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Unilateral climate policy and competitiveness: Differential emission pricing from a sectoral, regional and global perspective

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Outline of Talk

Background & Motivation

Competitiveness Concepts

Numerical CGE Framework

Illustrative Policy Scenario and Results

Conclusions

Background: Policy issues

- European Union: **co-existent priorities** within the EU Sustainable Development Strategy
 - EU-20-20-20: *Unilateral* emission reductions of 20 percent vs.1990 by 2020 (EU 2007)
 - Lisbon Strategy: EU as the most competitive economy of the world (EU 2000)

- Special regulatory treatment of energy-intensive industries in the EU
 - Alleviation of adverse competitiveness impacts (e.g. EU ETS allowance allocation)
 - “Improved competitiveness will foster economic well-being”
 - “Improved competitiveness will create jobs”

Defining concepts and objectives

- Severe methodological problems when dealing with competitiveness:
 - Lack of well-defined conceptual framework : competitiveness is **not a normative economic category** like welfare
 - Narrow perspective: firms and industries

- Objectives and approach:
 - Operationalisation of competitiveness concepts for sound policy advice
 - Review the literature but focus on the **common** elements in the definition
 - Define appropriate indicators alongside the defined dimensions
 - Measure competitiveness implications of a certain policy

 - Apply a **suitable methodology** to illustrate the economy-wide effects of policy aiming at improving competitiveness of certain industries

Competitiveness Notions

- Competitiveness as an outcome-based notion resides in the following abilities

	,ability to sell‘	,ability to earn‘
Sectoral Level	Jaffe et al. 1995, Jenkins 1998, Xu 2000, Klepper and Peterson 2003, Babool and Reed 2009	Sell 2003, EU 2005, Demailly and Quirion 2006, 2008, Smale et al. 2006, Sato et al. 2007
National Level	Durand and Giorno 1987, Nielsen et al. 1995	Jenkins 1998, EU 2004; Grilo and Koopman 2006; Aiginger 2006

- Determinants versus indicators of competitiveness

$$D \rightarrow C \rightarrow O \rightarrow I$$

- D* – Variety of factors (determinants) govern the competitiveness (e.g. R&D expenditures, investment flows, innovation potential)
- C* – Competitiveness (unobservable variable)
- O* – Observable outcome variables (e.g. international trade performance or profit)
- I* – Indicators that reveal competitiveness

Competitiveness Indicators at the Sectoral Level

International trade performance	Profitability performance
<ul style="list-style-type: none"> <li data-bbox="227 351 722 379">• Revealed comparative advantage References: Balassa (1965), Ballance et al. (1987), Gorton et al. (2000), Fertö and Hubbard (2003), Abidin and Loke (2008) <li data-bbox="227 572 890 636">• Export (import) ratio in world's total exports (imports) References: Kravis and Lipsey (1992), Carlin et al. (2001), Reichel (2002) <li data-bbox="227 748 668 776">• Constant market share index References: Koopmann and Langer (1988), Holst and Weiss (2004) <li data-bbox="227 888 846 916">• Intra-industry trade index (Grubel-Lloyd) References: EU (2005), Havrila and Gunawardana (2003) <li data-bbox="227 1028 819 1092">• Ratio of exports (imports) to production (consumption) References: Ballance et al. (1987) 	<ul style="list-style-type: none"> <li data-bbox="977 351 1663 415">• Earnings before interests, tax, debt and amortisation (EBITDA) References: Smale et al. (2006), Sato et al. (2007), Demailly and Quirion (2006, 2008) <li data-bbox="977 572 1329 601">• Gross operating rate References: EU (2005), Peltonen et al. (2008) <li data-bbox="977 748 1244 776">• Rate of return References: Rossi et al. (1986), Wang (1995), Manne and Barreto (2004) <li data-bbox="977 888 1209 916">• Profit share References: Torrini (2005)

Competitiveness Indicators at the National Level

International trade performance	Ability to create welfare
<ul style="list-style-type: none"><li data-bbox="195 448 929 568">• Terms of trade References: Riley (1980), Di Bartolomeo (2005), Hildebrandt and Silgoner (2007)<li data-bbox="195 596 846 716">• Trade balance (Current account) References: Nielsen et al. (1995), Deutsche Bundesbank (2007)<li data-bbox="195 745 900 905">• Export market share References: Fagerberg (1988), Amable and Verspagen (1995), ECB (2005), Danninger and Joutz (2007)<li data-bbox="195 933 672 1016">• (Real effective) exchange rate References: Vitek (2009)	<ul style="list-style-type: none"><li data-bbox="996 448 1742 568">• GDP per capita References: Grilo and Koopman (2006), Aiginger (2006)<li data-bbox="996 596 1742 716">• Real consumption References: Grilo and Koopman (2006), Aiginger (2006)

Selected Competitiveness Indicators

■ Terms of Trade (ToT)

⇔ compares the ratio of a country's overall export prices with the ratio of country's overall imports prices in all sectors

$$ToT_i = \frac{\sum_j P_{ij}^x X_{ij}}{\sum_j P_{ij}^m M_{ij}}$$

■ Revealed Comparative Advantage (RCA)

⇔ compares the ratio of exports by a specific sector over its imports with the ratio of exports over imports across all sectors of the region

$$RCA_{ir} = \frac{P_{ir}^x X_{ir} / P_{ir}^m M_{ir}}{\sum_i P_{ir}^x X_{ir} / \sum_i P_{ir}^m M_{ir}}$$

