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Conference Paper

The Global Effects of Subglobal Climate Policies

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2010: Ökonomie der Familie - Session: International Climate Policy after Copenhagen, No. D2-V1

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The Global Effects of Subglobal Climate Policies

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Project Meeting, Environment Canada
February 16-19, 2010

Based on paper with
Knut Einar Rosendahl (Statistics Norway)
and
Carolyn Fischer (Resources for the future)

Introduction

- Individual OECD countries (EU, US) are implementing policies to reduce greenhouse gas emissions
  - EU ETS (since 2005)
  - US cap-and-trade?
- Emerging economies lack comparable regulation – raises concerns about
  - Competitiveness of energy intensive industries
  - Carbon leakage
- As a response, controversial trade-related measures and allowance allocation designs are being proposed

Measures in Current Proposals – EU

<u>EU ETS Phase III – from 2013-2020:</u>

- (Almost) no allocation of allowances to power industry
- Substantial allocation of allowances to other industries
  - Sectors with significant risk of carbon leakage: 100% of ”benchmark”
    - Cost increase above 30%, OR Trade intensity above 30%, OR Cost increase AND trade intensity both above 5%
    - Includes extraction of fossil fuels
  - Other sectors: 80% (2012) → 30% (2020)
- Allocation is proportional to historic *production*
  - Revised if capacity is changed (including new entrants)
- Similarities with Output-based rebates
- Border carbon adjustment policies not on the table before 2020

Measures in Current Proposals – US

- American Clean Energy and Security Act of 2009 (ACESA) has provisions for "Ensuring Real Reductions in Industrial Emissions"
  - Passed by the House, not yet by the Senate
- Output-based rebates (OBR) of allowances for energy-intensive, trade exposed sectors (EITE)
  - EITE: 5% energy (or CO2) intensive and 15% trade intensive, or 20% energy intensive (more restrictive than EU ETS)
    - 100% of "benchmark"
  - Offsets domestic production cost increases (on average) from emissions liabilities
- Border carbon adjustment (BCA) for imports
  - Removes cost advantage for unregulated foreign competitors
  - Transition from OBR to BCA from 2020
  - Could also consider BCA for exports

Why are such measures necessary?

- EITE sectors are small share of economy (US: <6% of GDP and 10-20% of total emissions) but vocal, organized and unionized
  - US: Senators from key states
- Hard to ask sectors to take on costs when significant shares of their reductions may be offset by increases abroad
- Welfare costs per *global* emission reduction may be reduced
- Alternatives (exemptions, weak climate legislation) worse

Why are trade-related measures controversial?

- Fears of disguised protectionism
- WTO obligations
  - Nondiscrimination
  - Can regulate products, not processes
  - Some exceptions for environmental purposes
  - Least-trade restrictive alternative
  - Restrictions on subsidies
- Negotiations in WTO and UNFCCC already difficult

What's missing from the debate?

- Focus has been on targeted EITE sectors
- Need broader understanding about how climate policies implemented unilaterally (or sub-globally) affect all countries in the global trading system.
- Largest impacts are from the targeted carbon pricing itself, which generates
  - macroeconomic effects,
  - terms-of-trade changes, and
  - shifts in global energy demand and prices
  - changing the relative prices of energy-intensive and non-energy-intensive goods.

This Paper (Böhringer, Fischer,Rosendahl)

- Effects of climate policies implemented in the EU and/or US on global distribution of economic outcomes and carbon leakage
- How these outcomes may be altered by a variety of complementary policies aimed at addressing carbon leakage.

Numerical Model

- Global multi-sector, multi-region computable general equilibrium (CGE) model based on GTAP7 database
  - Detailed accounts of regional production, regional consumption, bilateral trade flows, energy flows and CO2 emissions
  - Static model with 2004 base year
- Assumptions:
  - No change in policies in other countries
  - No cap on emissions in Annex B

Energy and EITE Sectors

- Energy Goods
  - Coal (COL), Crude oil (CRU), Natural gas (GAS), Refined oil products (OIL), and Electricity (ELE).
- EITE Goods
  - Chemicals (CRP);
  - Non-metallic minerals, including cement and glass (NMM);
  - Pulp, paper, and print (PPP);
  - Iron and steel (I_S);
  - Nonferrous metals, including copper and aluminium (NFM).
- Other Goods/services
  - Transport
  - Rest-sector

Some model features

- Bilateral trade:
  - Armington approach of product heterogeneity
    - Exception: Crude oil (homogeneity)
    - Armington elasticities taken from GTAP7
- Fossil fuel supply:
  - Supply elasticities equal to one
- Resources:
  - Fixed endowment of labour and capital
  - Fixed investment and government expenditures
- Welfare:
  - Hicksian equivalent variation (HEV) in income

Policy Scenarios

- US and/or EU reduce emissions by 20%
  - No international trading
- Different treatment of EITE sectors

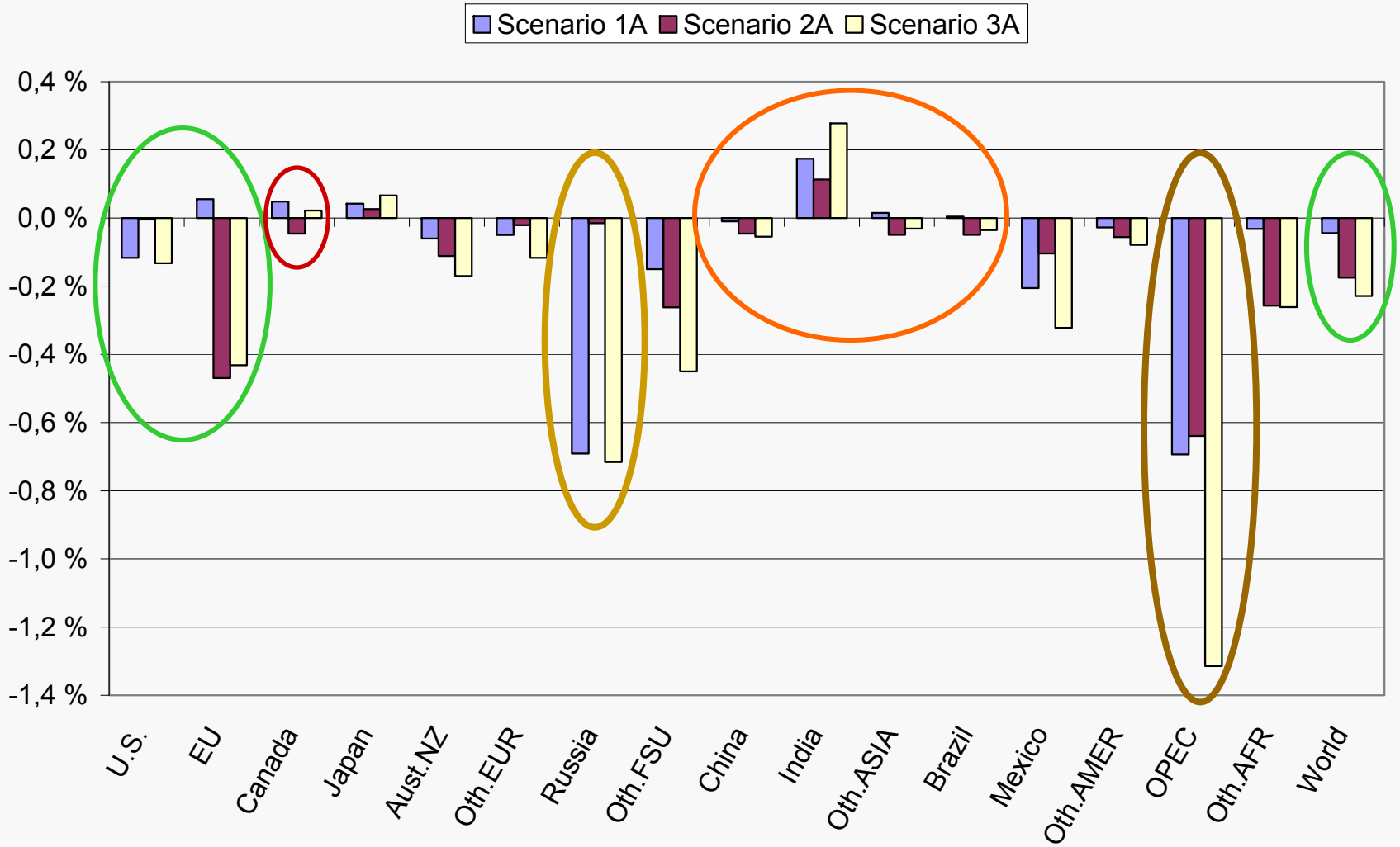
	A	B	C	D	E
1	U.S. AUCTION	U.S. OUTPUT	U.S. REBATE	U.S. TARIFF	U.S. BTAX
2	EU AUCTION	EU OUTPUT	EU REBATE	EU TARIFF	EU BTAX
3	U.S.&EU AUCTION	U.S.&EU OUTPUT	U.S.&EU REBATE	U.S.&EU TARIFF	U.S.&EU BTAX

Results of Auctioned Allowances

- Welfare costs substantially higher in the EU than in U.S.
  - U.S. has cheaper abatement options:

    Carbon prices are $60/ton C for the U.S., and $125/ton C for the EU.
    - ($16 and $34/ton CO2)
    - ($63 and $129 when jointly implemented)
  - Different trade intensities and terms-of-trade effects.
    - Natural gas prices are stimulated by the climate policies, whereas coal and crude oil prices are depressed.
    - EU is net importer of all three fossil fuels, whereas U.S. was a net exporter of coal in 2004.
- Welfare effects of unilateral policies can be quite different for different trade partners
  - Larger for some countries than for the US/EU

