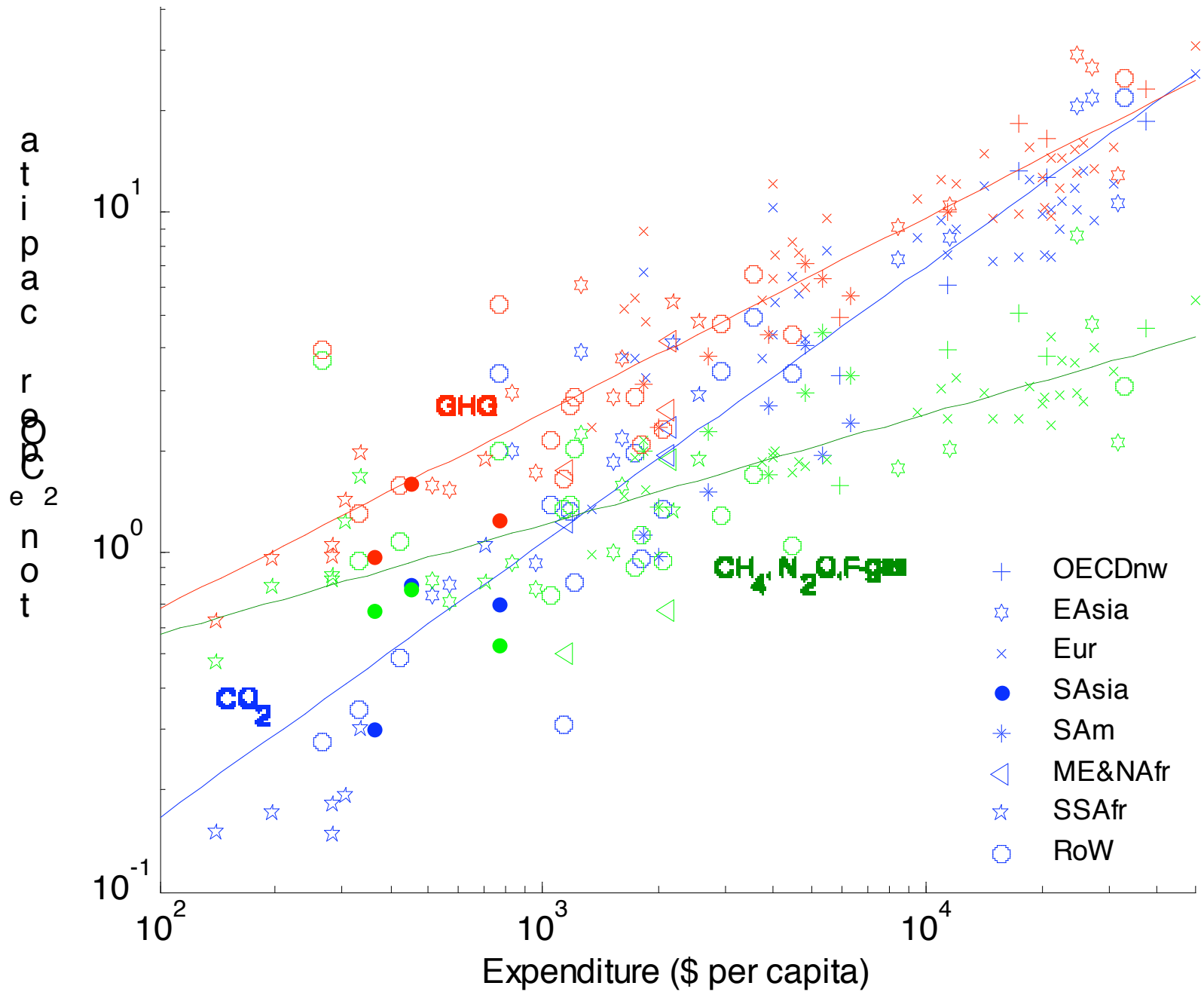
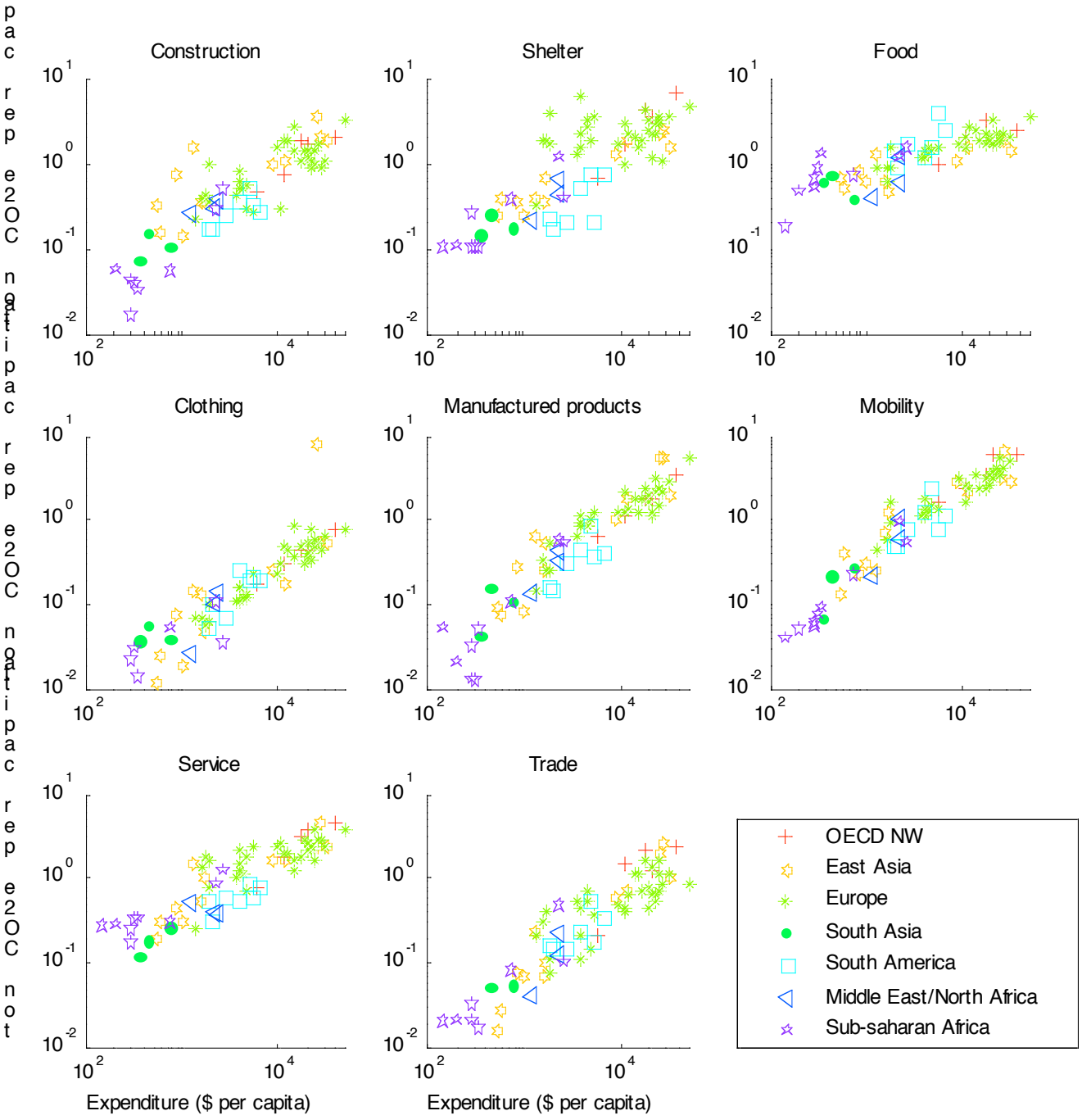