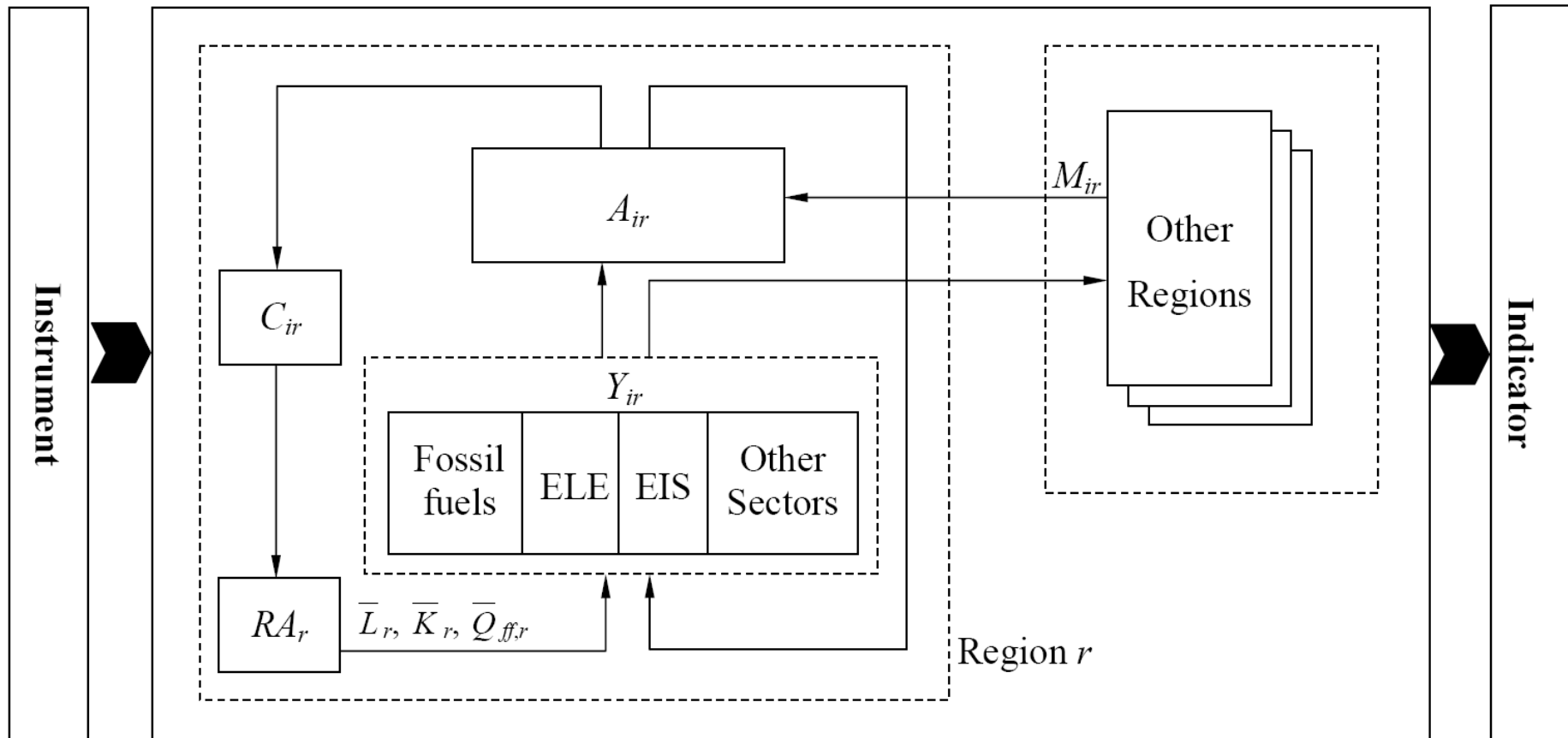
■ Relative World Trade Shares (RWS)

⇔ compares the ratio of country's exports in a certain sector over the world's exports in this sector with the ratio of country's overall exports over the world's exports in all sectors

$$RWS_{ir} = \frac{P_{ir}^x X_{ir} / \sum_r P_{ir}^x X_{ir}}{\sum_i P_{ir}^x X_{ir} / \sum_r \sum_i P_{ir}^x X_{ir}}$$

Static CGE Model of Global Trade and Energy Use

- Global coverage with bilateral trade flows (product heterogeneity)
 - International price changes (terms-of-trade effects)
 - Emission leakage
- Detailed national accounts
 - Domestic production (IO) and consumption structure
 - Physical energy and carbon flows



Data and Model Parameterization

■ Data

- GTAPv7 for model calibration (base year 2004, 57 sectors, 113 regions)
- Empirical KLEM substitution elasticities (Okagawa and Ban 2008)

■ Aggregation for stylized climate policy analysis

Production sectors	Regions and primary factors
<i>Energy</i>	<i>Regions</i>
Coal	European Union (EUR)
Crude oil	Non-EU OECD (OEC)
Natural gas	Rest of World (ROW)
Refined oil products (EITE)	
Electricity	
<i>Non-Energy</i>	<i>Primary factors</i>
Energy-int. and trade-exp. industries (EITE)	Labour
Rest of industry and services (OTH)	Capital
Savings good	Fixed factor resources for coal, oil and gas

*EITE: iron and steel, chemical products, non-metallic minerals, non-ferrous metals, paper, pulp, printing, air transport, refined oil products

