Macroeconomic Impacts of Sectoral Approaches:

The Role of the Cement Sector

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Agenda

1. Motivation
2. Types of Sectoral Approaches
3. Extensions of CGE Model
4. Policy Scenarios
5. Conclusions

Motivation

- Sectoral approaches as a key instrument to incentivize GHG abatement in energy-intensive industries of developing countries
- Potentially with assistance from developed regions
- Previously: qualitative analyses of sectoral approaches
  - Sterk and Wittneben (2006), Egenhofer and Fujiwara (2008), Aasrud et al. (2009), Fujiwara (2010)
- This study:
  - Quantitative examination of alternative designs of sectoral approaches in the cement sector using PACE model

Types of Sectoral Approaches (1)

- Classification based on Egenhofer and Fujiwara (2008)

<u>Sector-wide transnational approaches:</u>

- Aim at softening competitiveness concerns
- Affect all companies operating in the same sector
- For multinational companies → reduction of incentives for carbon leakage
- In developing countries: investments in necessary capital may be costly

Types of Sectoral Approaches (2)

Bottom-up country commitments:

- Aggregation of mitigation potential in respective sectors → determine country-wide mitigation potential
- Specific targets for individual countries, either by
  - Absolute emission caps
  - Relative sectoral caps, i.e. emission intensities
- Might be combined with no-lose targets

Types of Sectoral Approaches (3)

Top-down sectoral crediting systems:

- Imply multilateral standards for production technologies
- Companies in developed countries can gain credits by investing in clean technologies
- Investments via technology or financial transfers
- Developed countries may reject such a system if gains of investing company are not high enough
- Sectoral crediting (Baron and Ellis, 2006):
  - Closely connected to sectoral CDM
  - Developing countries are allowed to sell CERs into existing carbon market

Types of Sectoral Approaches (4)

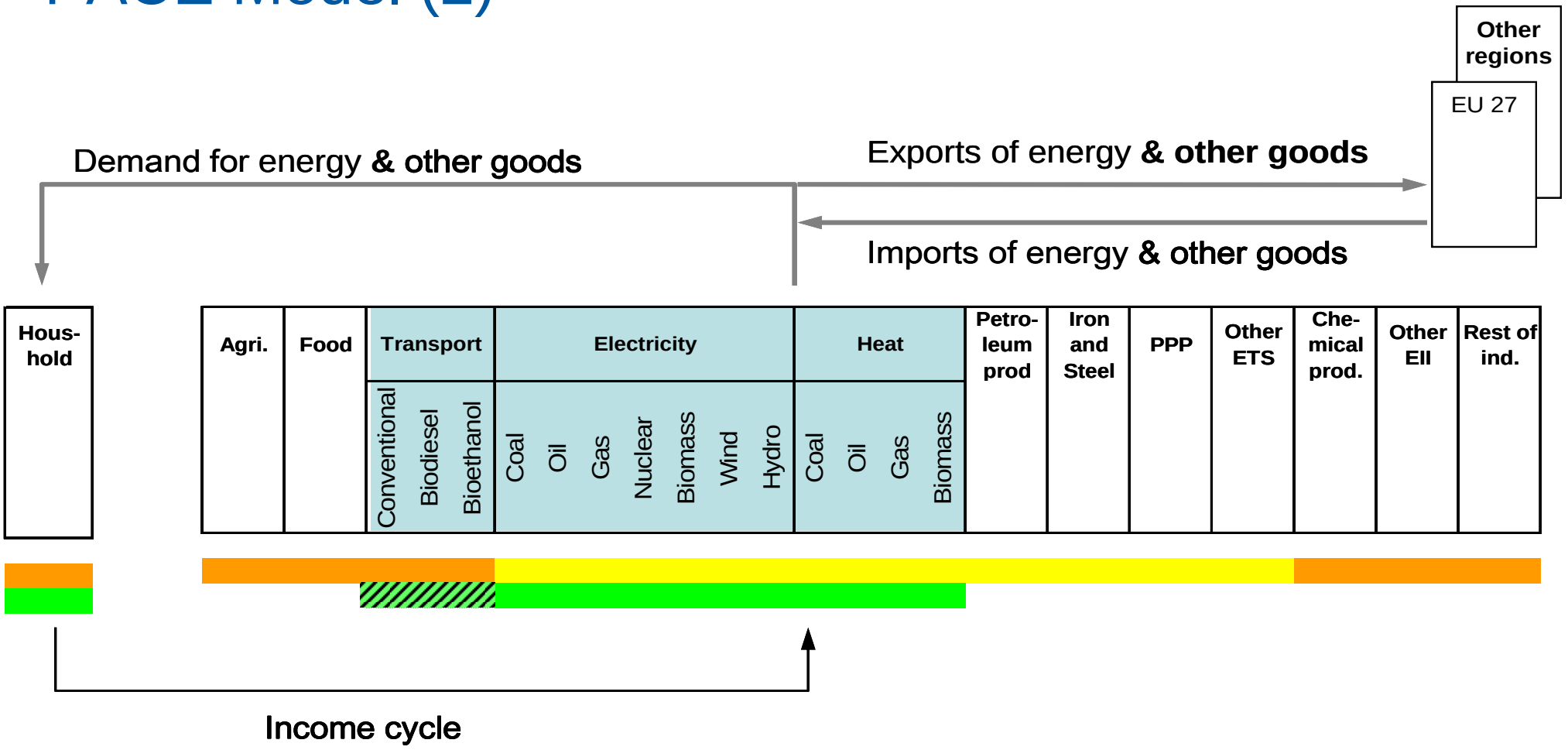
- Transnational approaches have less support than other types due to high costs for developing countries
- Quantitative analysis concentrates on bottom-up commitments and top-down sectoral crediting