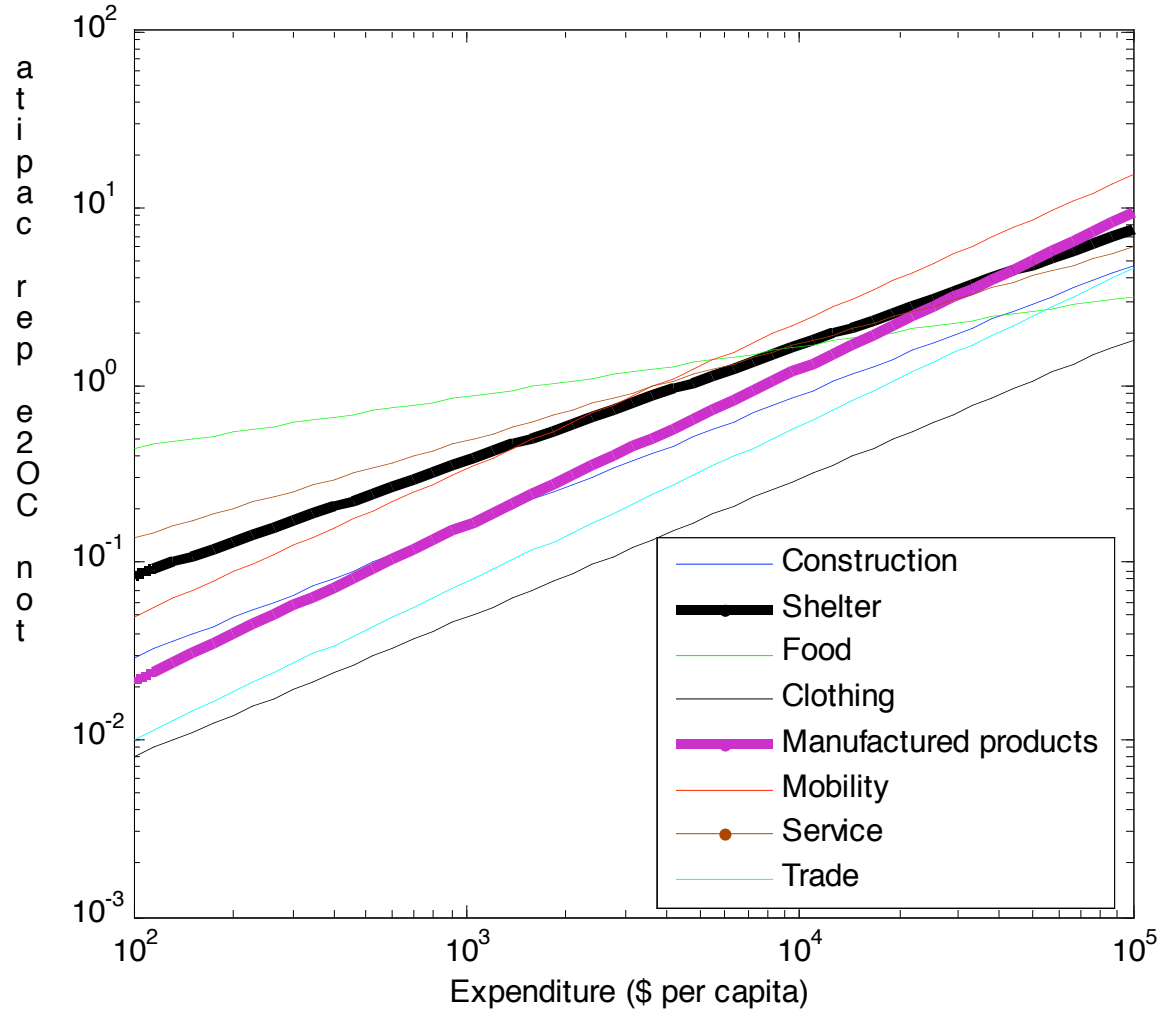