*EITE: GDP share 7 %, CO2 share 14%

Illustrative Application: EU Leadership in Climate Policy

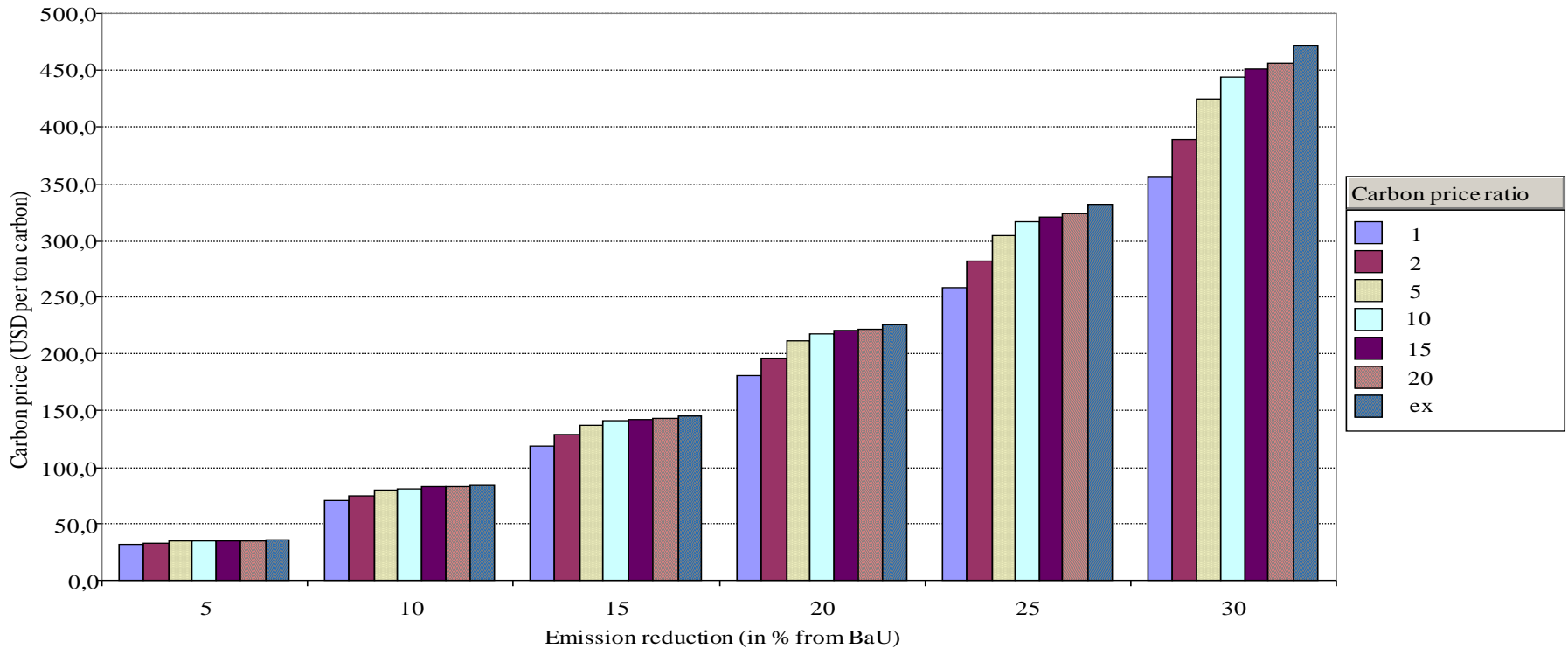
- Unilateral emission reduction targets on behalf of the European Union
 - 5,10,15, 20, 25, 30% cutback of CO₂ emissions compared to BaU

- Policies to achieve emission reduction
 - Uniform emission pricing (CO₂ tax or auctioned emission allowances)
 - Differential emission pricing in favour of energy-intensive and trade exposed industries
 - Tax ratios between carbon-intensive and trade-exposed industries and the rest of economy:
1 (uniform), 2, 5, 10, 20, *inf* (exemptions)