- Focus on cement sector, in particular in China
- Cement industry accounts for 5% of global emissions
- Plenty of room for efficiency improvement
- China accounts for half of worldwide cement production

PACE Model (1)

- Use PACE (Policy Analysis based on Computable Equilibrium) model to assess impacts of different sectoral approaches on:
  - Welfare
  - Emission levels
  - Sectoral production
- Multi-sector, multi-region CGE model of global trade and energy use

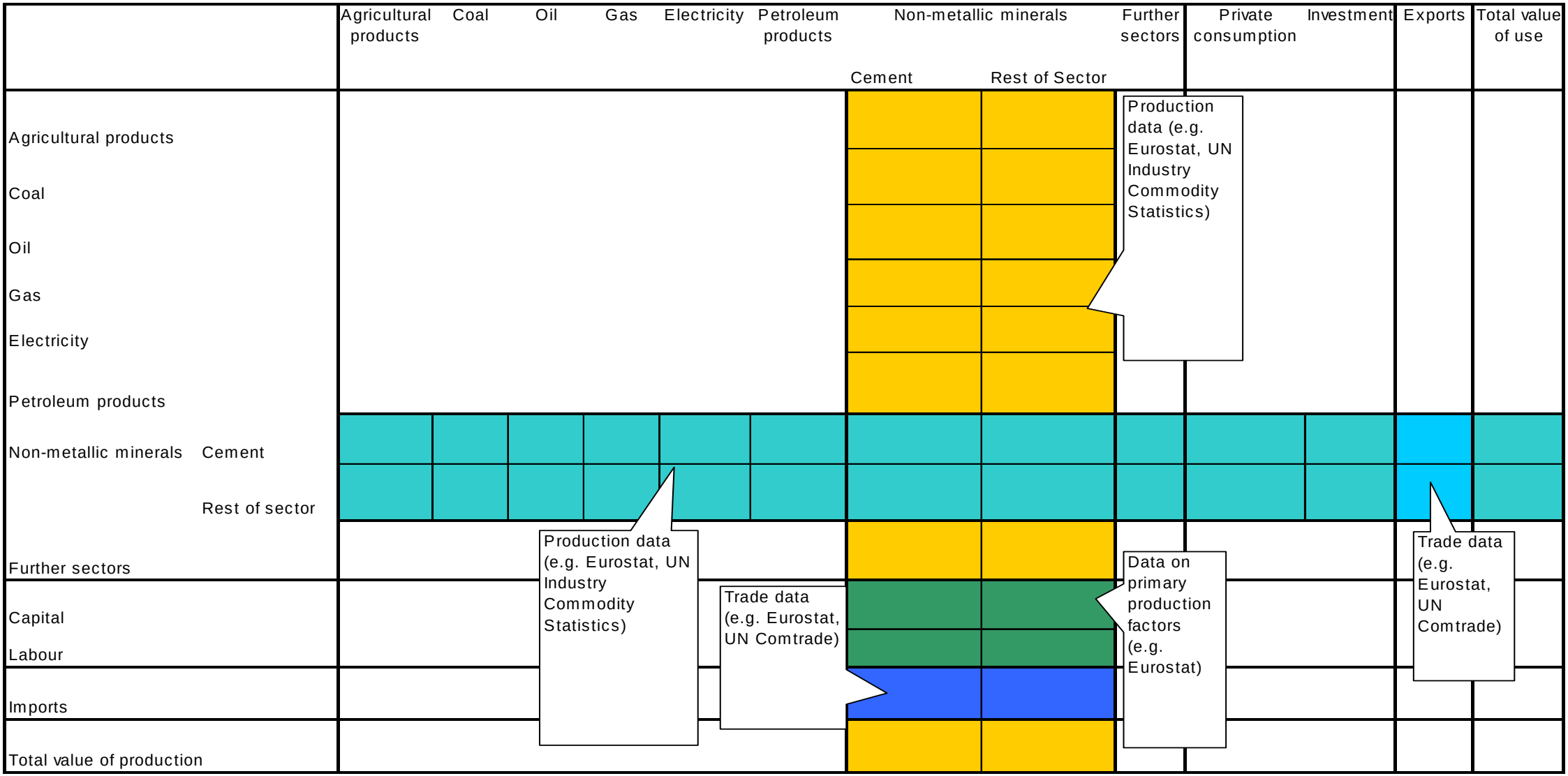
PACE Model (2)