GHG
CO2
CH4, N2O,Fgas
OECDnw
EAsia
Eur
SAsia
SAm
ME&NAfr
SSAfr
RoW
Expenditure ($ per capita)


Construction
Shelter
Food
Clothing
Manufactured products
Mobility
Service
Trade
Expenditure ($ per capita)
Expenditure ($ per capita)
OECD NW
East Asia
Europe
South Asia
South America
Middle East/North Africa
Sub-saharan Africa

Importance of categories as a function of wealth



	GHG footprint elasticity
Construction	0.74
Shelter	0.65
Food	0.29
Clothing	0.79
Manufactures	0.88
Mobility	0.83
Service	0.55
Trade	0.88

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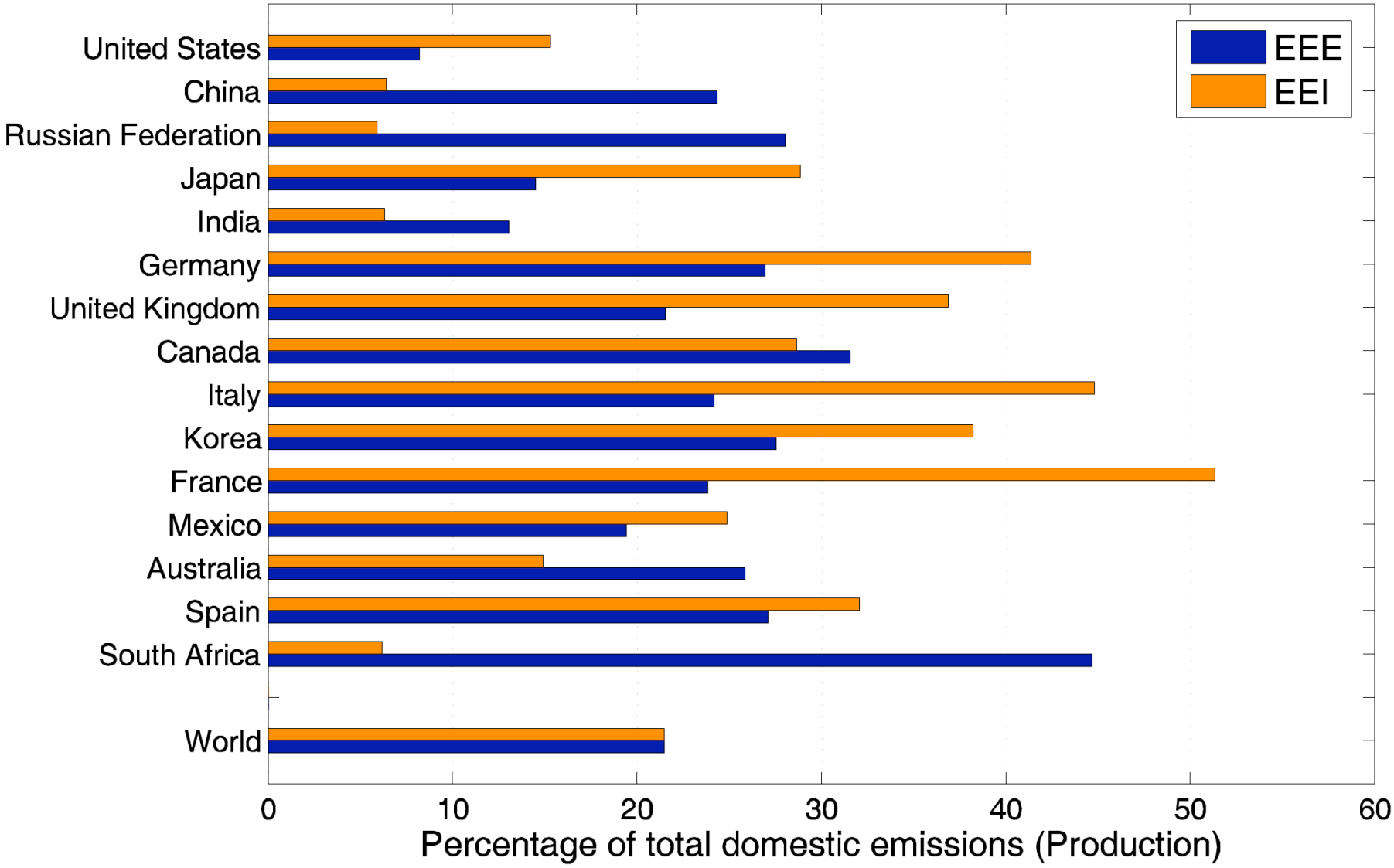
Emissions Embodied in Exports and Imports



Peters & Hertwich, *Env.Sci.Tech.* 2008

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Carbon Leakage

- The total emissions embodied in trade from non-participant countries to participant countries
- In 2001, ca. 5% of total CO_2 emissions.