- Complementary analysis on the role of international spillover effects

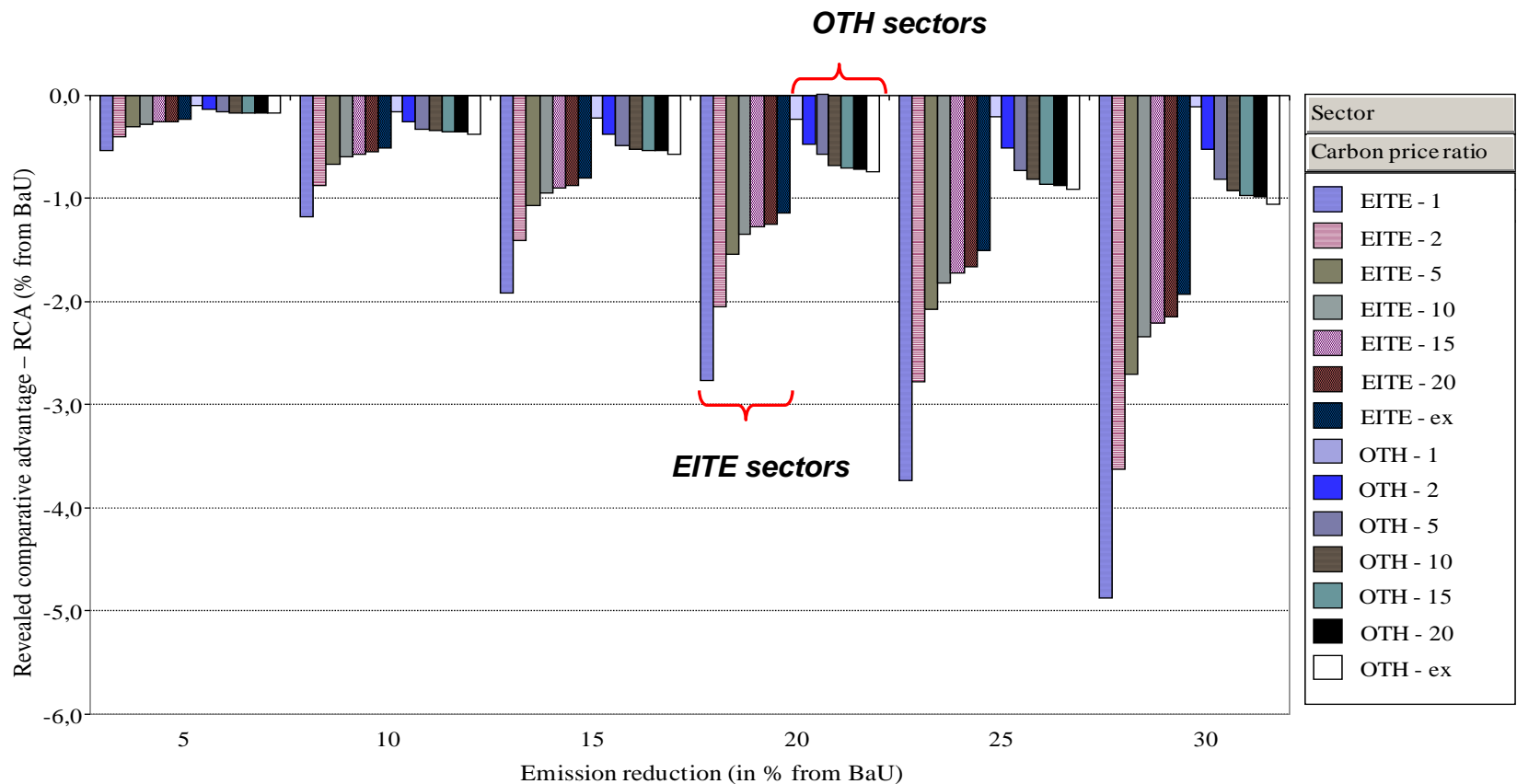
Marginal Abatement Cost

USD₂₀₀₄ per ton of carbon in the EU non-EITE segments



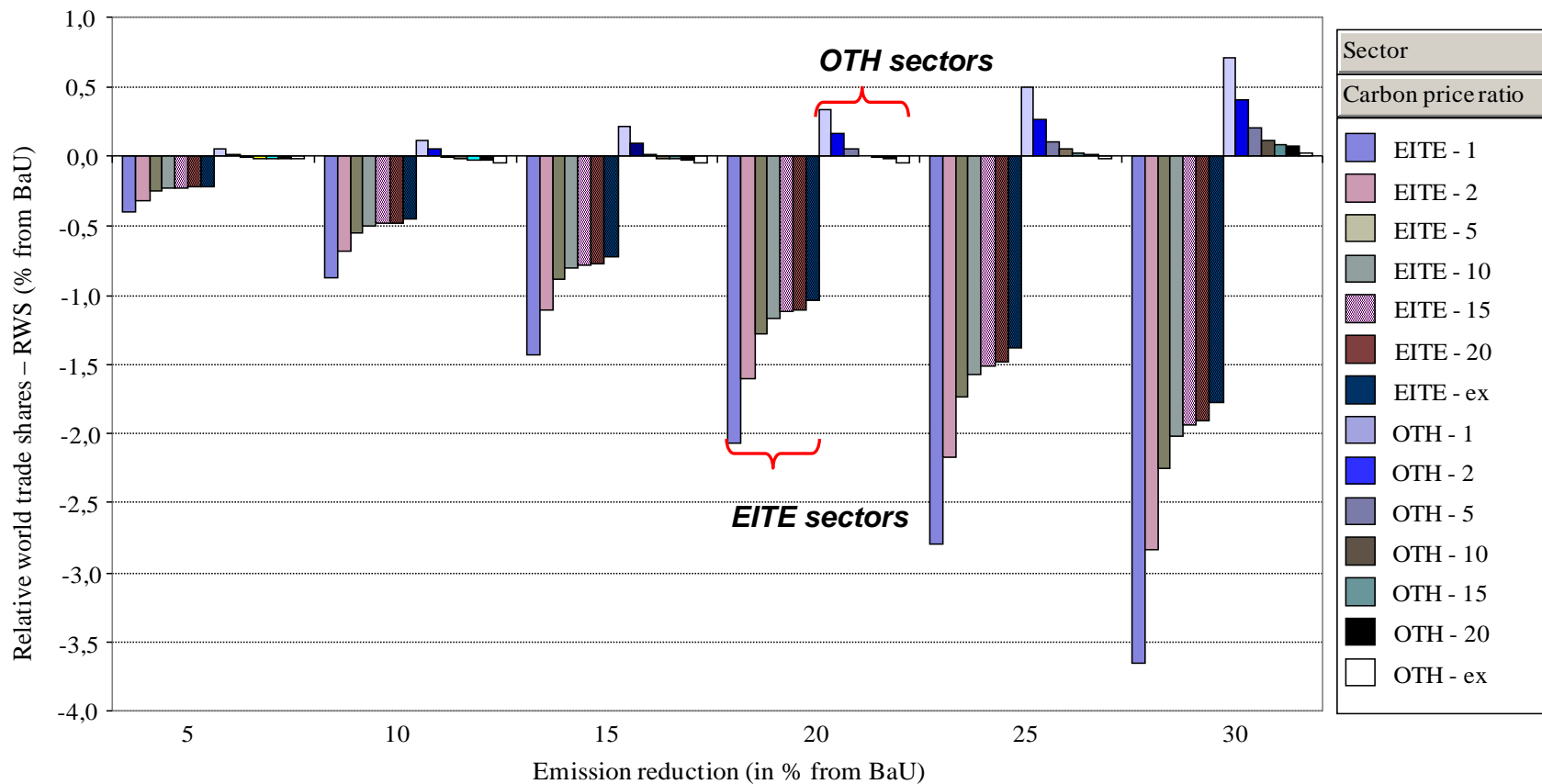
EU Sectoral Competitiveness Effects (1)

