The Economic and Environmental Effects of Border Tax Adjustments for Climate Policy

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Why border tax adjustments?

- Some countries will impose carbon restrictions but others will not

- Increase differences in energy costs:
  - Rise in countries controlling carbon; lower elsewhere
  - Energy intensive industry might migrate
  - Less effect on emissions: "leakage"

- Border tax adjustments:
  - Impose equivalent tax on imports; refund taxes on exports

- Motivations:
  - Reduce industry migration
  - Avoid emissions leakage
  - Punish non-participating countries

How would they work?

- Compute carbon content embodied in each import
- Levy tariffs to match domestic carbon controls

- Example:
  - Production of X requires 0.1 tons of coal
  - Domestic carbon tax of $20 per ton of carbon
  - Coal is 65% carbon

  - Tariff would be 0.1*0.65*20 = $1.30

Computing carbon content

- Based on sum:
  - Fossil energy **directly** in producing the good
  - Fossil energy used in **inputs** to the good
  - Fossil energy used in **inputs to inputs**
  - …

- Example: Boeing 777
  - Energy used by Boeing to assemble the plane
  - Energy used to produce sheet aluminum
  - Energy used to refine aluminum from bauxite
  - Energy used to mine bauxite

Data on direct fuel use

□ Input-output tables for each economy

  ■ Direct use of inputs by each industry

□ Example: in 1992, the construction industry used

  ■ $23.3 billion of "lumber and wood products"

  ■ $4.1 billion of "paints and allied products"

  ■ ...

□ Typically very detailed:

  ■ Some tables have 600+ industries and products

□ US table produced by the BEA from Census of Manufacturers, etc.

Calculating total fossil fuel use …

1. Convert table to show inputs per unit of output
   - Divide each column by the industry's output

2. Invert to obtain "total requirements" table
   - Input of each good used directly or indirectly to produce a unit of output

3. One row for each fossil fuel
   - One column for each product

… converting fuel use to tariffs

4. Multiply inputs of fuels by emissions factors
   - Sum result to get carbon per unit of output

5. Multiply carbon content by effective carbon tax
   - Unit tax per unit of output

6. Convert to an ad valorem tariff
   - Divide by original price of the corresponding good
   - Alternately, could be a unit tax

Quantitative effects?

- Assess using the G-Cubed model of the world economy
  - Divided into 10 regions; some are individual countries

- Regions are connected by bilateral flows
  - Trade in goods and services; flows of financial capital

- Each region is represented by a separate submodel
  - 12 sectors of production
  - Households, government, financial sector, taxes, etc.

- Input-output data is used in building the regional models

Regions and sectors in G-Cubed

Regions:

United States
Japan
Australia
Europe
Other OECD countries
China
India
Developing countries
Eastern Europe & Former USSR
Oil exporting countries

Sectors:

Electric utilities
Gas utilities
Petroleum refining
Coal mining
Crude oil and gas extraction
Other mining
Agriculture
Forestry and wood products
Durable goods
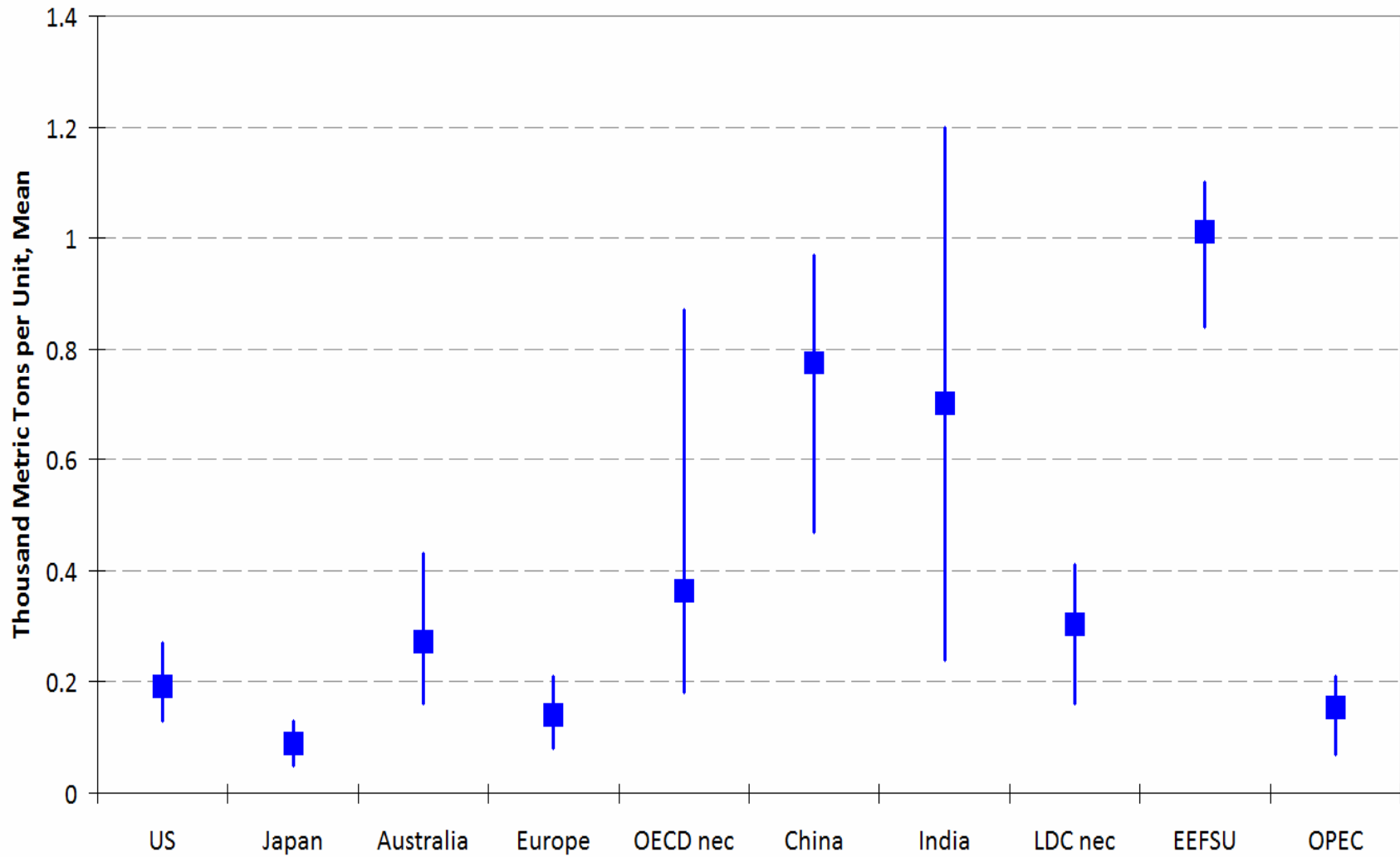Nondurables
Transportation
Services