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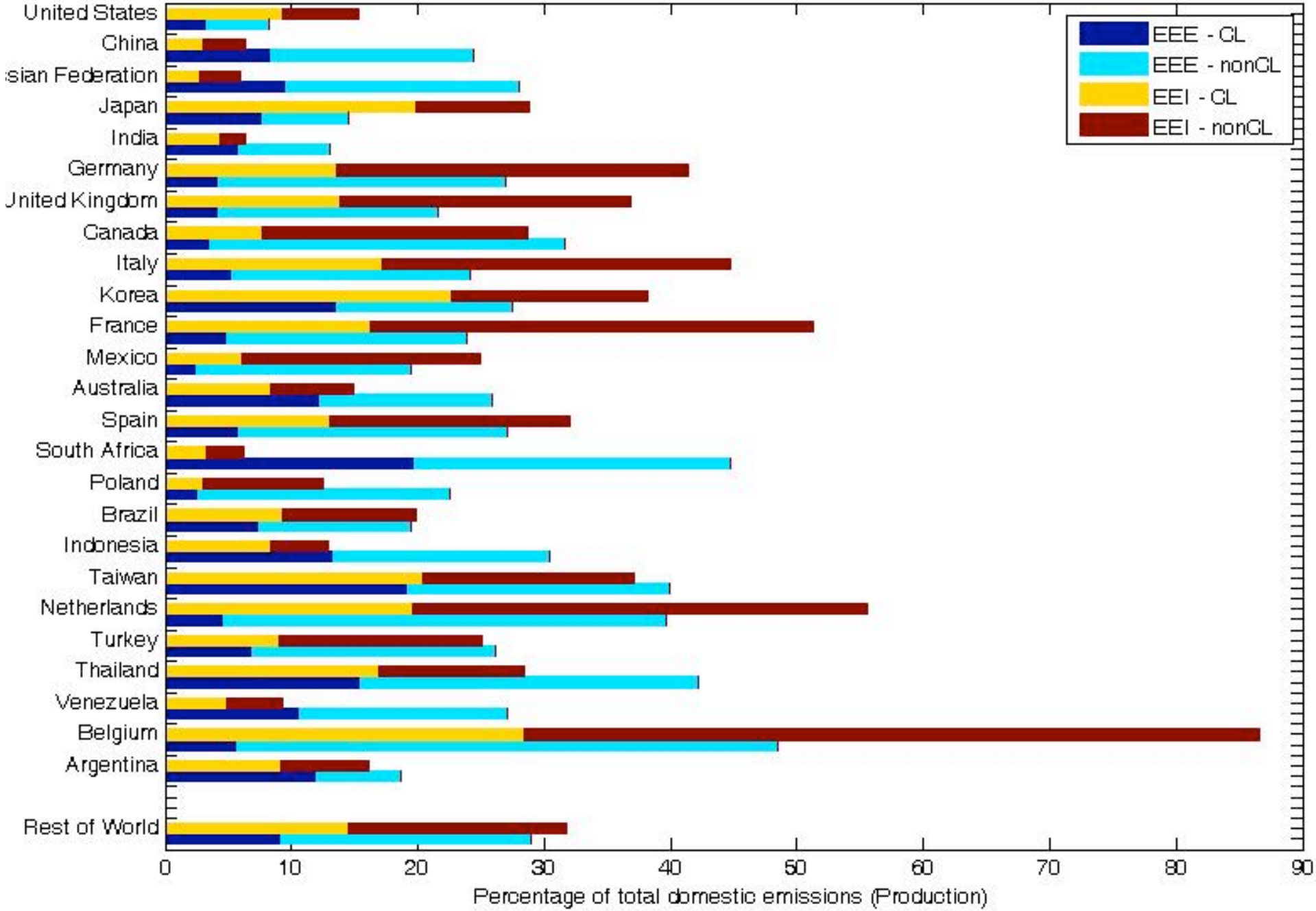
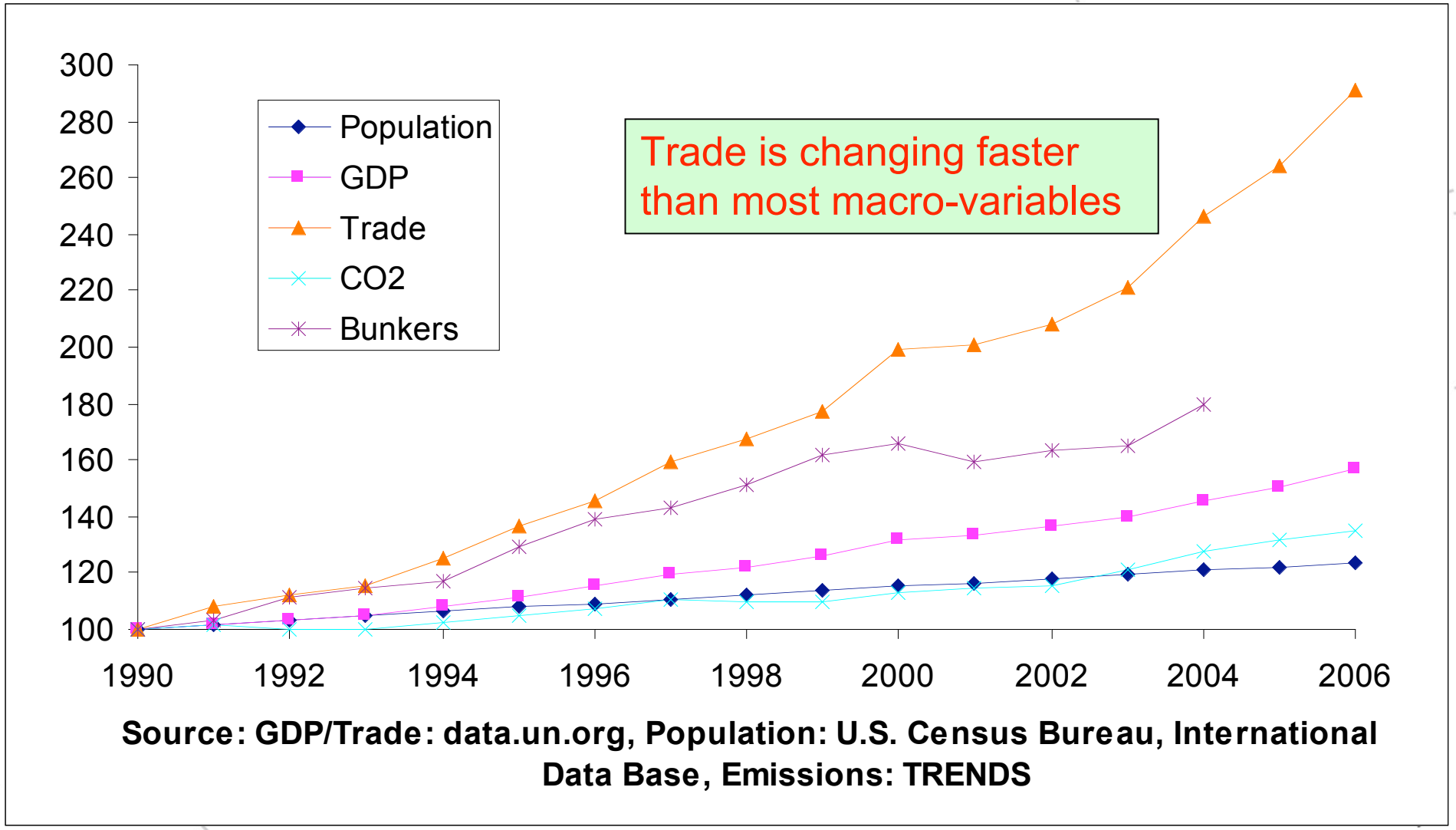