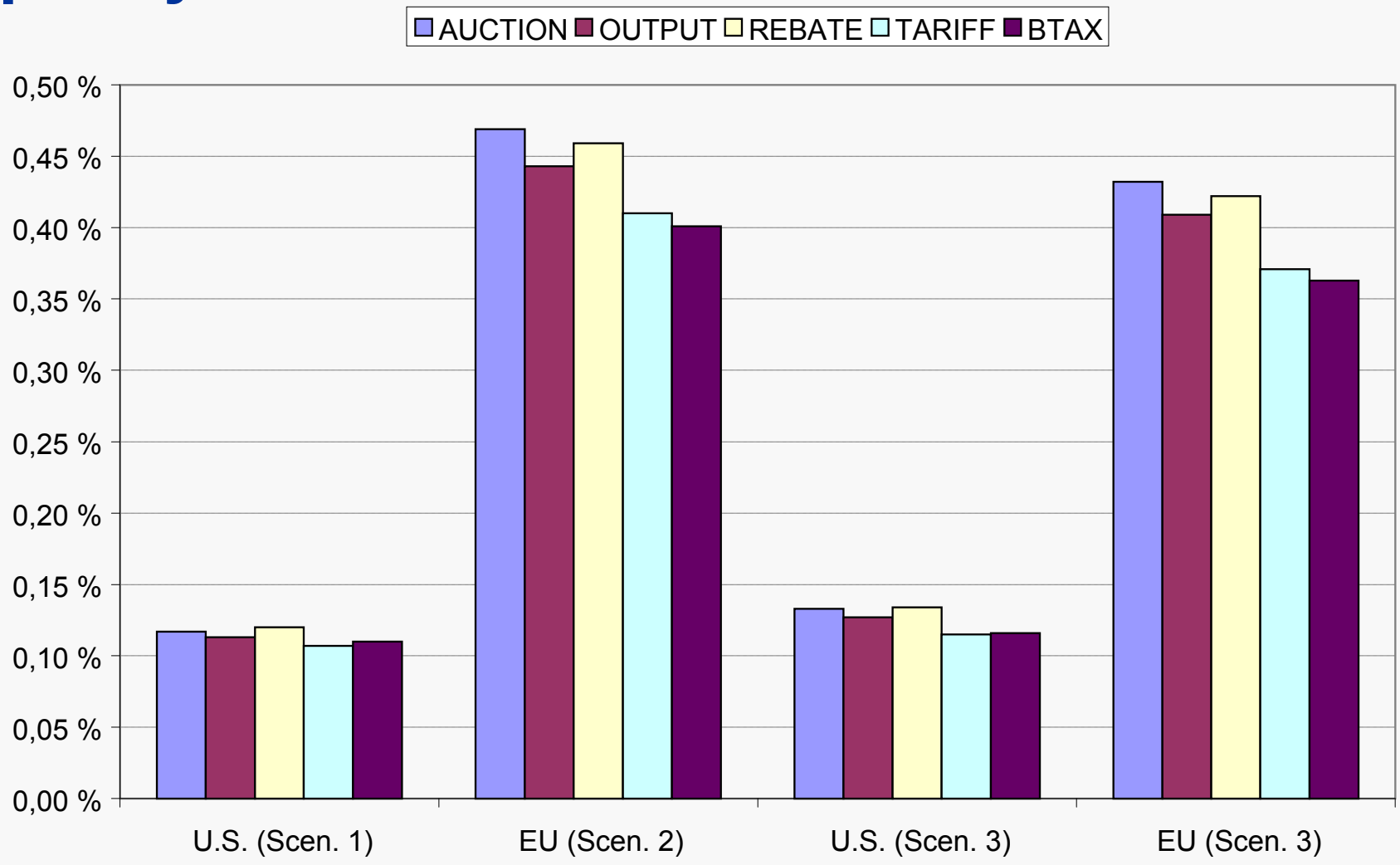
Welfare effects of auctioned allowances in U.S. (Scenario 1A) , the EU (2A) or both (3A)



Effects of additional policies

- Not valuing the additional benefits of avoided leakage
  - Alternative assumption: Keep global emissions fixed
- Effects of other policies small but positive
  - beneficial terms of trade effects from protecting EITE sectors in these two large economies
  - Larger for EU, in which EITE larger share of emissions
- U.S. carbon price is not sensitive to the adjustment policies, while the EU carbon price rises 2% in the OUTPUT scenario and 4% with BTAX.

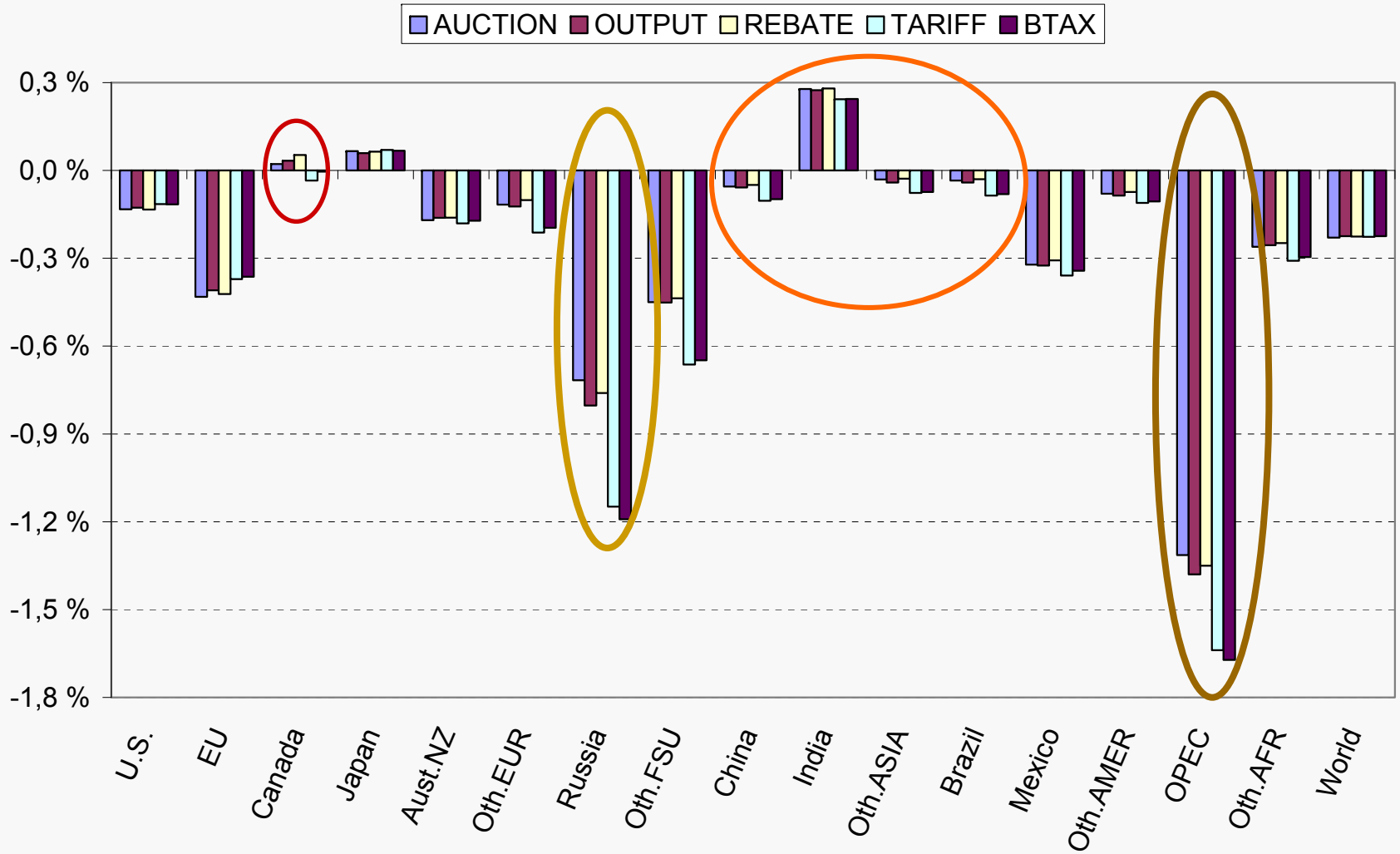
Welfare costs in the U.S. and the EU by policy scenario



Welfare effects for other regions

- Moderate differences for most regions and negligible for the world as a whole.
- Losses for crude oil and coal exporting regions are generally highest when the U.S. and the EU also impose import tariffs
  - Demand for fossil fuels outside these two regions are lower than in the other scenarios,
- Import tariffs also negatively affect exporters of energy-intensive goods, notably China, India and Canada.
  - Adjustments based on exporters' emissions intensities