Direct Use of Coal in the US Input-Output Table

■ Direct
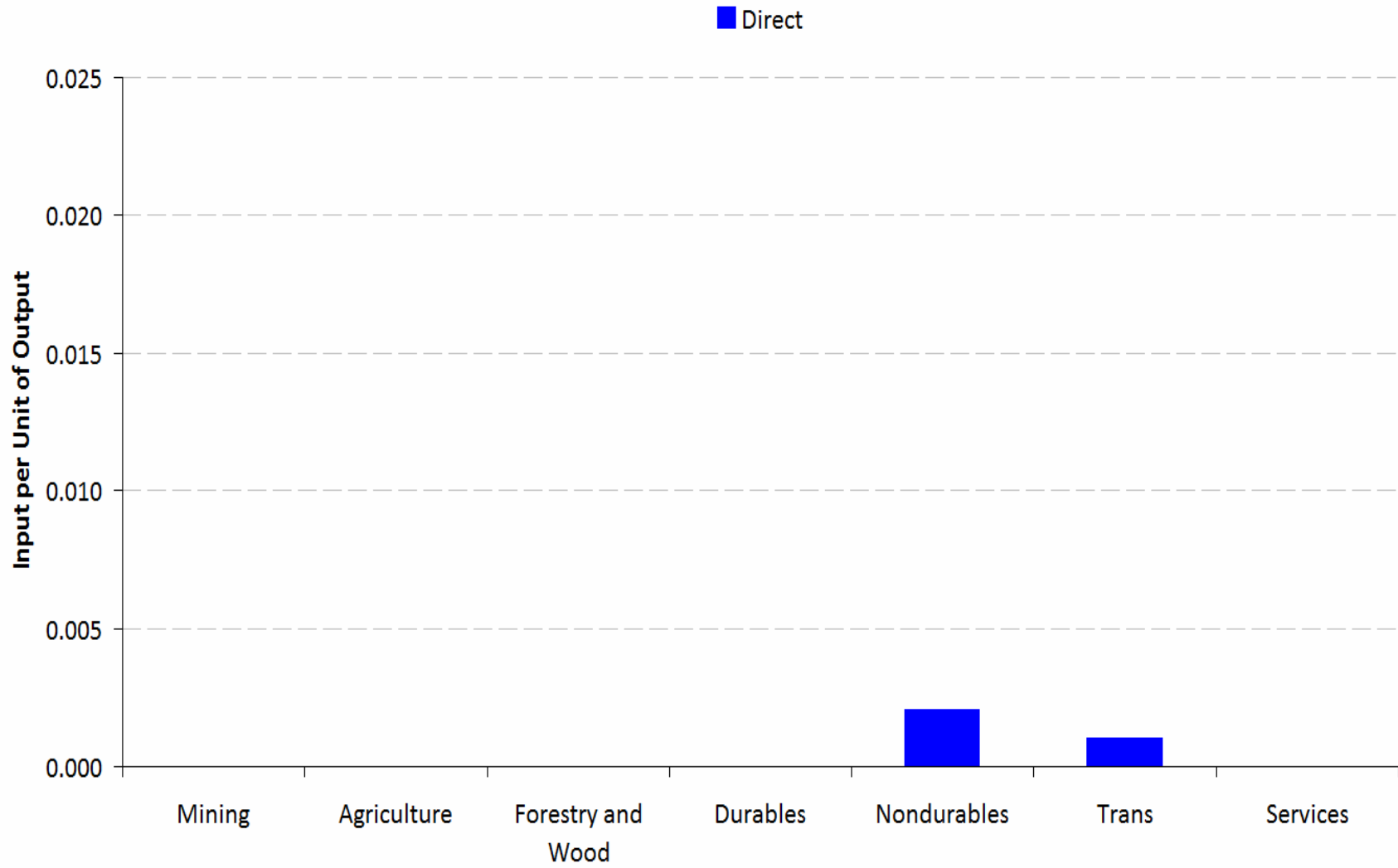
Total Use of Coal in the United States