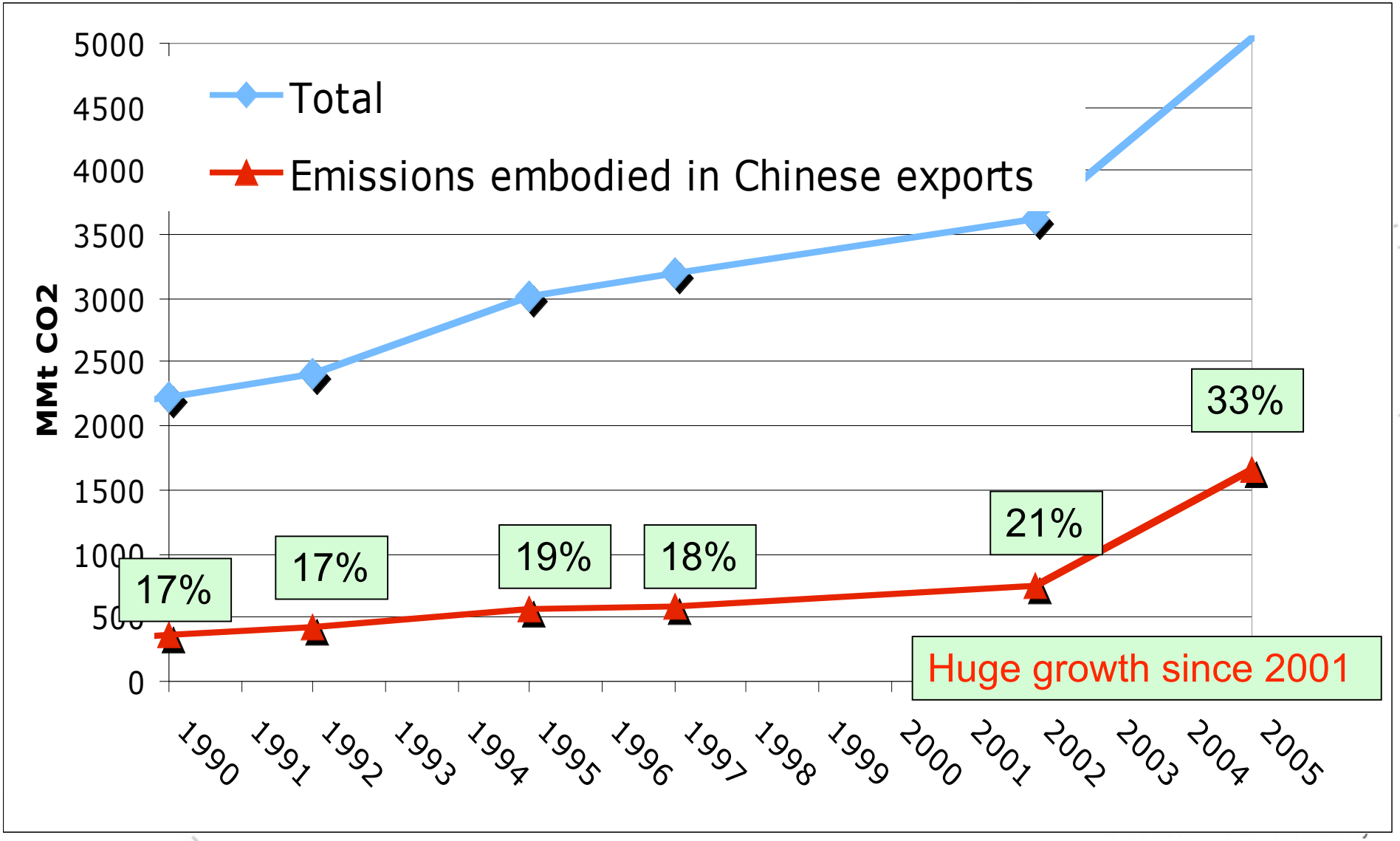