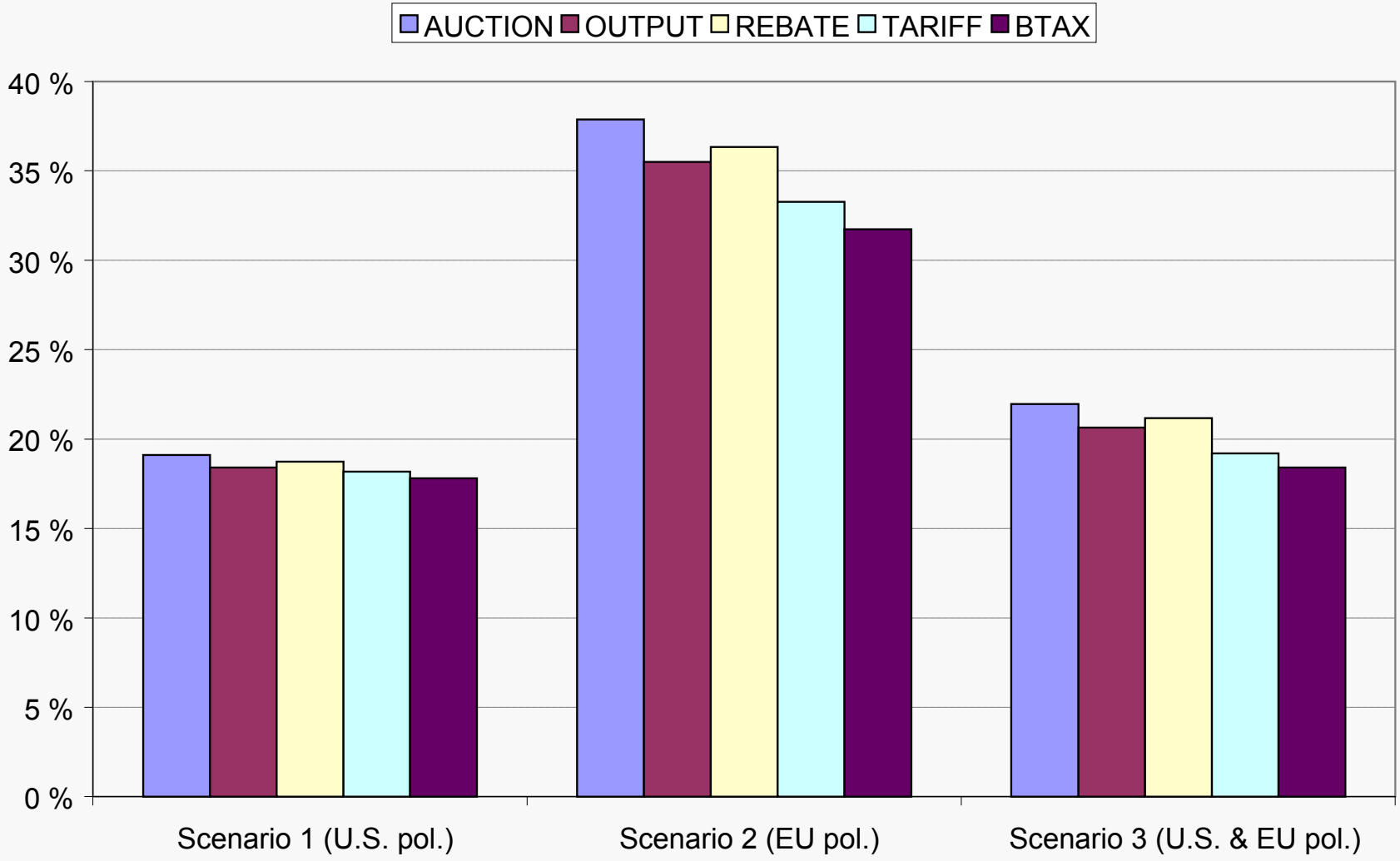
Welfare effects in different regions of joint caps in US and EU



Effects on Leakage

- Carbon leakage highest with unilateral EU cap
  - Up to 38%, compared to 19% for U.S.
  - EU is a more open economy than the U.S.
  - EU is a much bigger importer of fossil fuels
  - EU EITE industries less carbon-intensive
- When both regions reduce emissions, the leakage rates are closer to the U.S. policy scenarios.
  - U.S. has higher emissions than the EU
  - Joint caps eliminate EU-US leakage
- Policies limited in reducing leakage
  - Address production shifting, but not energy markets
  - Full border adjustment most effective

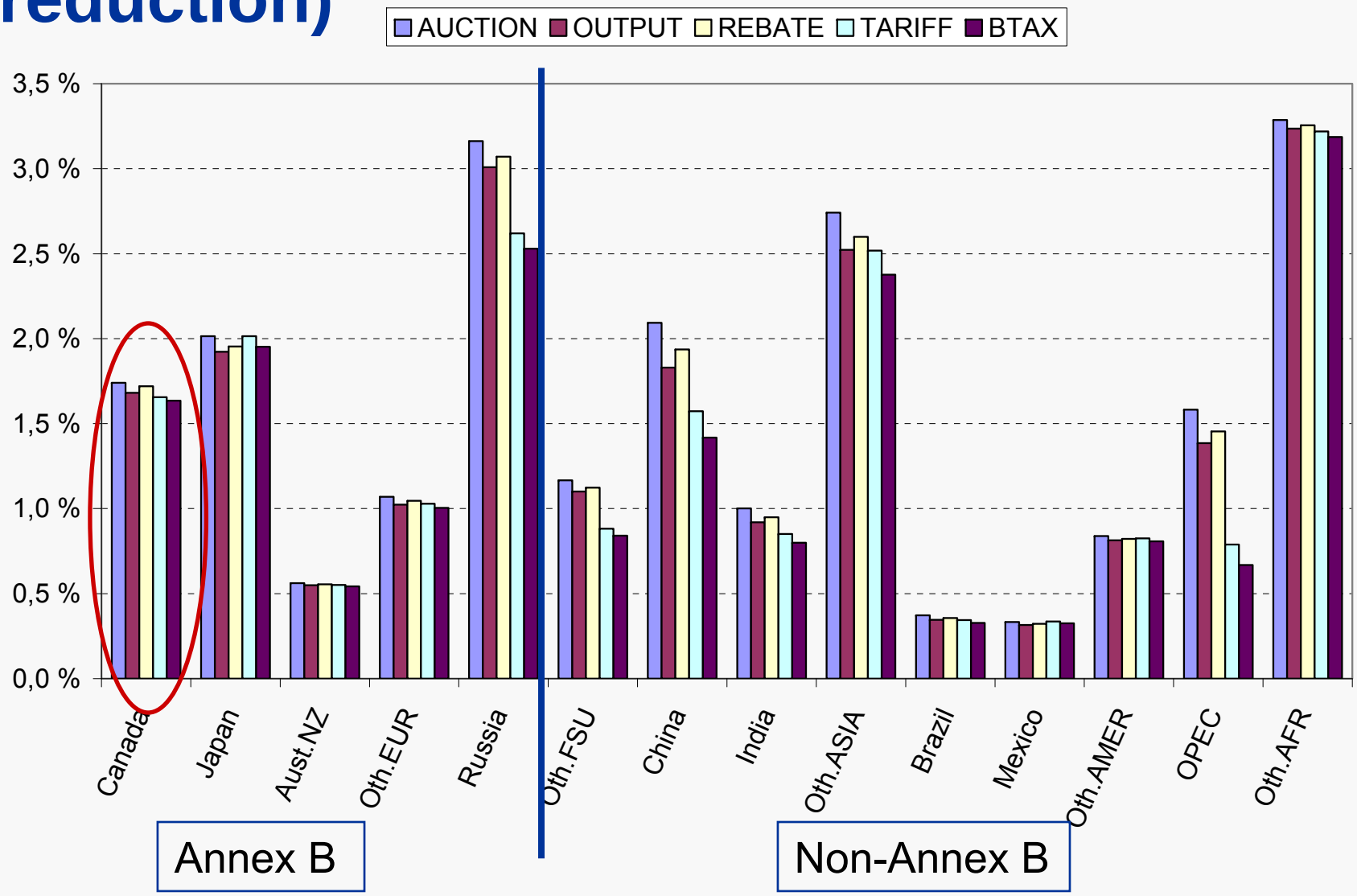
Global Leakage Effects



Distribution of Leakage

- 40% of leakage to Annex B countries
  - Large share to Russia
  - More for US unilateral policy
- Effects of adjustment policies
  - Hardly reduce leakage to other OECD countries, and also to Latin American and African countries.
  - The largest impacts on leakage are in Asian countries, former Soviet Union, and OPEC.

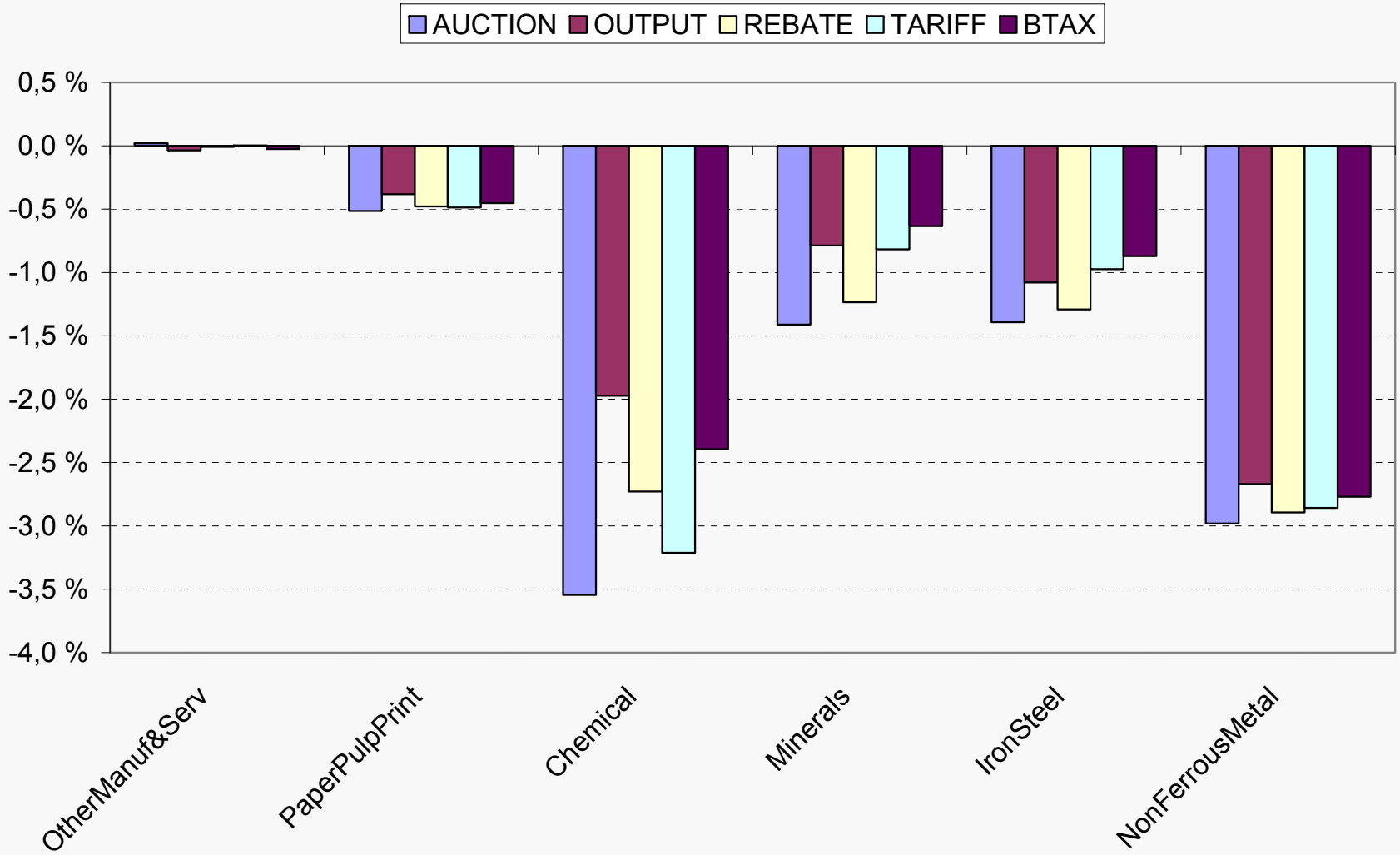
Leakage Rates by Region (US&EU reduction)