■ Direct ■ Indirect
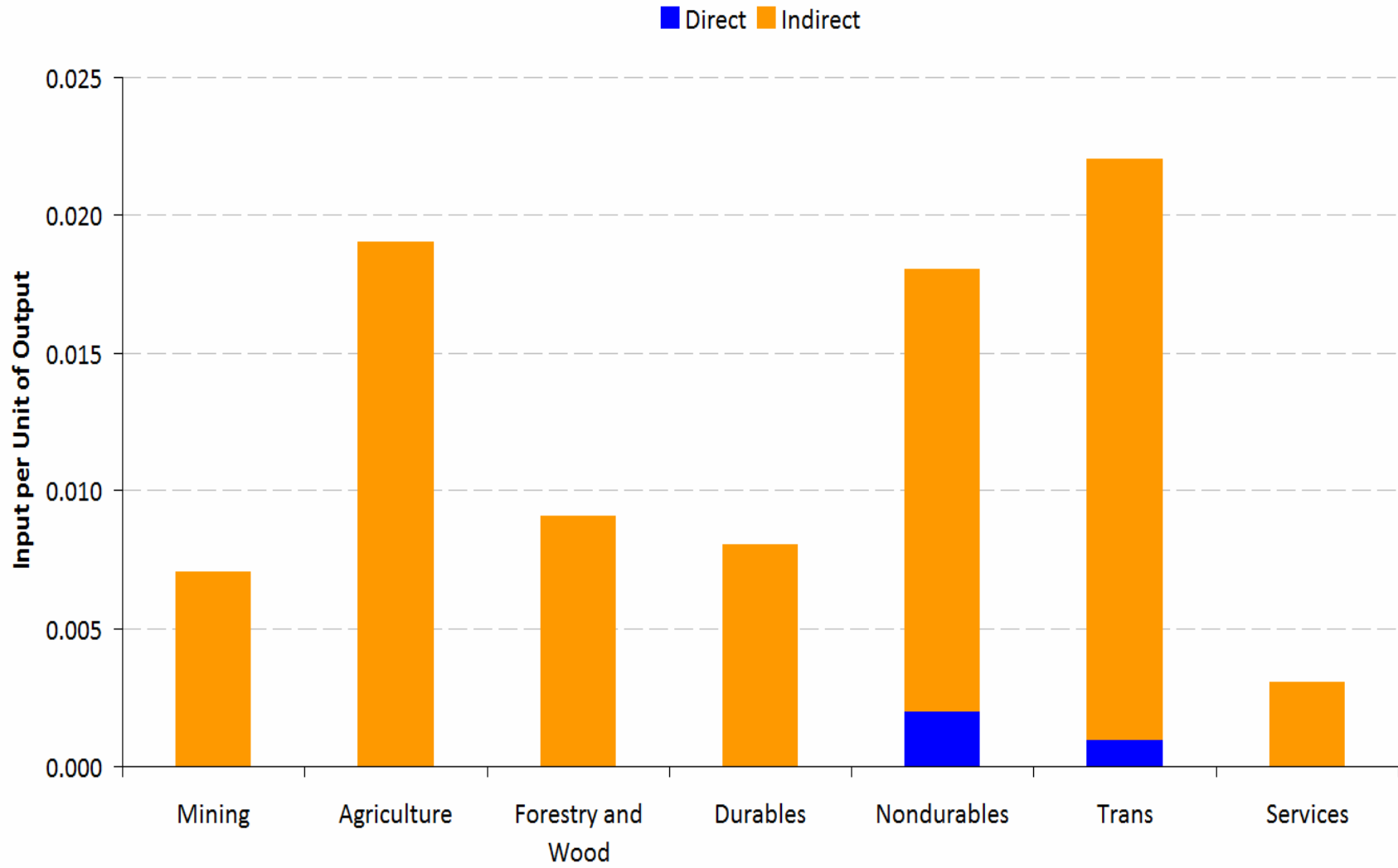
Carbon Content of Traded Goods in the G-Cubed Model