Revealed comparative advantage (% change from BaU)



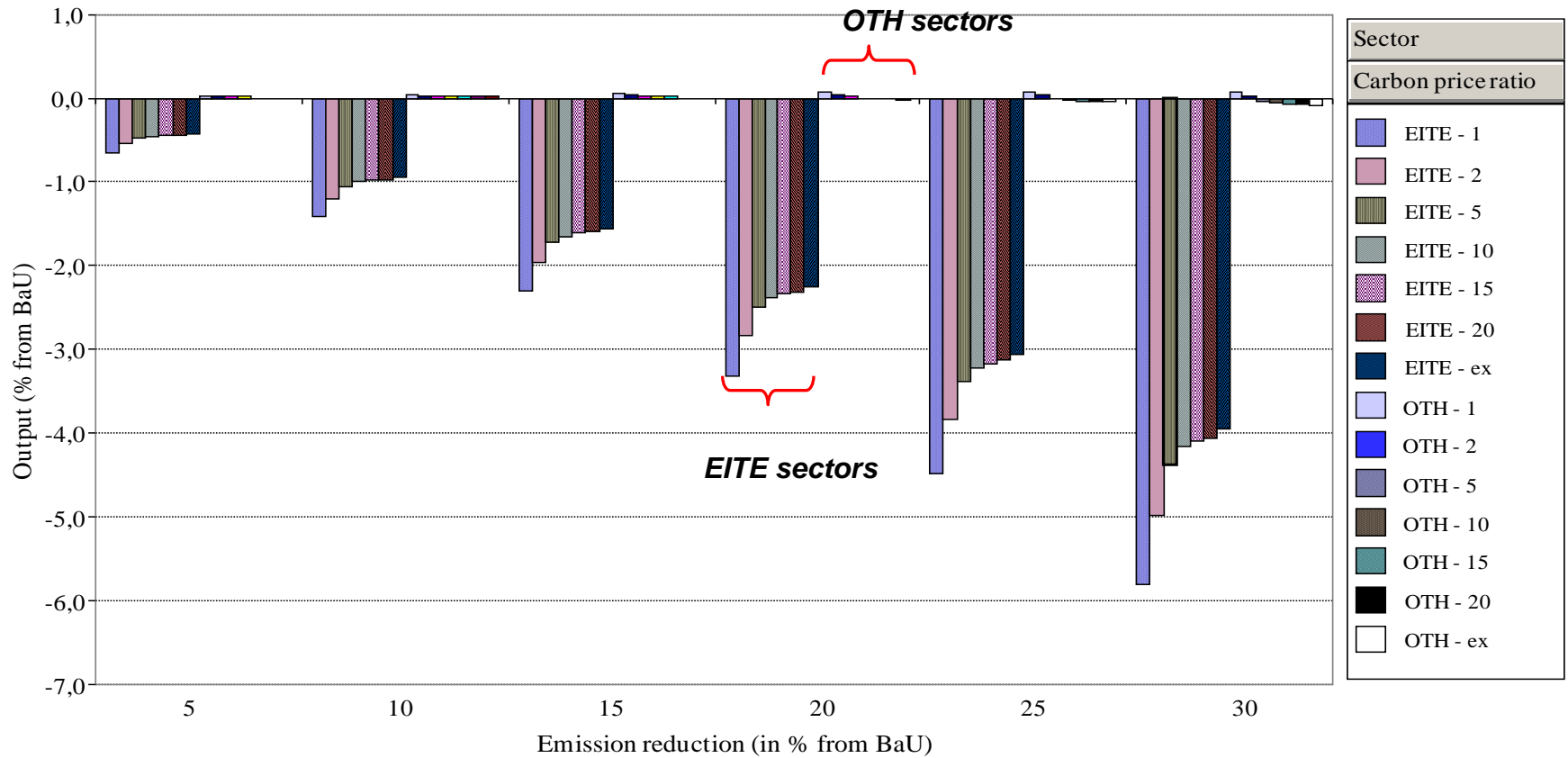
EU Sectoral Competitiveness Effects (2)

World trade shares (% change from BaU)