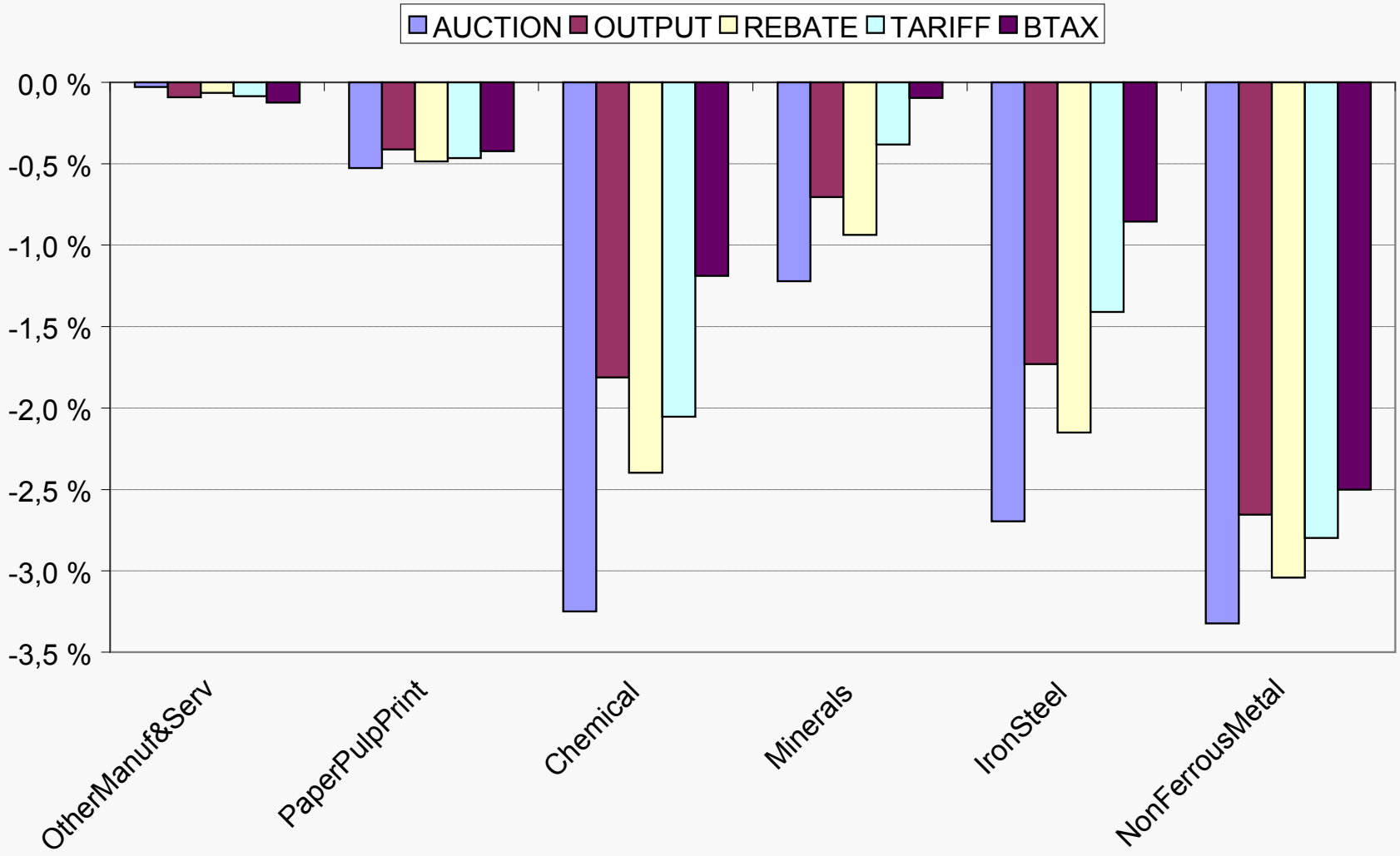
Effects on EITE competitiveness (production)

- Both output-based allocation and border adjustment policies dampen the production decrease.
  - Largest impacts in the EU
  - Full border adjustment usually most effective
  - Output-based allocation has about the same effect as import tariffs alone.
  - Small effects on electricity-intensive sectors
    - Not adjusting for indirect emissions
    - If the import tariffs also take into account indirect emissions (i.e., from electricity production) embodied in the products, production of non-ferrous metals in the EU will actually increase

Effects on U.S. production of different U.S. climate policies



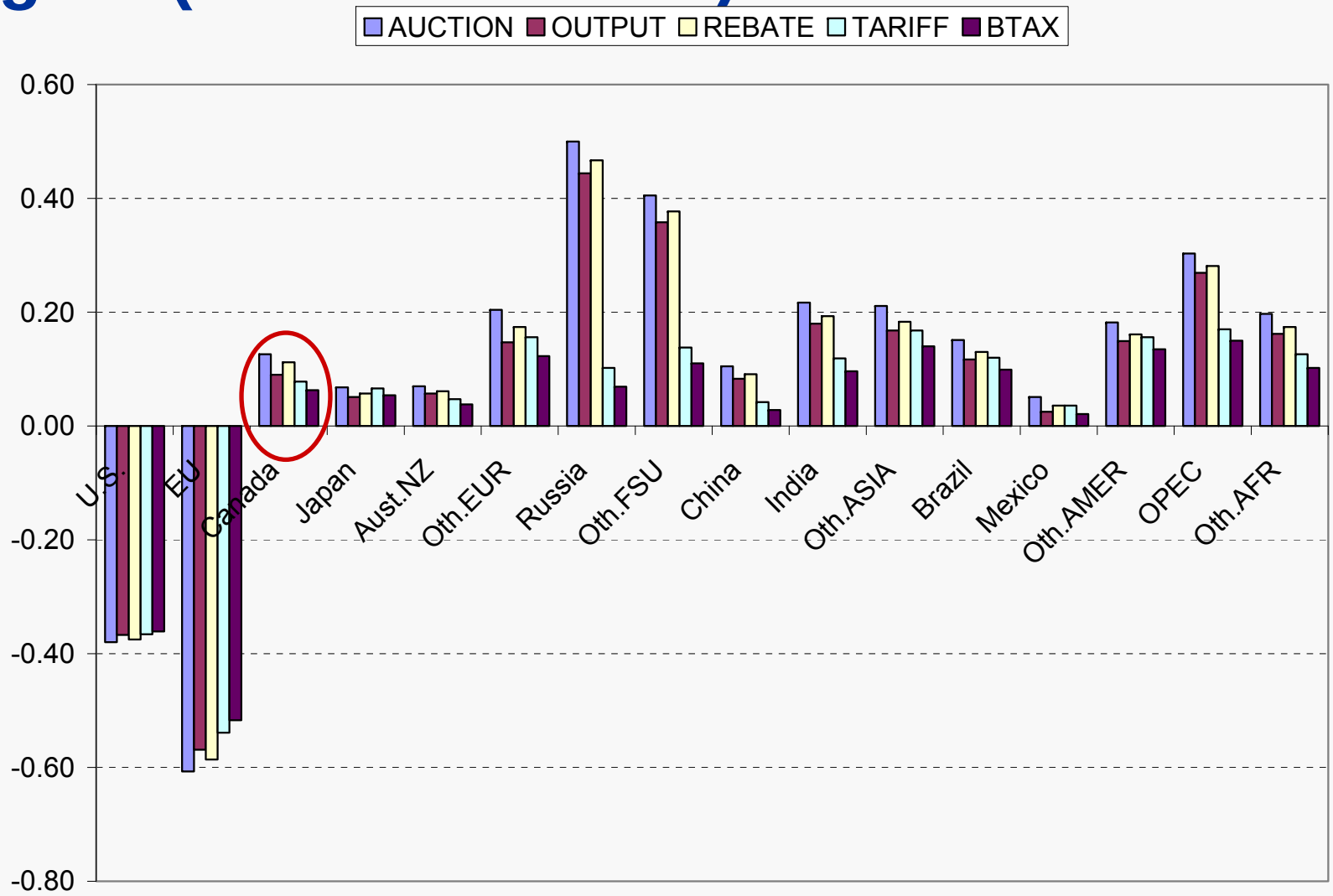
Effects on EU production of different EU climate policies