Two pairs of border tax experiments

- Case 1: Between regions with similar technology
  - 1a: Carbon tax in Europe only
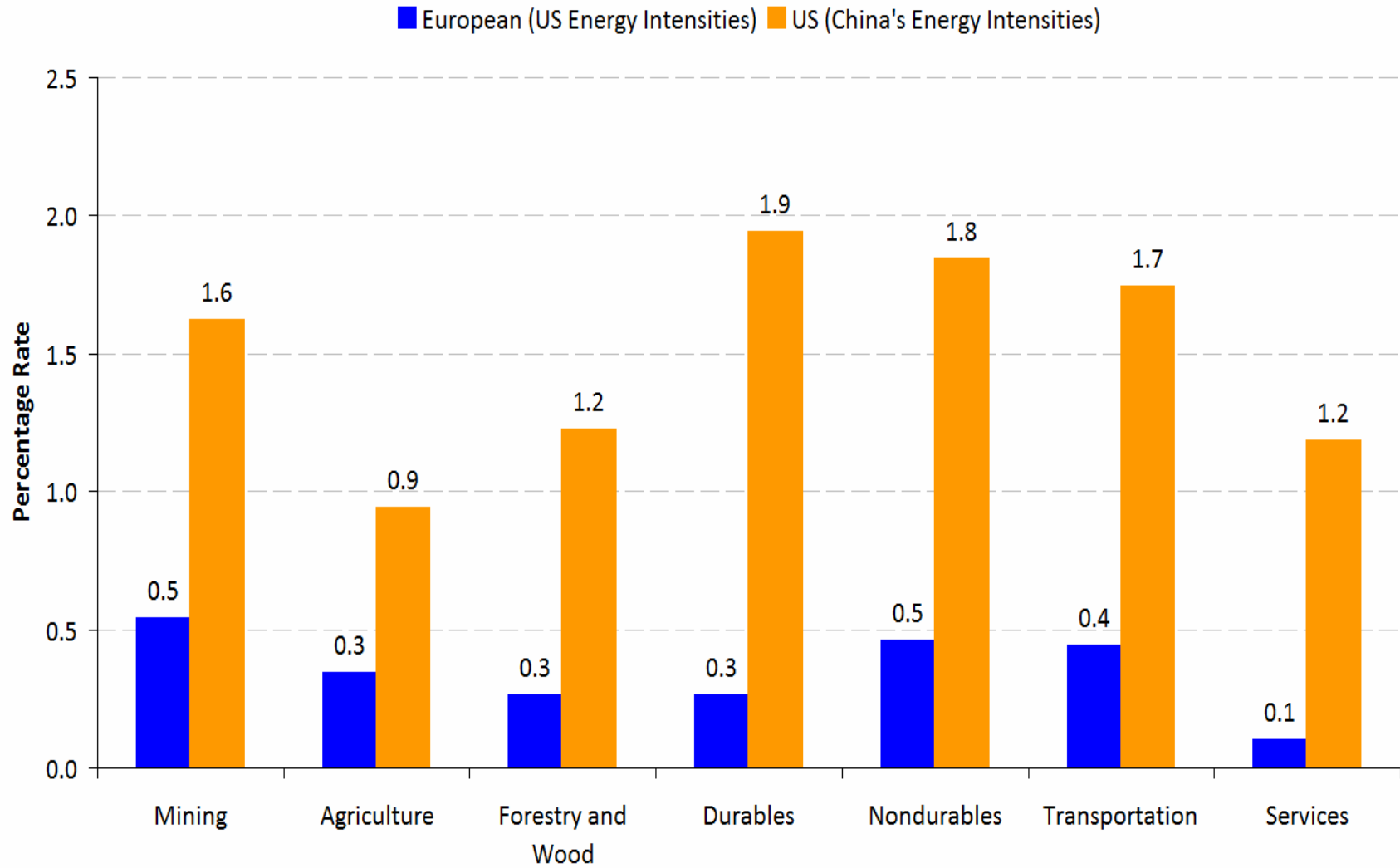 - 1b: Same plus European border taxes based on US energy intensity

- Case 2: Between regions with different technology
  - 2a: Carbon tax in the US only
  - 2b: Same plus US border taxes based on China's energy intensity