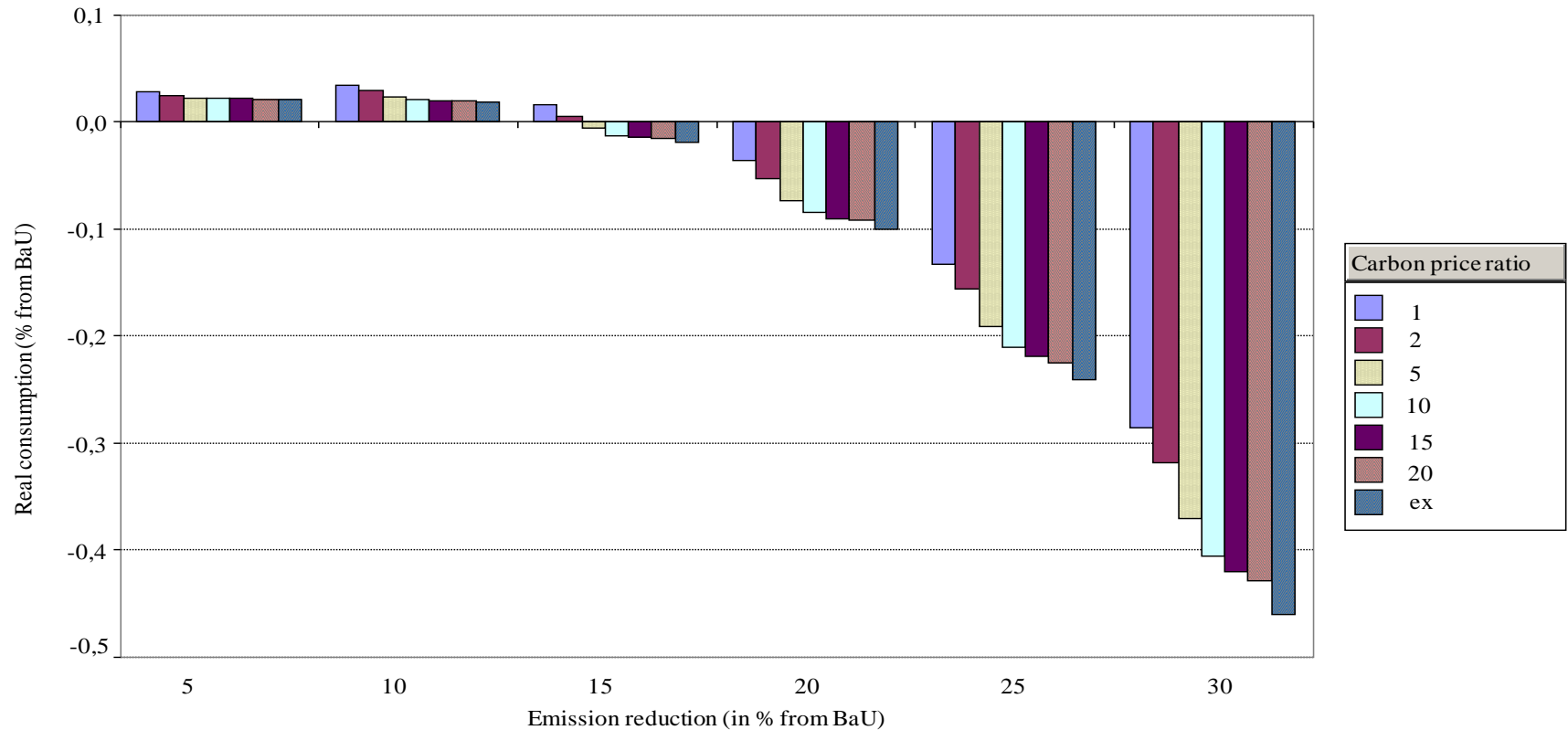
Sectoral Output Effects

Output effects in the EU (% change from BaU)