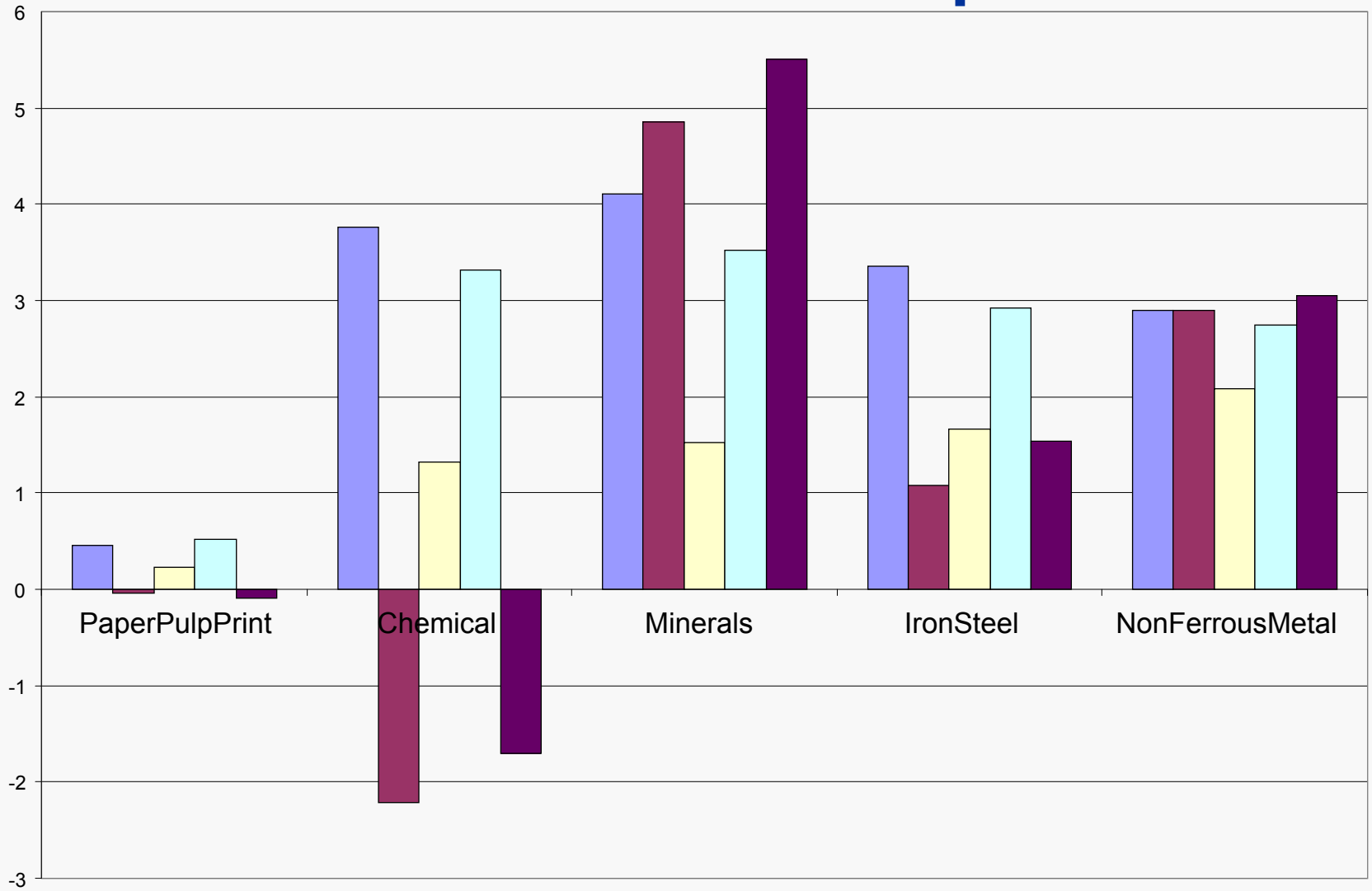
Competitiveness in Non-implementing Regions

- Production in EITE sectors increases across the board
- “Rest-sectors” experience production decreases in all countries except OPEC.
  - “Rest-sectors”: Excluding Energy, EITE and Transport sectors
- Adjustment policies in part shift production in the other regions back toward “Rest-sectors” from EITE.
- Aggregate production remains higher across the board with adjustment policies than with no climate policy action
  - Similar effects on EITE exports
- Welfare is determined by consumption rather than production, so while other regions reap competitiveness benefits, most remain worse off.

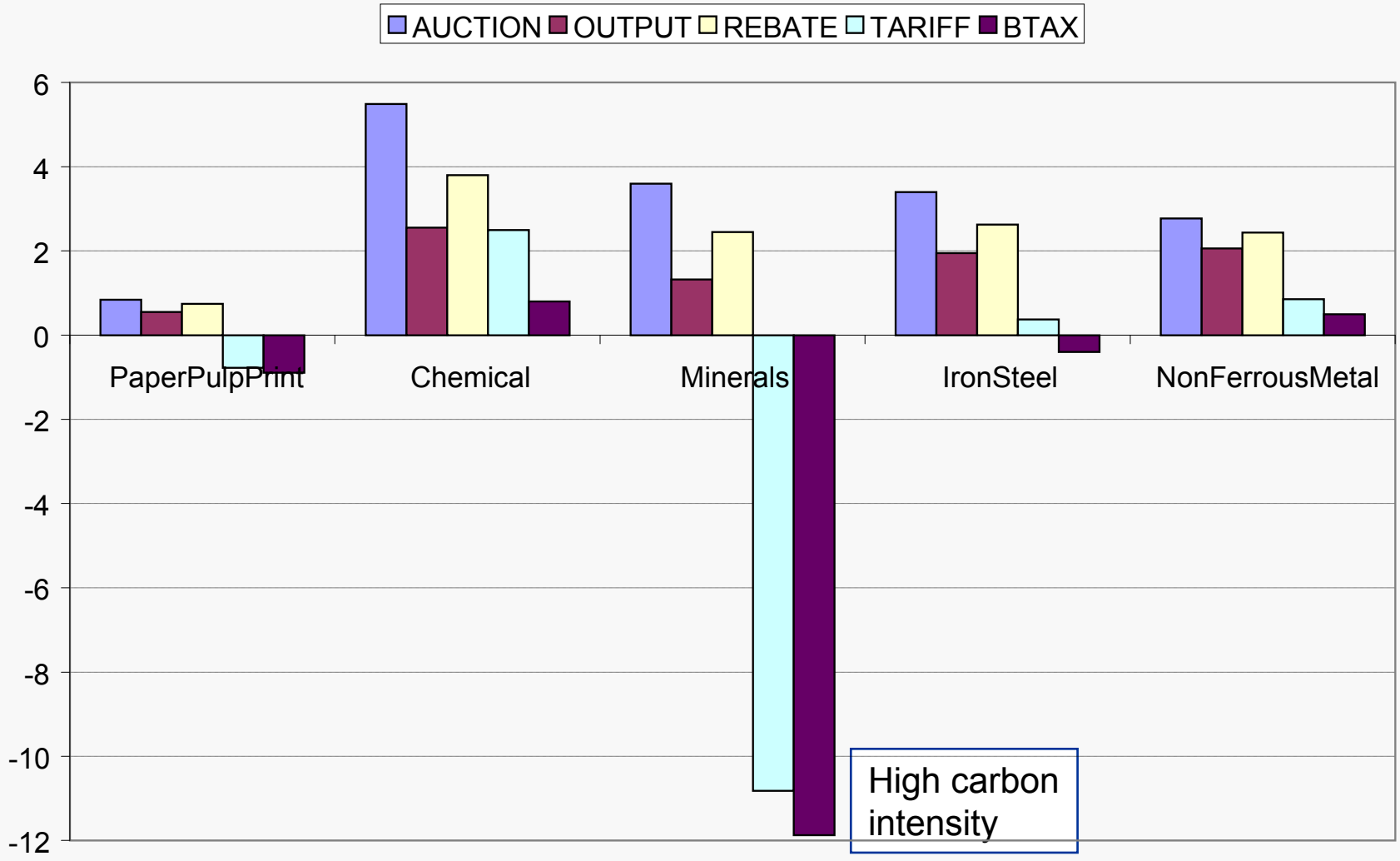
Percentage Change in Total Production, by Region (US&EU reduction)