- Presentation focuses on Case 1

Details of the carbon tax

- Initially $20 per metric ton of carbon
- Rising by $0.50 per year to $40
- Fiscal deficits held constant
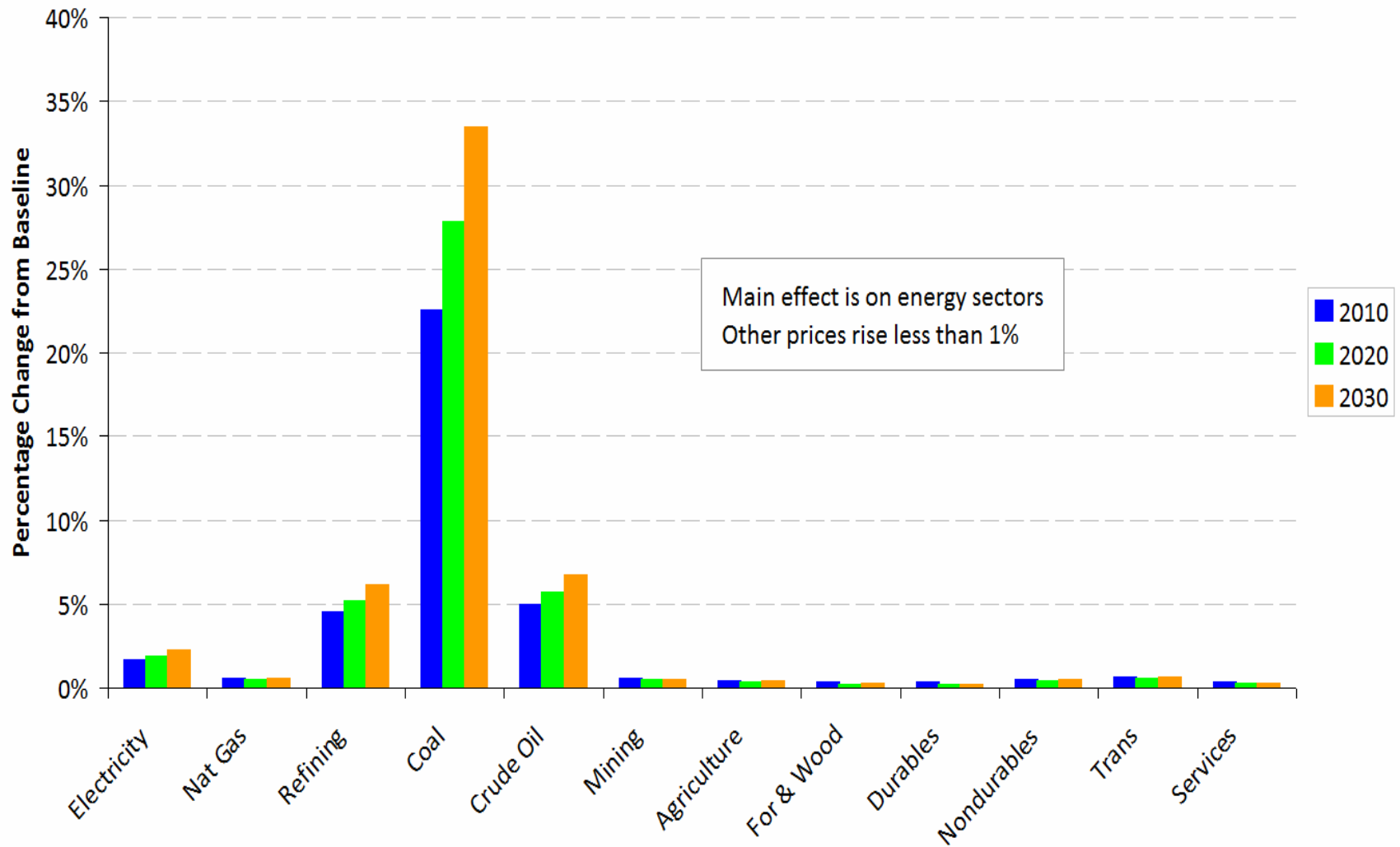- Revenues used to increase government spending

Border Tax Adjustments for a $20 Carbon Tax

■ European (US Energy Intensities)   ■ US (China's Energy Intensities)

Sector	European (US Energy Intensities)	US (China's Energy Intensities)
Mining	0.5	1.6
Agriculture	0.3	0.9
Forestry and Wood	0.3	1.2
Durables	0.3	1.9
Nondurables	0.5	1.8
Transportation	0.4	1.7
Services	0.1	1.2

Percentage Rate

Carbon tax in Europe

- Scenario 1a

Prices in Europe under a European Carbon Tax

Main effect is on energy sectors
Other prices rise less than 1%

Legend:
- 2010
- 2020
- 2030

Y-axis: Percentage Change from Baseline (0% to 40%)