Other regions
EU 27
Demand for energy & other goods
Exports of energy & other goods
Imports of energy & other goods
Hous-hold
Agri.
Food
Transport
Conventional
Biodiesel
Bioethanol
Electricity
Coal
Oil
Gas
Nuclear
Biomass
Wind
Hydro
Heat
Coal
Oil
Gas
Biomass
Petro-leum prod
Iron and Steel
PPP
Other ETS
Che-mical prod.
Other EII
Rest of ind.
Income cycle
GHG target
Renewable target
Non ETS
ETS
Renewables
Transport

Further Model Development

- Level of sectoral disaggregation in core model is based on GTAP 7 database (full bilateral trade flows)
- Sectoral disaggregation of the cement sector using data by
  - Eurostat and UN Industrial Commodity Statistics (production and energy)
  - UN Comtrade (Trade)
- Use Splitcom (Horridge 2005, 2008) to perform disaggregation

Sectoral Disaggregation of Cement Sector



Scenarios (1)

3 types of scenarios:

1. EU and PLEDGES
   - Only EU or Annex I countries commit to emission reduction targets
2. UNI
   - Unilateral reductions by cement sector of selected countries in addition to reductions of developed countries
   - Correspond to bottom-up country commitments
3. INT
   - Reductions by cement sector of selected countries in an international context
   - Correspond to sectoral crediting

Scenarios (2)

Scenario EU

- No international agreement until 2020 ➔ unilateral EU policy
- By 2020:
  - 21% GHG reduction vs. 2005 in sectors covered by the EU Emissions Trading Scheme (EU ETS)
  - 11% in sectors not covered by EU ETS vs. 2005

Scenarios (3)

Scenario PLEDGES

- Same reduction targets for EU27 as in Scenario EU
- Major developed countries commit to reduction targets

Region	Red. target	Reference year
Canada	17%	2005
Japan	25%	1990
US	17%	2005
Russia	15%	1990
Australia & New Zealand	5%	2000

Scenarios (4)

Scenario UNI_L

- PLEDGES reduction targets for EU27 and major developed countries
- Chinese cement sector introduces unilateral reduction target
- Negative cost options as computed by a bottom-up (BU) analysis are realized
- Corresponds to 8.6% reduction by 2020 vs. BaU 2020 in the Chinese cement sector

Scenarios (5)

Scenario UNI_M

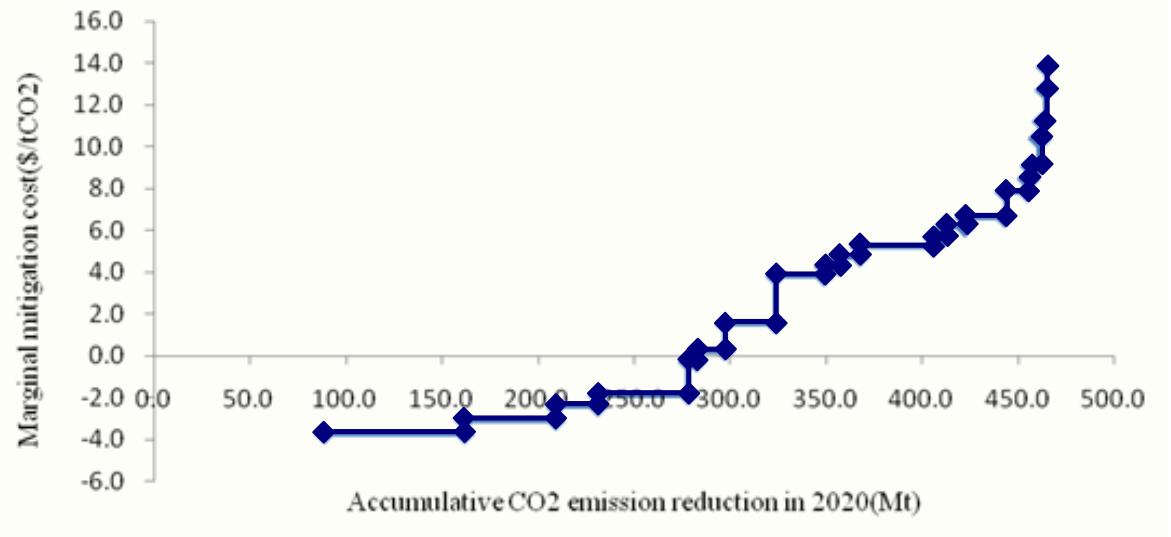
- Targets as in UNI_L
- BUT cement BU cumulative costs are zero in China
- Corresponds to 13.4% reduction by 2020 vs. BaU 2020 in the Chinese cement sector
- In addition: Analogous reduction targets in Mexican and Brazilian cement sector → 3.0% and 3.4% reduction targets by 2020, respectively