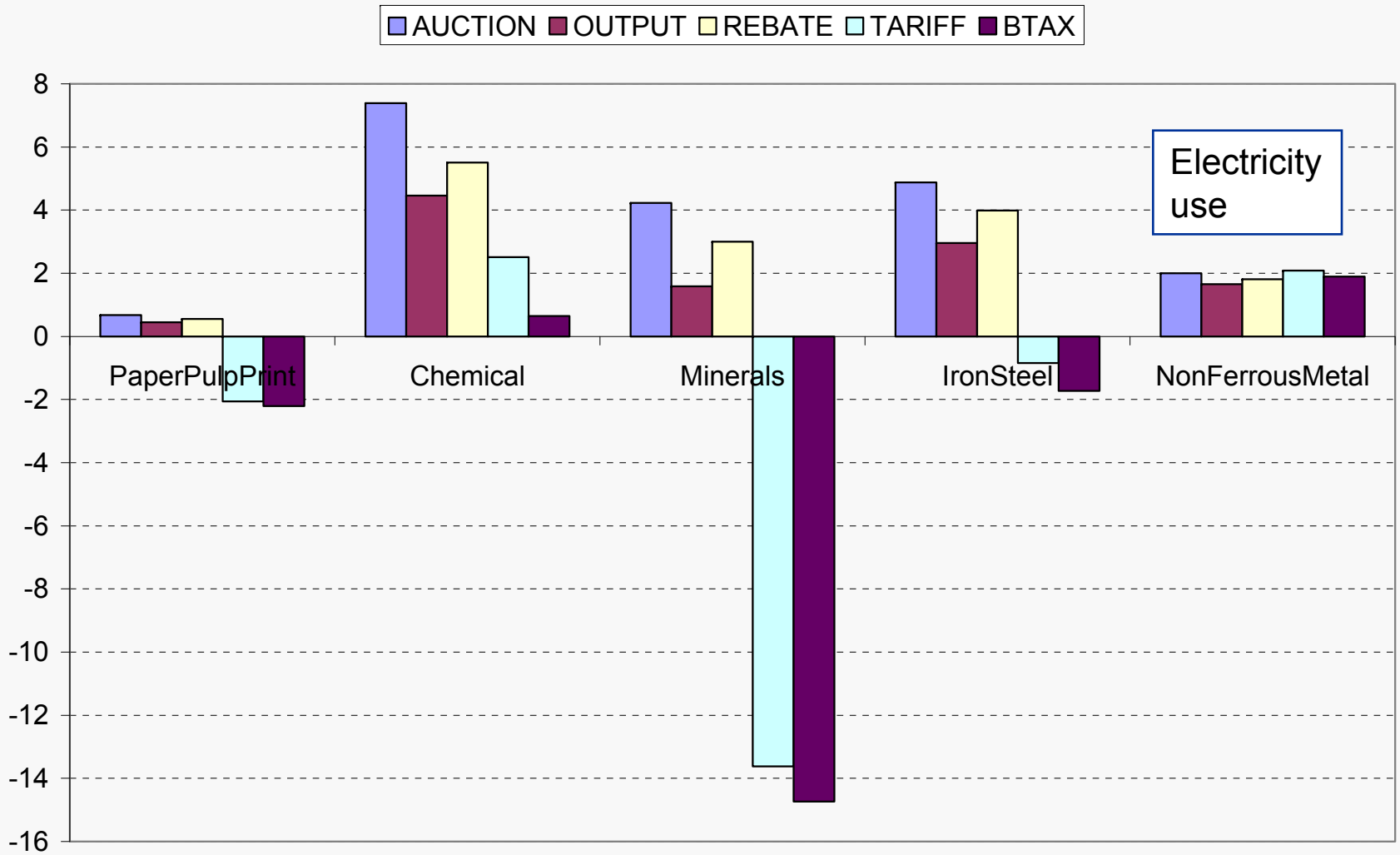
Effects on Canadian EITE exports of different U.S. and EU climate policies



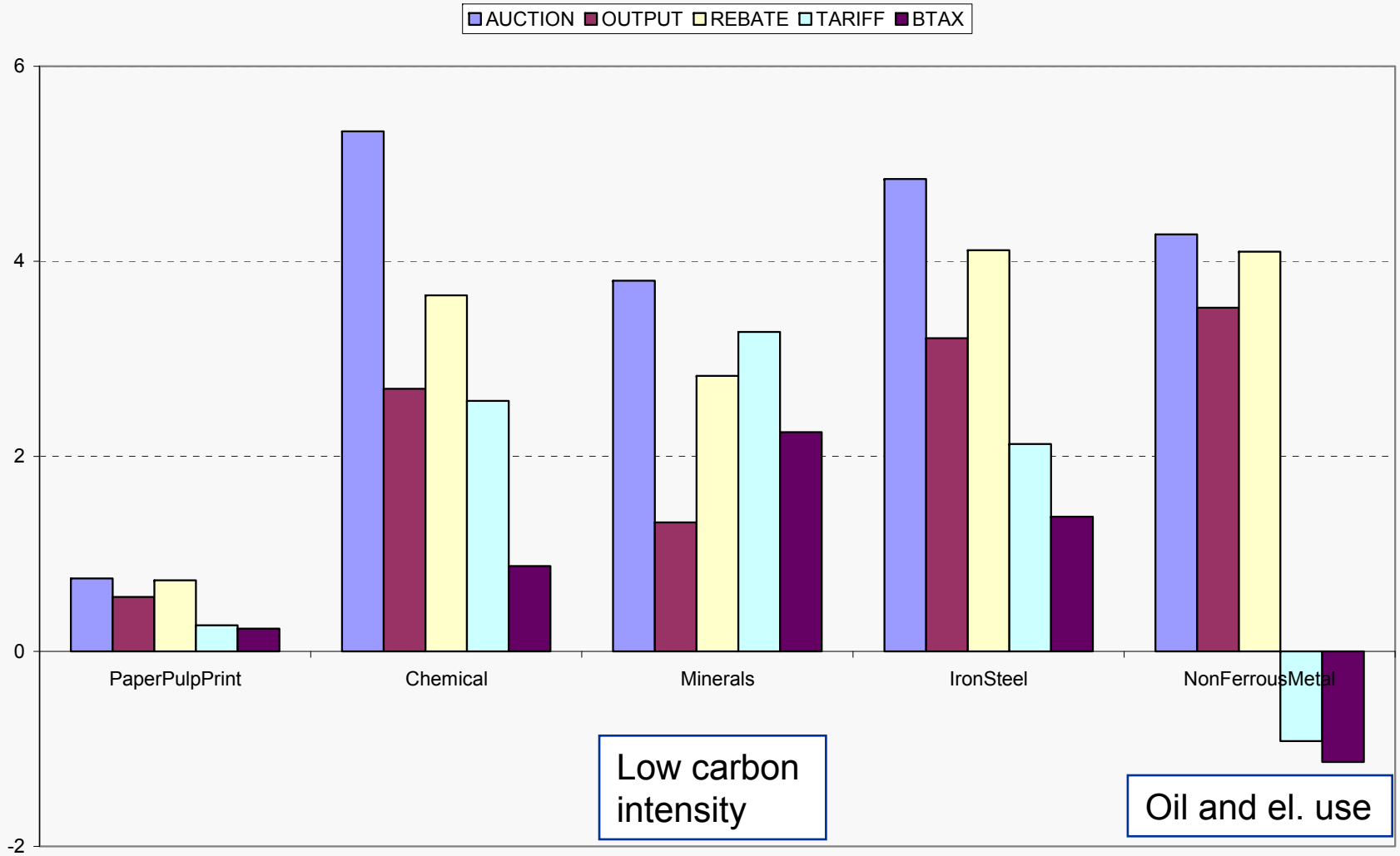
Effects on Chinese EITE exports of different U.S. and EU climate policies



Effects on Indian EITE exports of different U.S. and EU climate policies



Effects on Brazilian EITE exports of different U.S. and EU climate policies



Summary: Welfare

- Welfare effects of subglobal climate policies are significant not only for the countries undertaking them but also for their trade partners
  - Mostly negative, but some winners
- Policies intended to avoid leakage have little effect on welfare overall – even in the countries implementing them
  - Mainly shift global production in certain energy intensive goods.
- However, import adjustments can have significant effects for fossil fuel producing nations.

Summary: Leakage

- Significant share occurs via changes in global energy prices
- None of the countervailing policies are able to reduce leakage rates very much – at most by 15%, in the case of full border adjustments
- 30-50% of leakage from U.S. and EU climate policies can be attributed to other Annex B nations.
- Adjustment policies do have significant effects on the energy intensive sectors to which they are applied.
- Still, for the most part, domestic production is lower and foreign exports are higher than without any climate policy intervention.
  - Exception for cement and glass for some exporters.

Sensitivity Analysis

- Specific plans:
  - Leakage compensation (fixed global emission reduction)
    - EU welfare effects more differentiated
  - Energy supply elasticities
  - Trade elasticities
  - EITE coverage (e.g., refineries)
  - Targets
  - ??

Some conclusions

- Main effects on global welfare, emissions, and leakage arise from the primary climate policies themselves
- Developing nations do not actually gain economically from developed country efforts to reduce GHGs.
- Nor do their sectors targeted specifically by anti-leakage policies necessarily lose, compared to a world without any climate policies.
- Ultimately, it is in all countries' interest to mitigate climate change as comprehensively and cost-effectively as possible
  - The larger question is whether or not unilateral anti-leakage policies can help in that transition.