X-axis categories: Electricity, Nat Gas, Refining, Coal, Crude Oil, Mining, Agriculture, For & Wood, Durables, Nondurables, Trans, Services
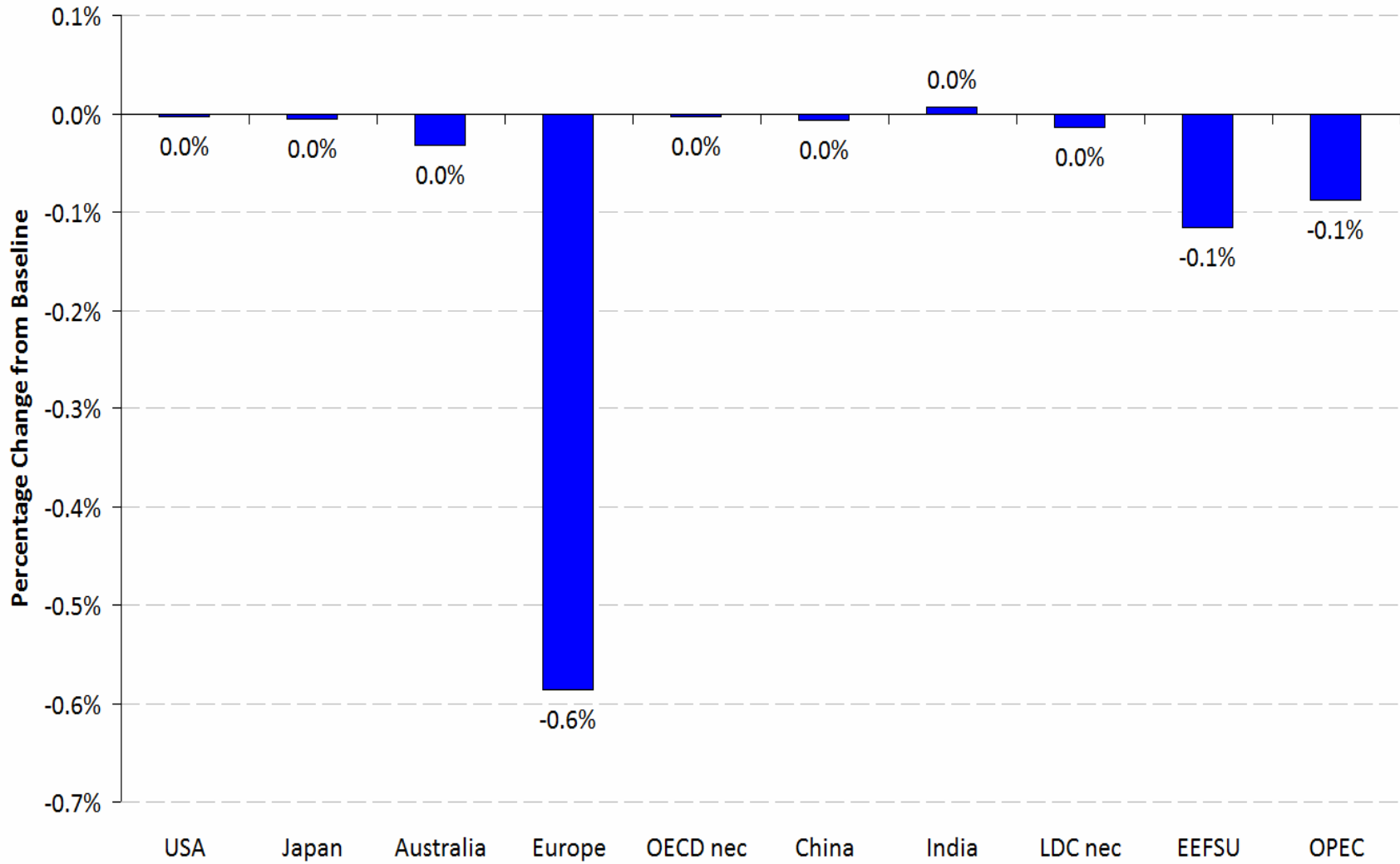
Output in Europe under a European Carbon Tax