Scenario UNI_H

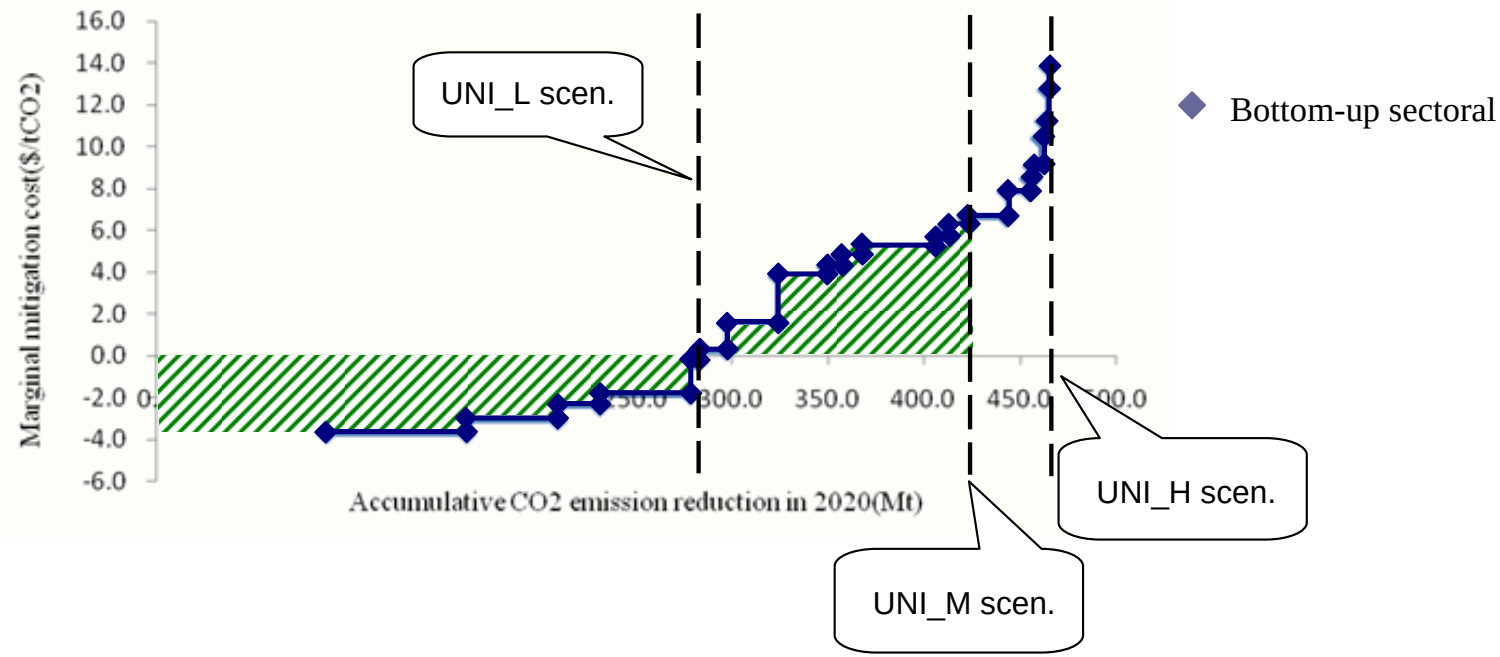
- All BU abatement options realized

→ corresponds to 14.4%, 8.3% and 6.9% reduction by 2020 vs. BaU 2020 in the Chinese, Mexican and Brazilian cement sectors, respectively