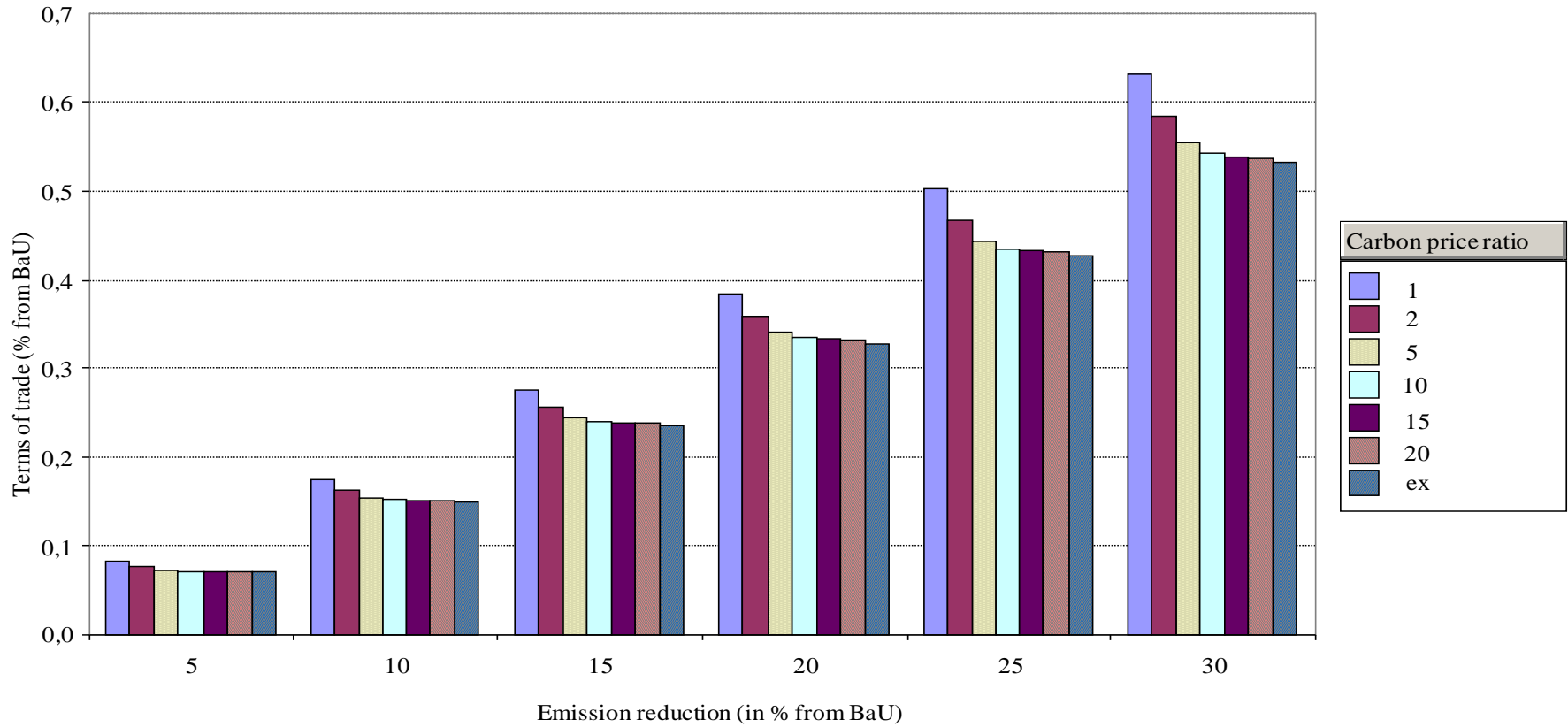
EU Compliance Cost

Changes in real consumption in the EU (% change from BaU)



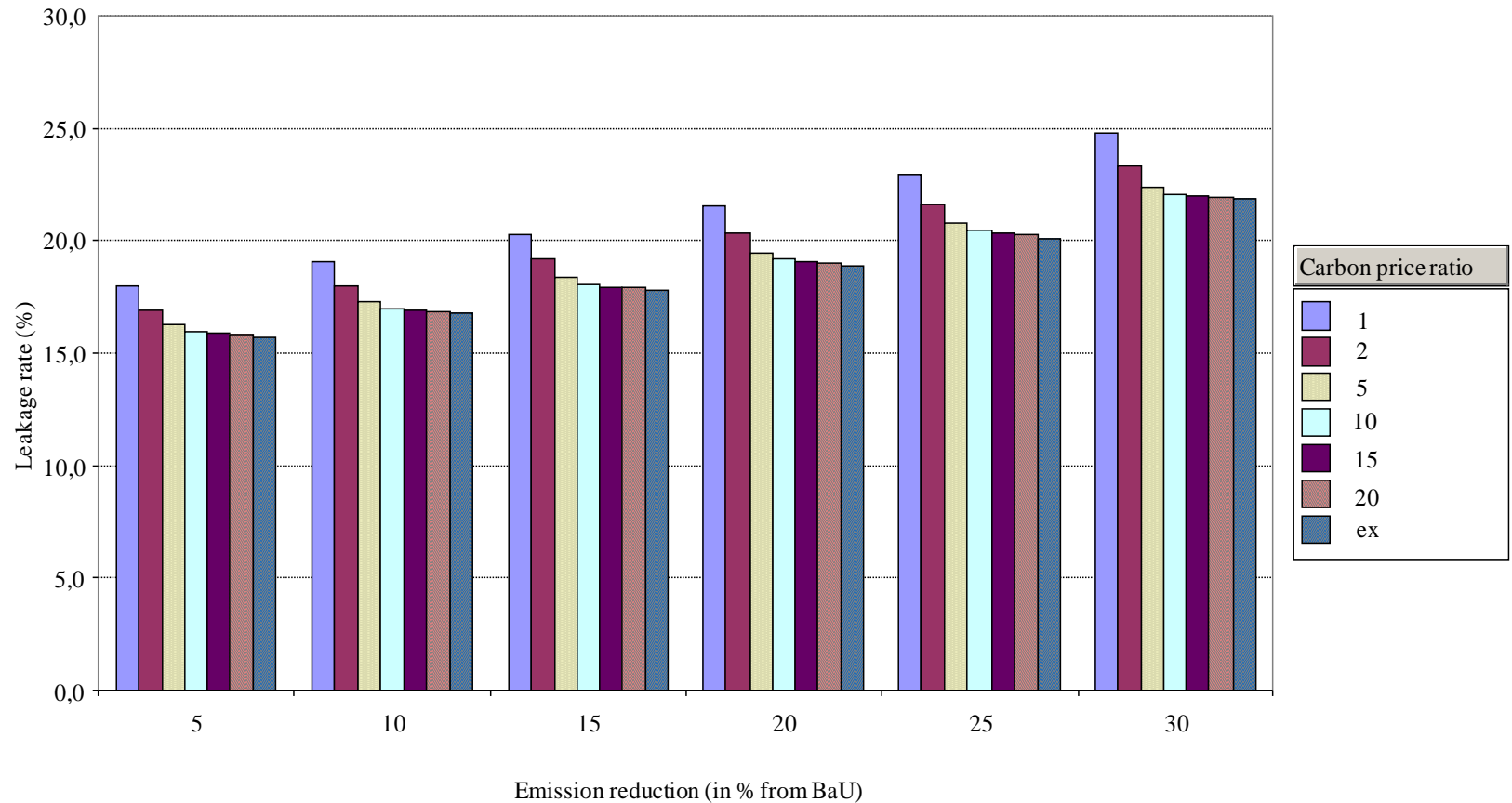
Terms of Trade (ToT) effects

Terms of trade in the EU (% change from BaU)