United States
China
sian Federation
Japan
India
Germany
Jnited Kingdom
Canada
Italy
Korea
France
Mexico
Australia
Spain
South Africa
Poland
Brazil
Indonesia
Taiwan
Netherlands
Turkey
Thailand
Venezuela
Belgium
Argentina
Rest of World
EEE - CL
EEE - nonCL
EEI - CL
EEI - nonCL
0
10
20
30
40
50
60
70
80
90
Percentage of total domestic emissions (Production)

Underlying dynamics of macro-variables



Source: GDP/Trade: data.un.org, Population: U.S. Census Bureau, International Data Base, Emissions: TRENDS

Chinese emissions 1990-2005



Weber, Peters, et al. 2008

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Carbon leakage

- GHG emissions for the production of internationally traded products are significant
- Shifts in trade patterns could have a significant effect on the attainment of emissions targets, e.g. the Kyoto protocol
- Border Tax Adjustments as mechanism to compensate for economic distortions caused by regional climate policy differences

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Border Carbon Adjustments

- (Selected) Products **imported** from countries without carbon tax or cap&trade systems are taxed according to their (approximate) embodied GHG emissions
- (Selected) Products **exported** to regions without carbon tax or cap&trade systems are refunded the tax paid
- BCA more compatible with tax than with ETS

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Political efforts

USA: Warner-Liebermann act: Procedure to take up emissions with countries that do not have limits/rules; leading to tariffs on selected products
Issue likely to reemerge.

EU: 2006 EP committee initiative

Verheugen – Mandelson conflict

Australia: topic very pertinent under new government

China: keen observer

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Implications

- Interest in Carbon Footprint of traded products expected to rise
- Expertise and overview urgently needed

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Questions?

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