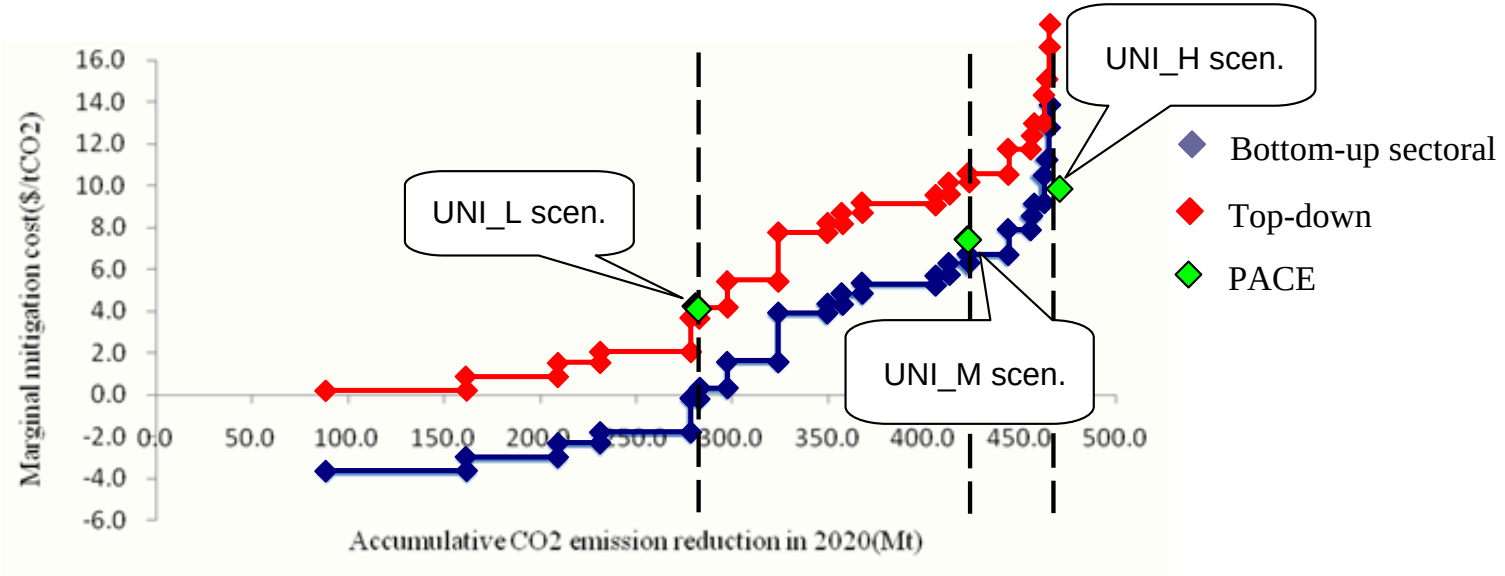
Marginal Abatement Costs



Marginal Abatement Costs



Marginal Abatement Costs



Significant share of negative cost options in sectoral analyis

neoclassical model w/o free lunch, i.e. no negative marginal abatement costs can be implemented (reduction efforts might e.g. imply transaction costs)

→ shift MAC curve of sector study upwards (to start with zero MAC for abatement option with lowest cost) and compare carbon prices

Scenarios (6)