EC Implementation (1)

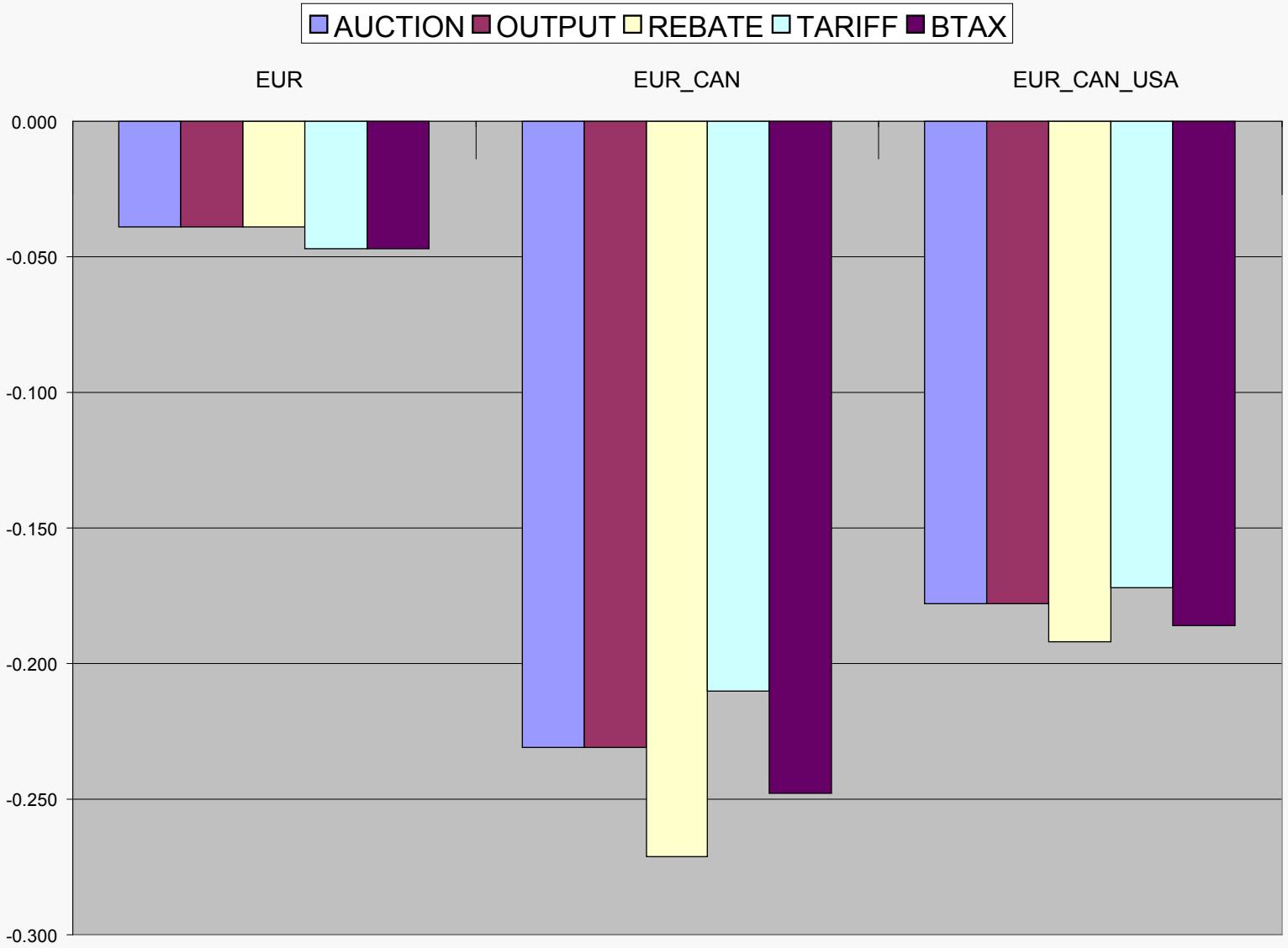
- Economic implications of unilateral Canadian climate policies without US action
  - Ex-post justification for Kyoto compliance problems?
  - Specific protection policies for EITE (border measures and trade allowance allocation)
- Domestic/international emission reduction policies:
  - EU only (scenario: EUR)
  - EU and Canada (scenario: EUR_CAN)
  - EU and Canada and the USA (scenario: EUR_CAN_USA)
- Issues addressed:
  - Importance of US “comparable effort” for economy-wide and sectoral implications of unilateral climate policies in Canada
  - Effectiveness of border measures or output-based allocation measures for welfare, EITE output (“competitiveness”) and leakage

EC Implementation (2)

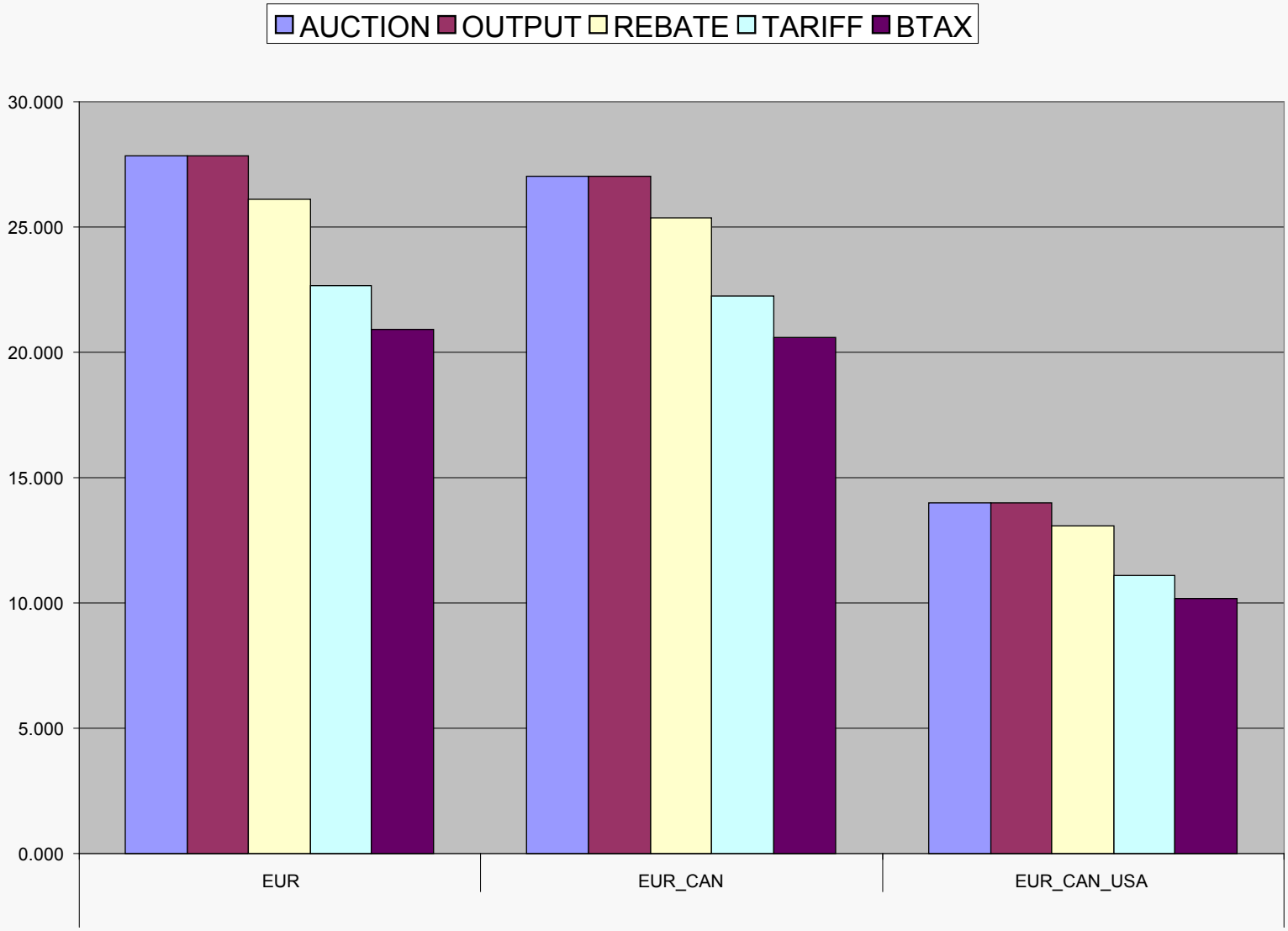
- Leakage argument:
  - Need for leakage adjustment towards constant global effectiveness
  - Leakage adjustment through proportional scaling of domestic reduction targets

  N.B.: By default there is no leakage adjustment.
- Robustness of policy conclusions:
  - Inclusion of embodied carbon for electricity (default: only direct carbon)
  - Fuel supply elasticities (default: coal=4; oil/gas=1)
  - (Armington) trade elasticities ➔ empirical estimates beyond GTAP
  - Stringency of policy target (default: 20%)
  - Coverage of EITE sectors (e.g. inclusion of refined oil products)
- [Application to 2020 forecast]