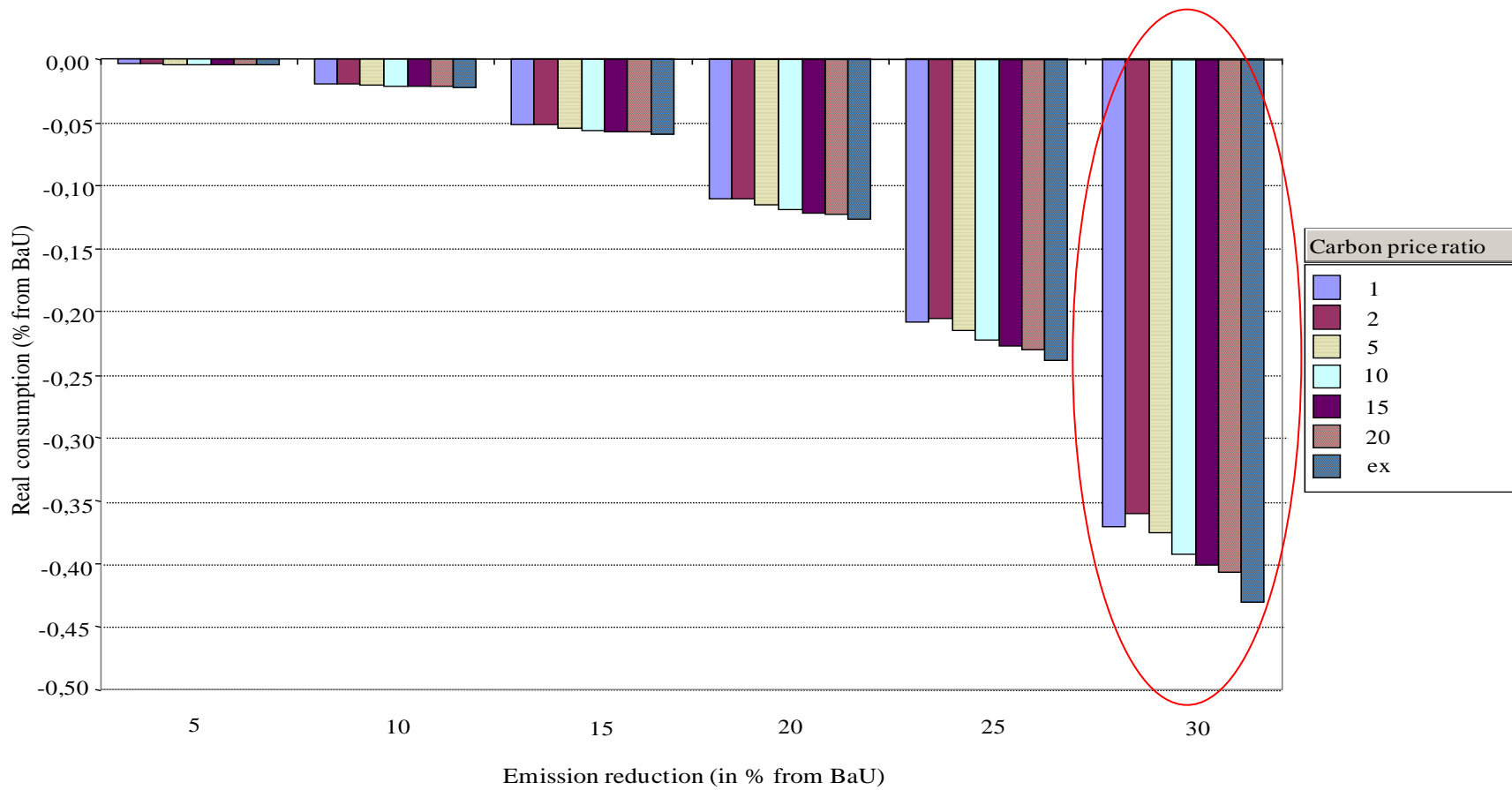
Emission leakage rates

Emission leakage rates (in %) in the case of unilateral leakage compensation



Global Economic Adjustment Cost

Changes in global real consumption (% from BaU)



Key messages

■ Competitiveness definition:

- Much agreement in the literature on the definitions of competitiveness presented above
- Selected indicators are **consistent** but establishing the explicit linkages between competitiveness and welfare is possible for TOT indicator only.

■ Use the methodology which allows accounting for trade-offs in the economy

- Improving competitiveness in EII by means of tax differentiation goes at the expense of OTH industries
- There are non-negligible welfare losses in the EU if there is a tax differentiation
- But tax differentiation might help addressing the carbon leakage concerns, even if at a limited scope (“second best”)