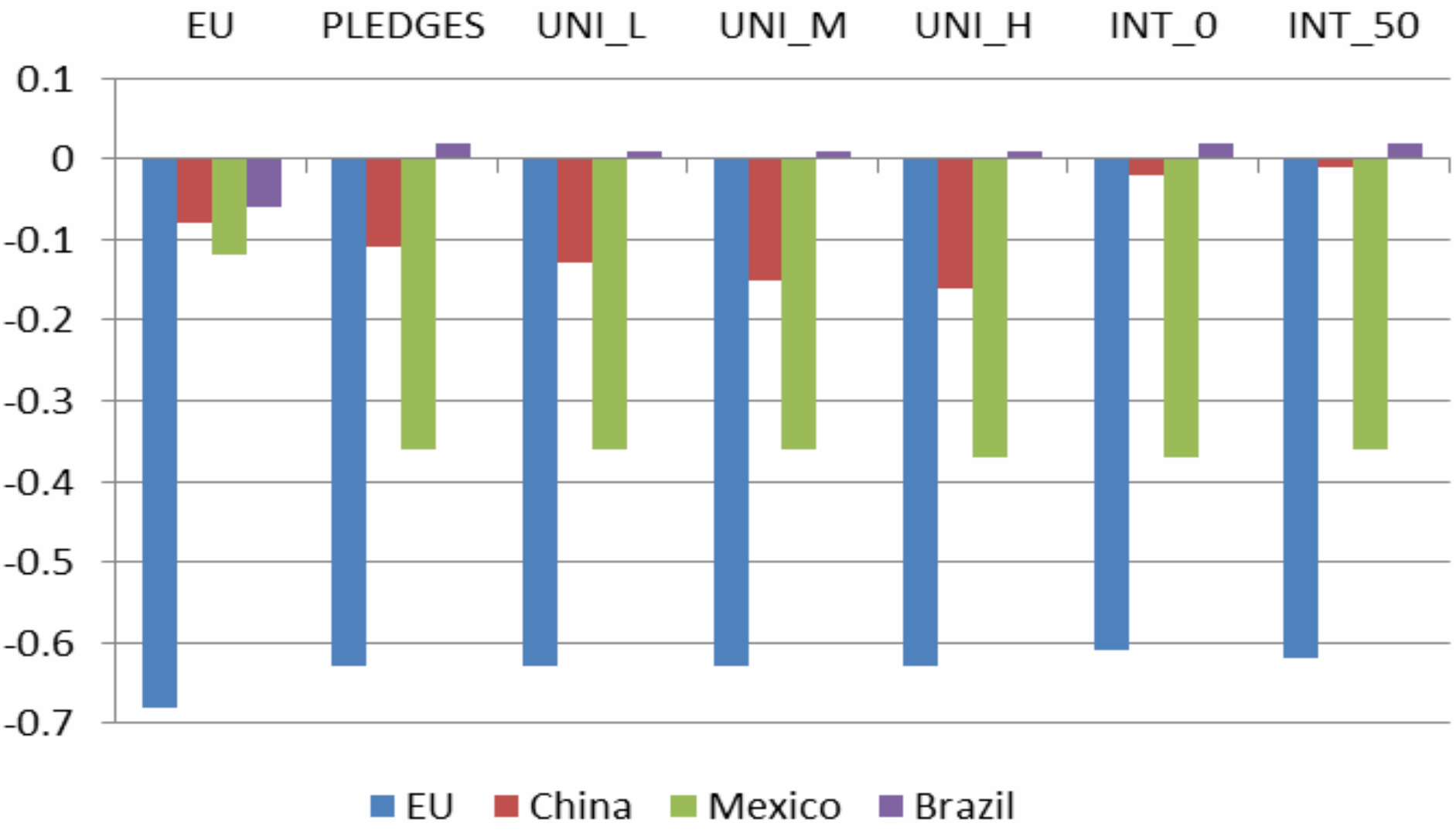
Scenario INT_0

- Targets as in UNI_H
- BUT integration in EU ETS
- Government is endowed with certificates