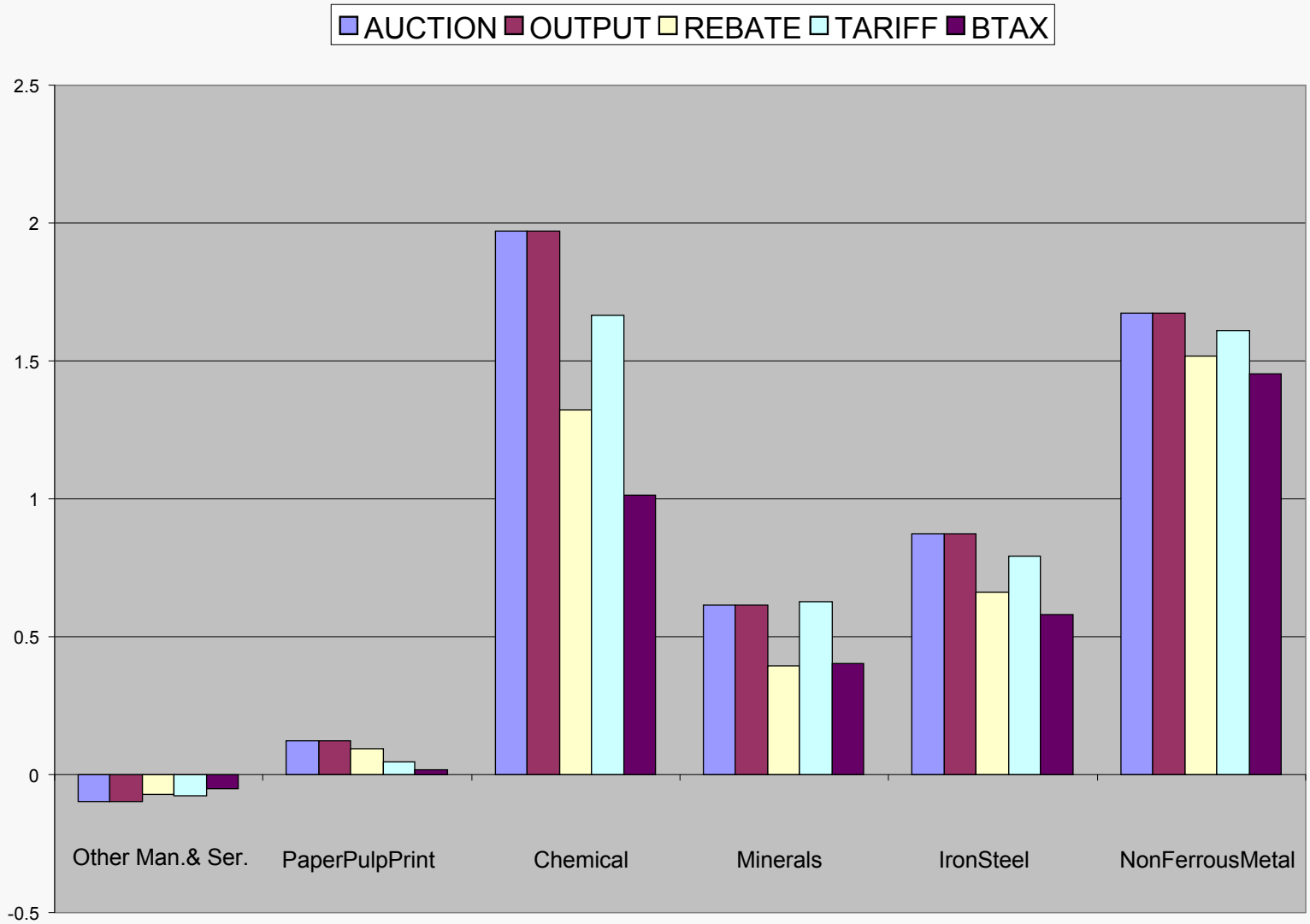
Welfare impact for Canada



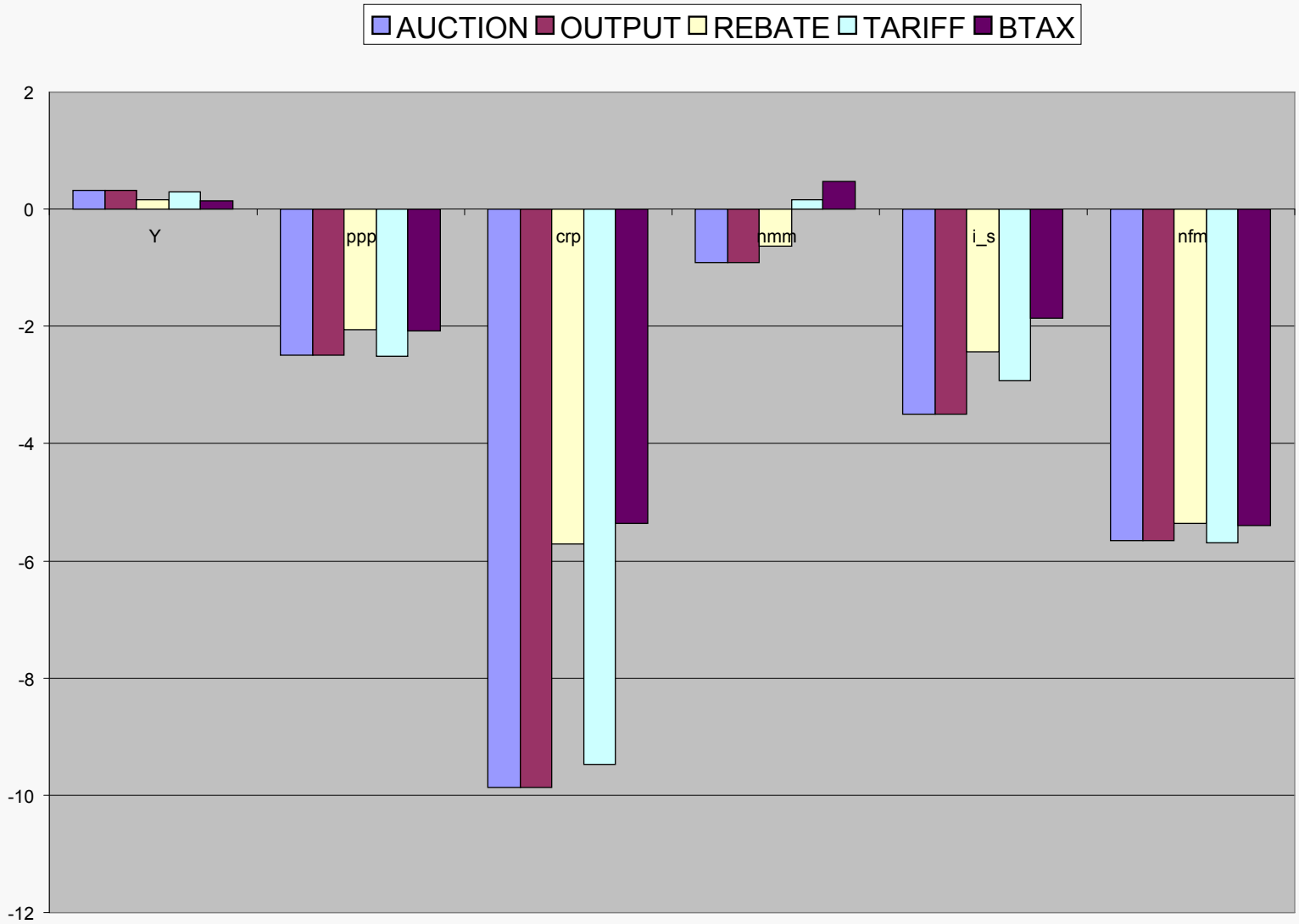
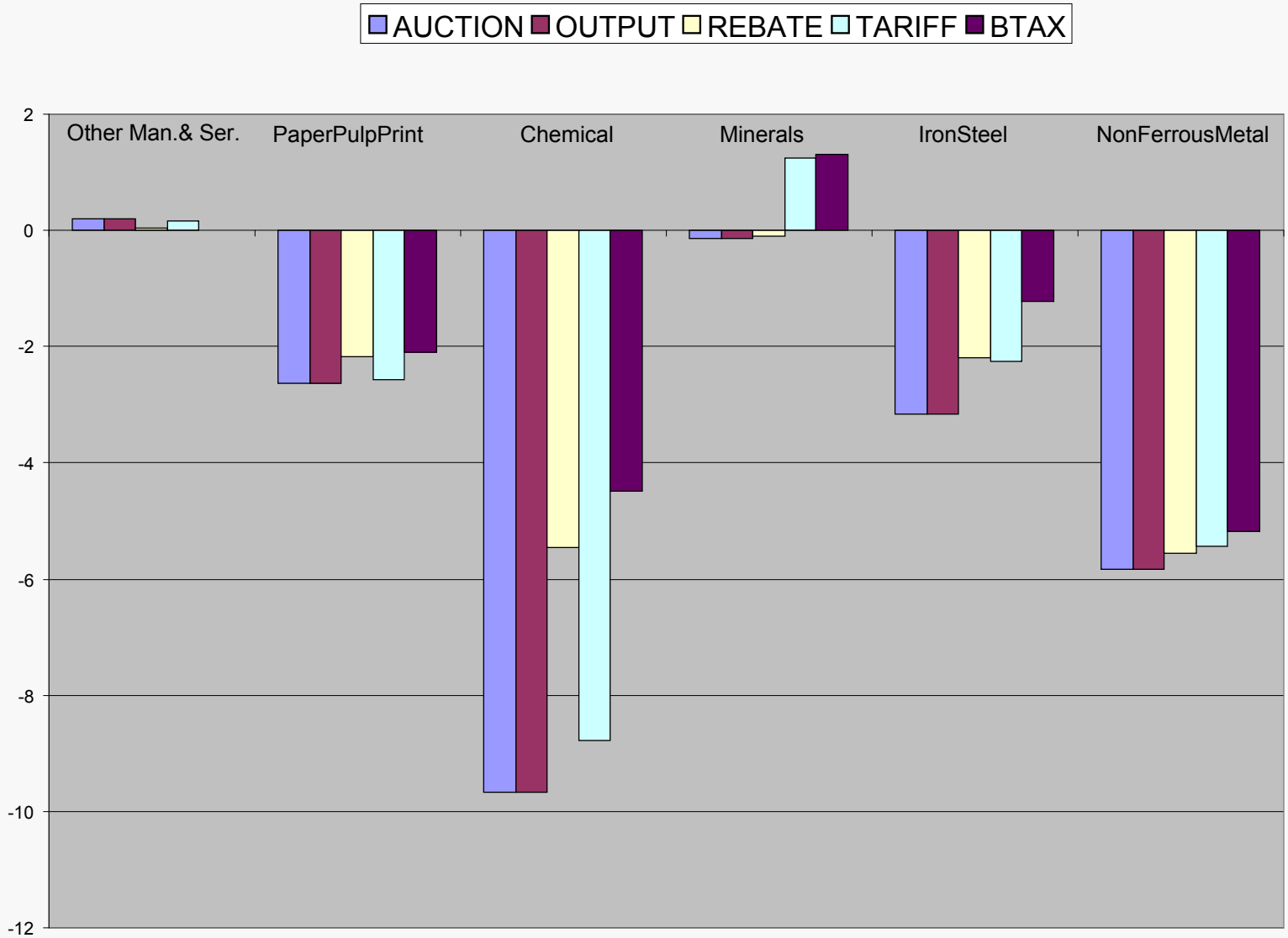
Global leakage rates



EUR: Effects on Canadian production



EUR_CAN: Effects on Canadian production



EUR_CAN_USA: Effects on Canadian production