9 June 2008

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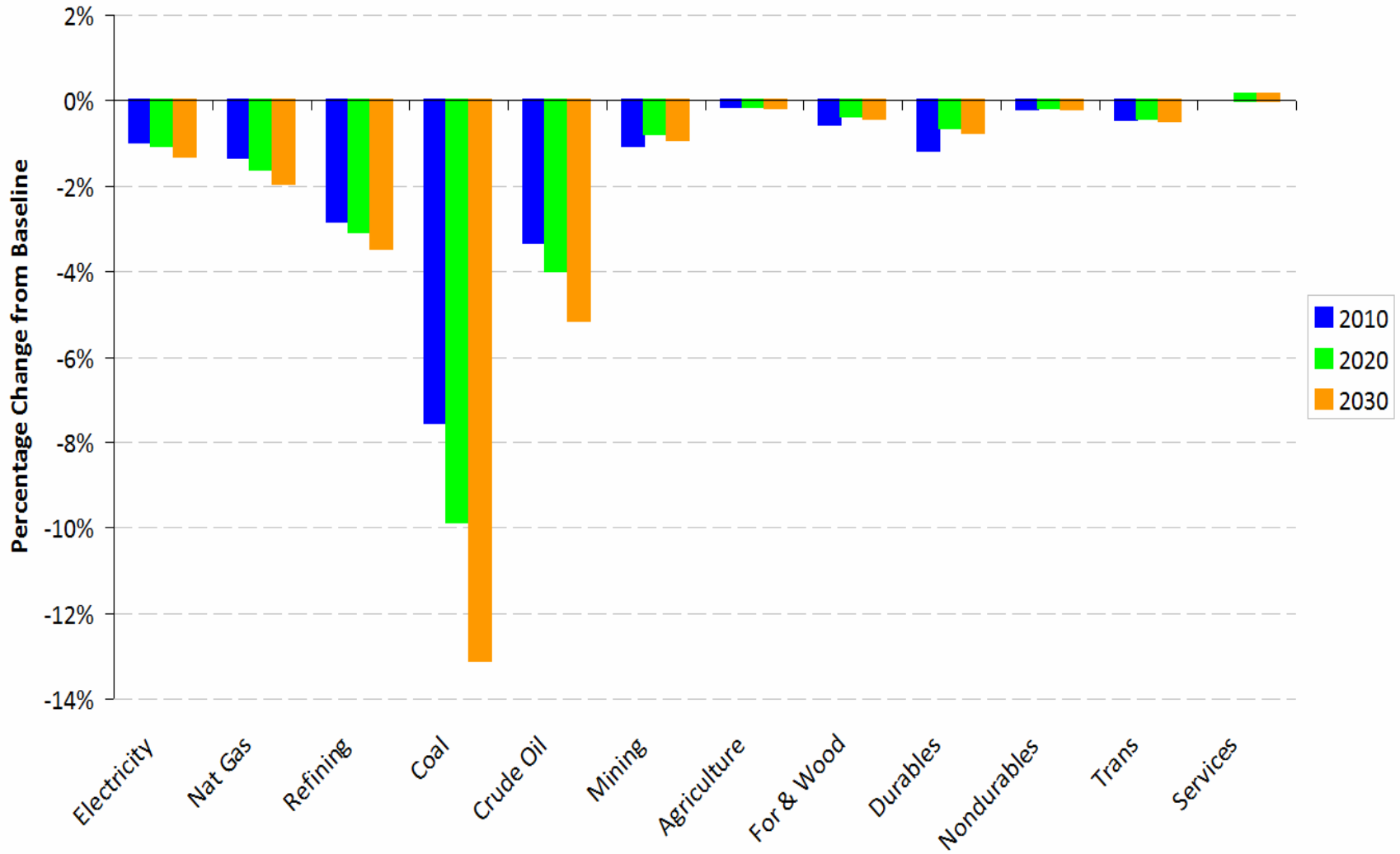