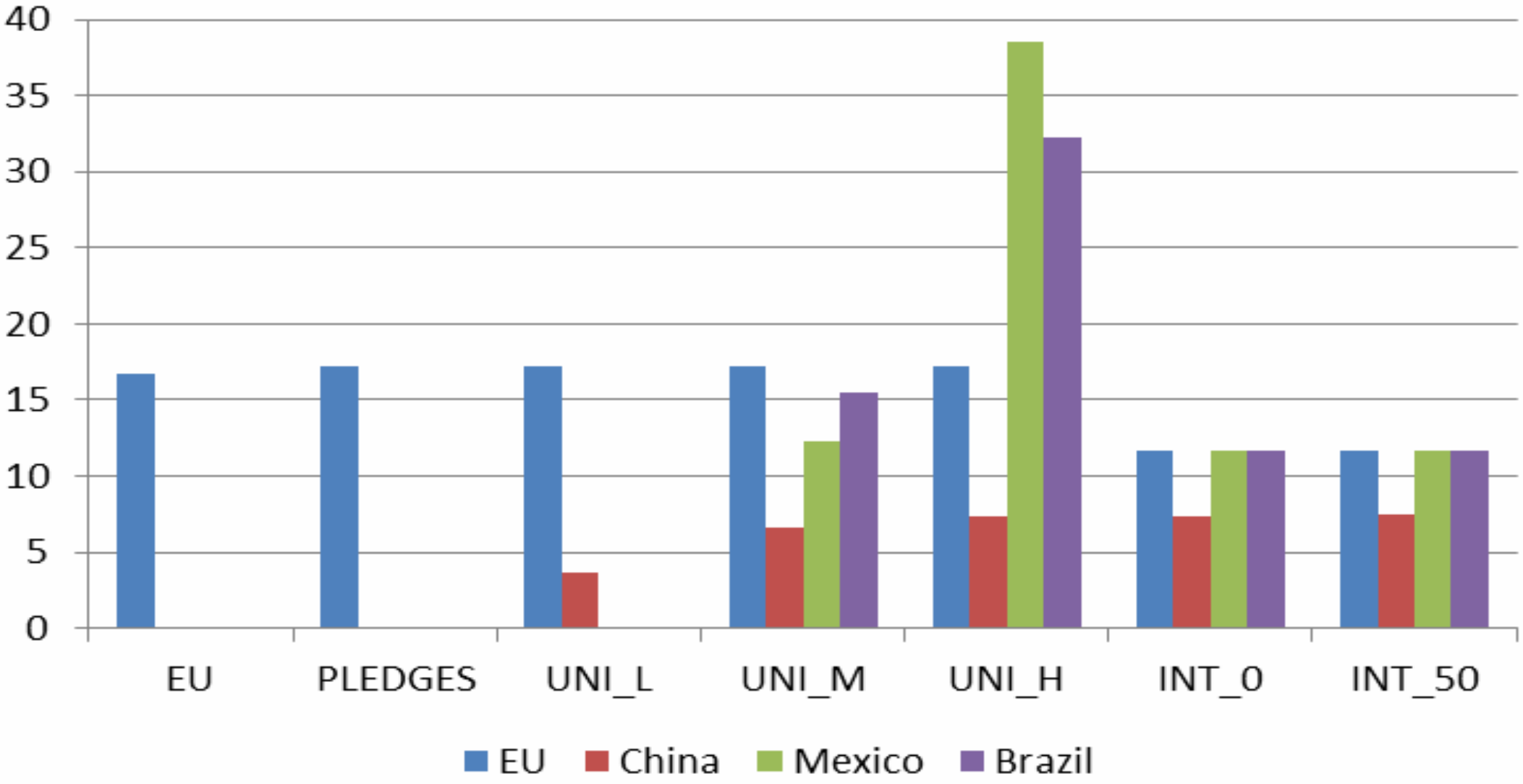
Scenario INT_50

- Targets as in UNI_H
- Government returns 50% of CO2 revenues back to sector

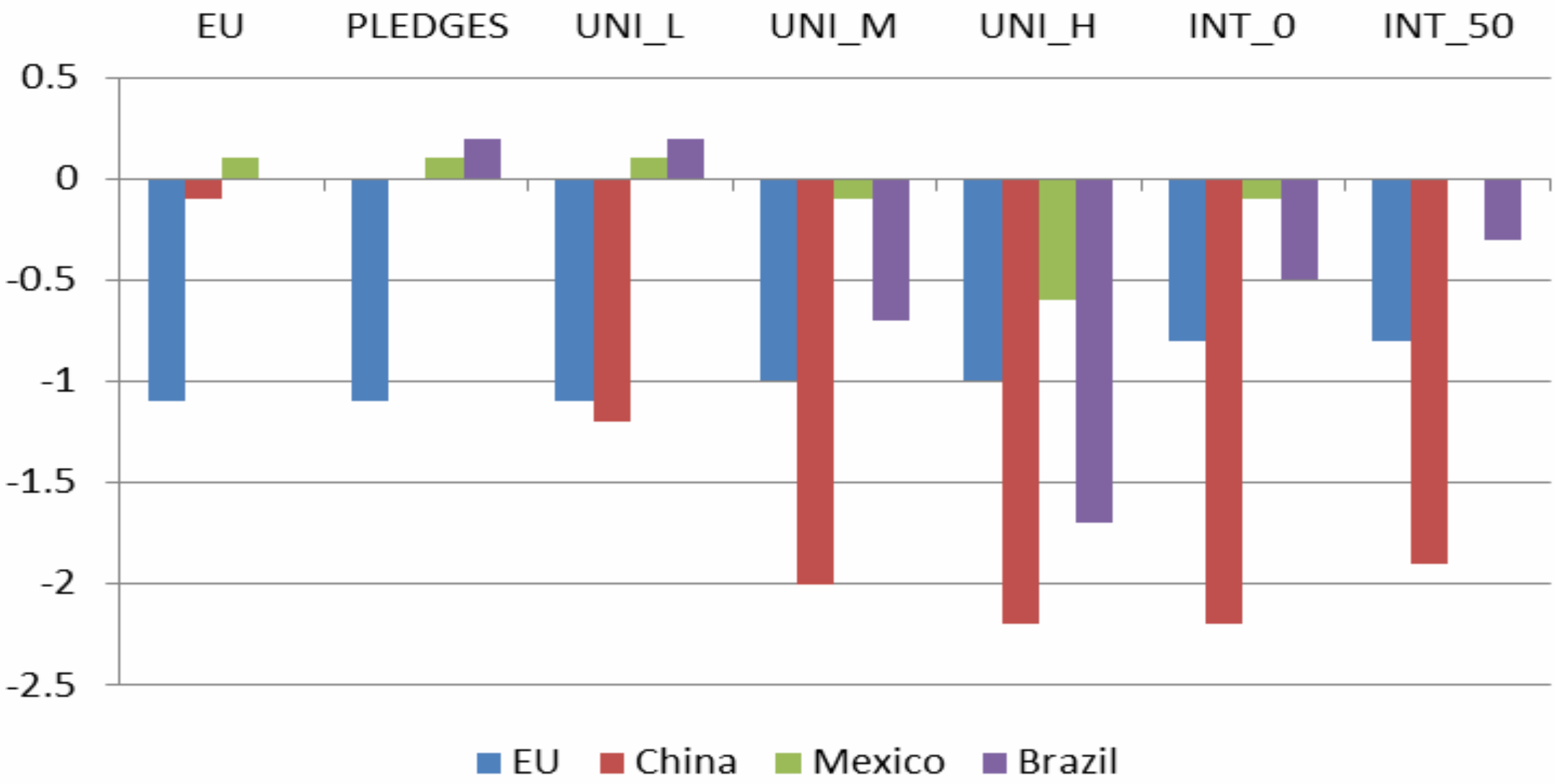
Simulation Results – Welfare



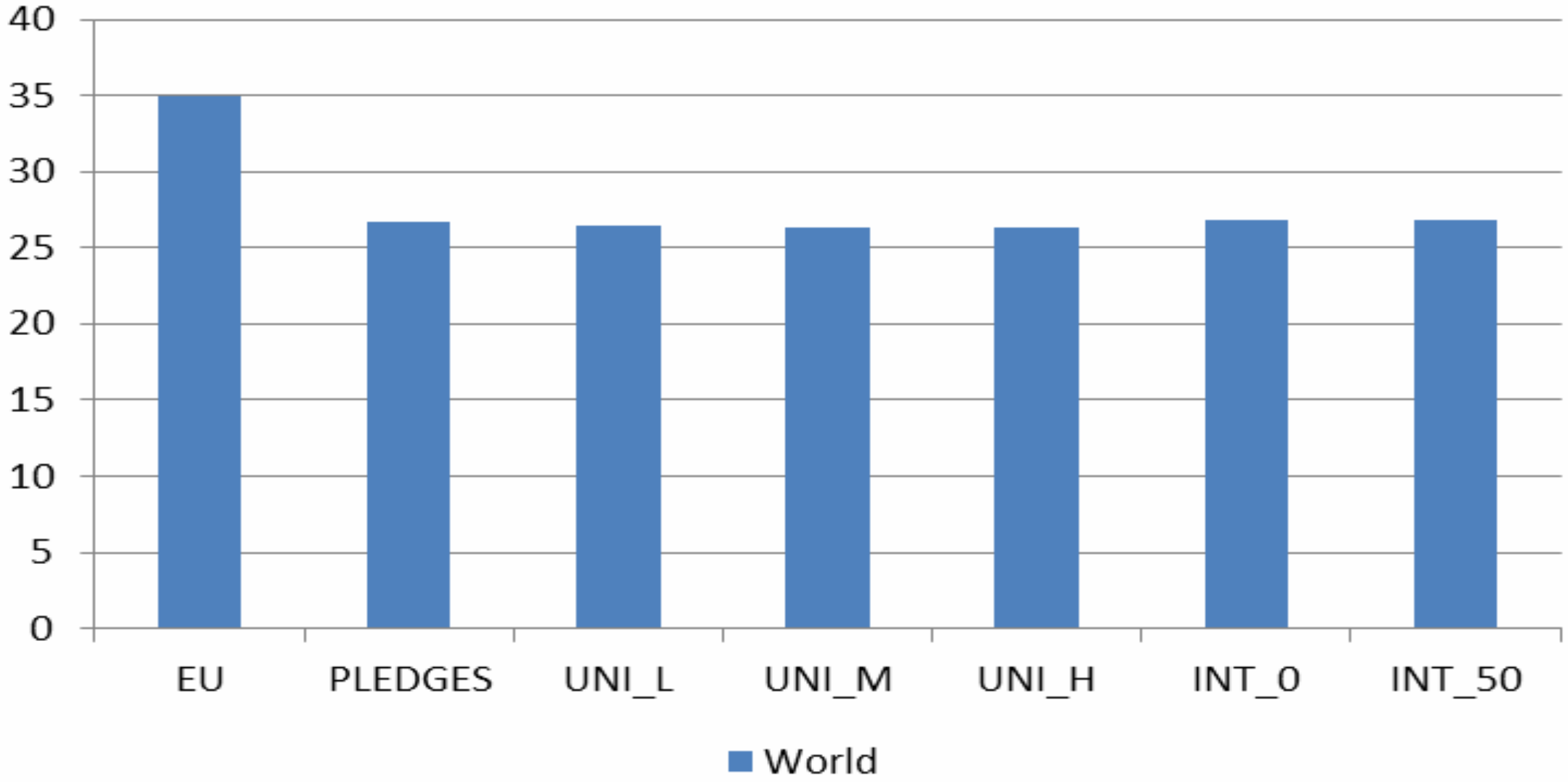
Simulation Results – Marginal Abatement Costs



Simulation Results – Cement Output



Simulation Results – CO_2 Emissions



Conclusions

- Sectoral Approaches can help reduce worldwide emissions BUT to small extent
- Result depends on countries under consideration
- Highest impact induced by reductions in Chinese cement sector

  → accounts for appr. 50% of worldwide cement production, moderate abatement costs
- Reductions in Mexico and Brazil less important from global perspective and more expensive
- Integration in EU ETS increases overall efficiency, in particular with respect to welfare
- Inclusion of further sectors and countries can increase moderate effects on global emissions level