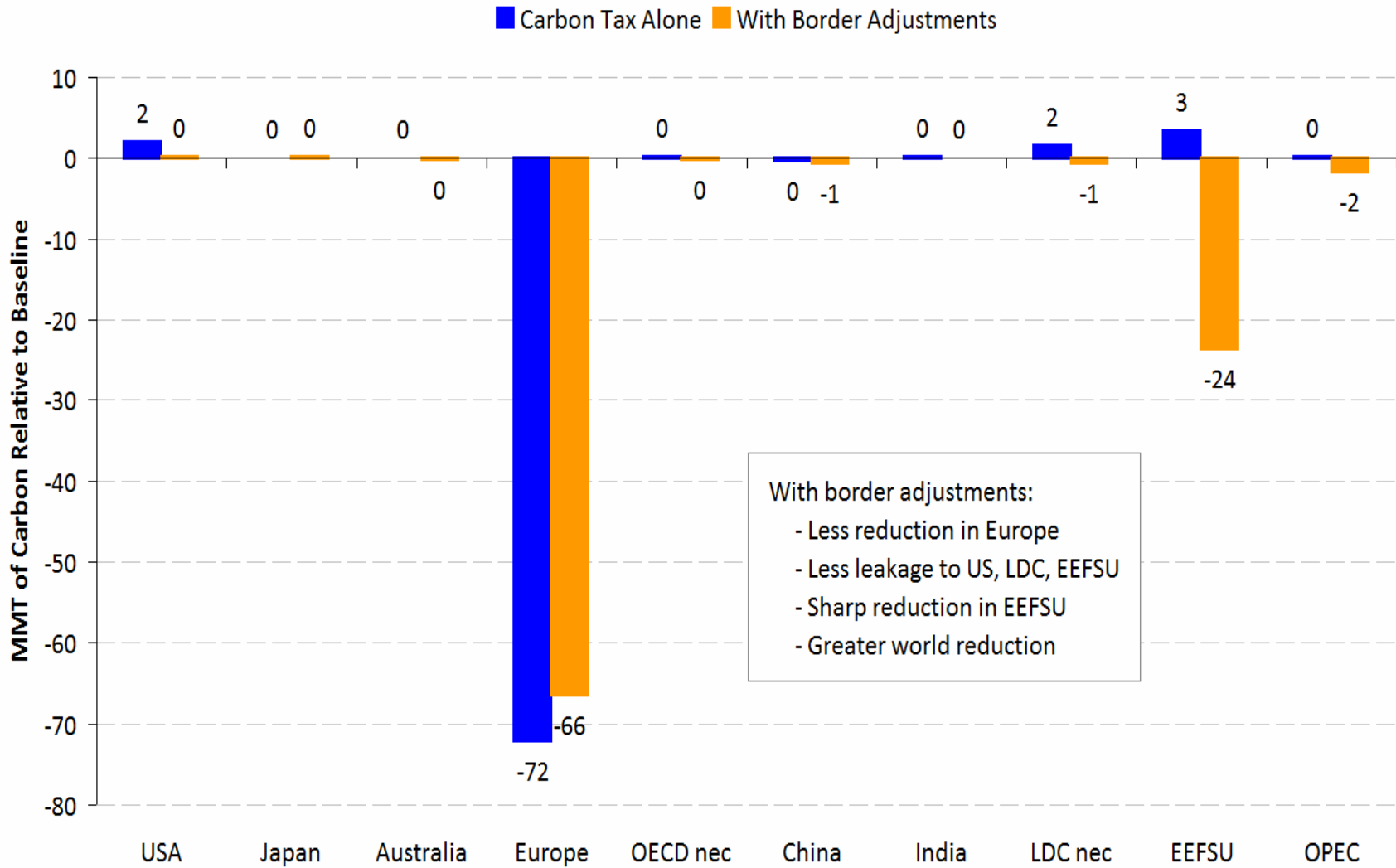Change in World Carbon Emissions under a European Carbon Tax
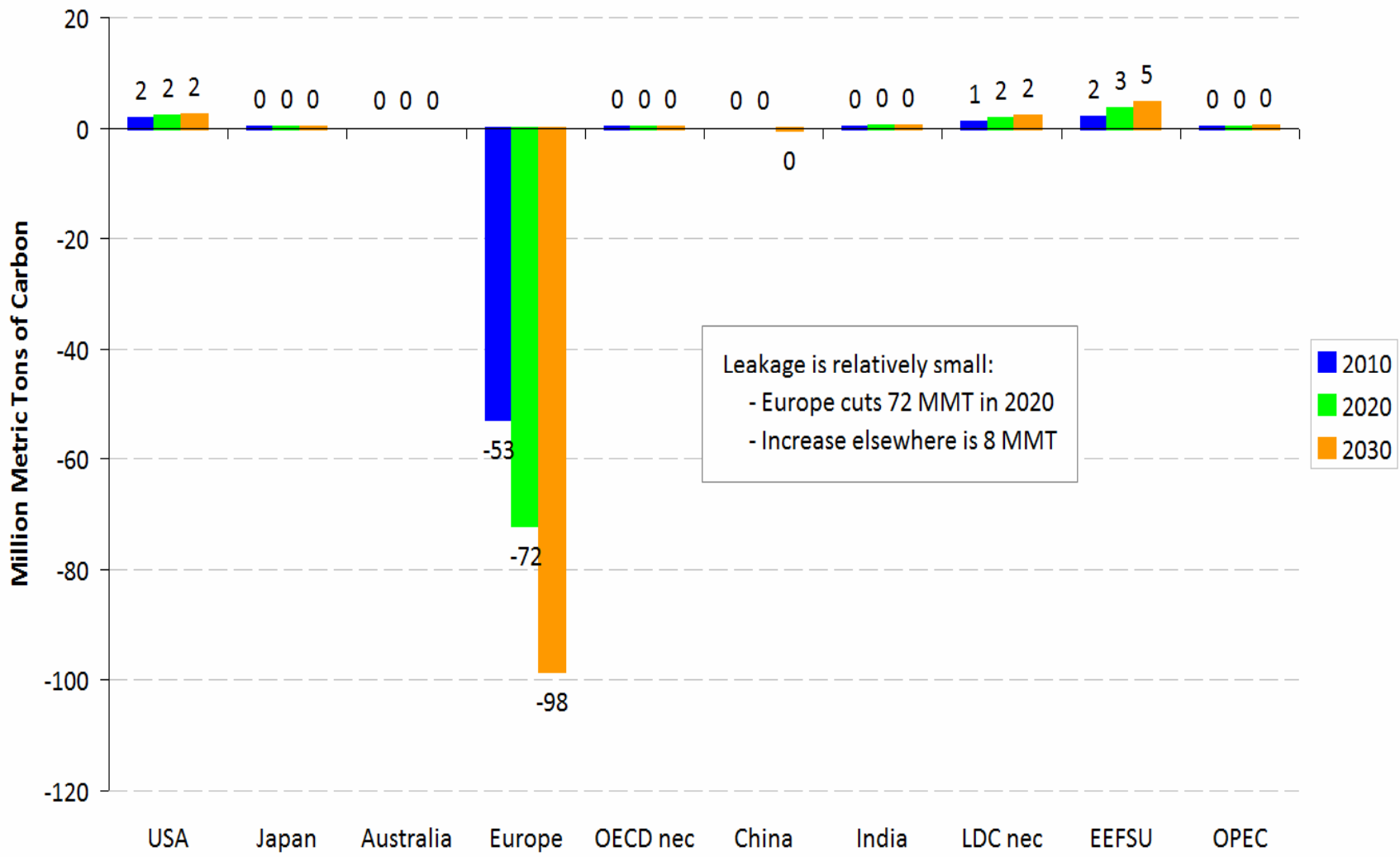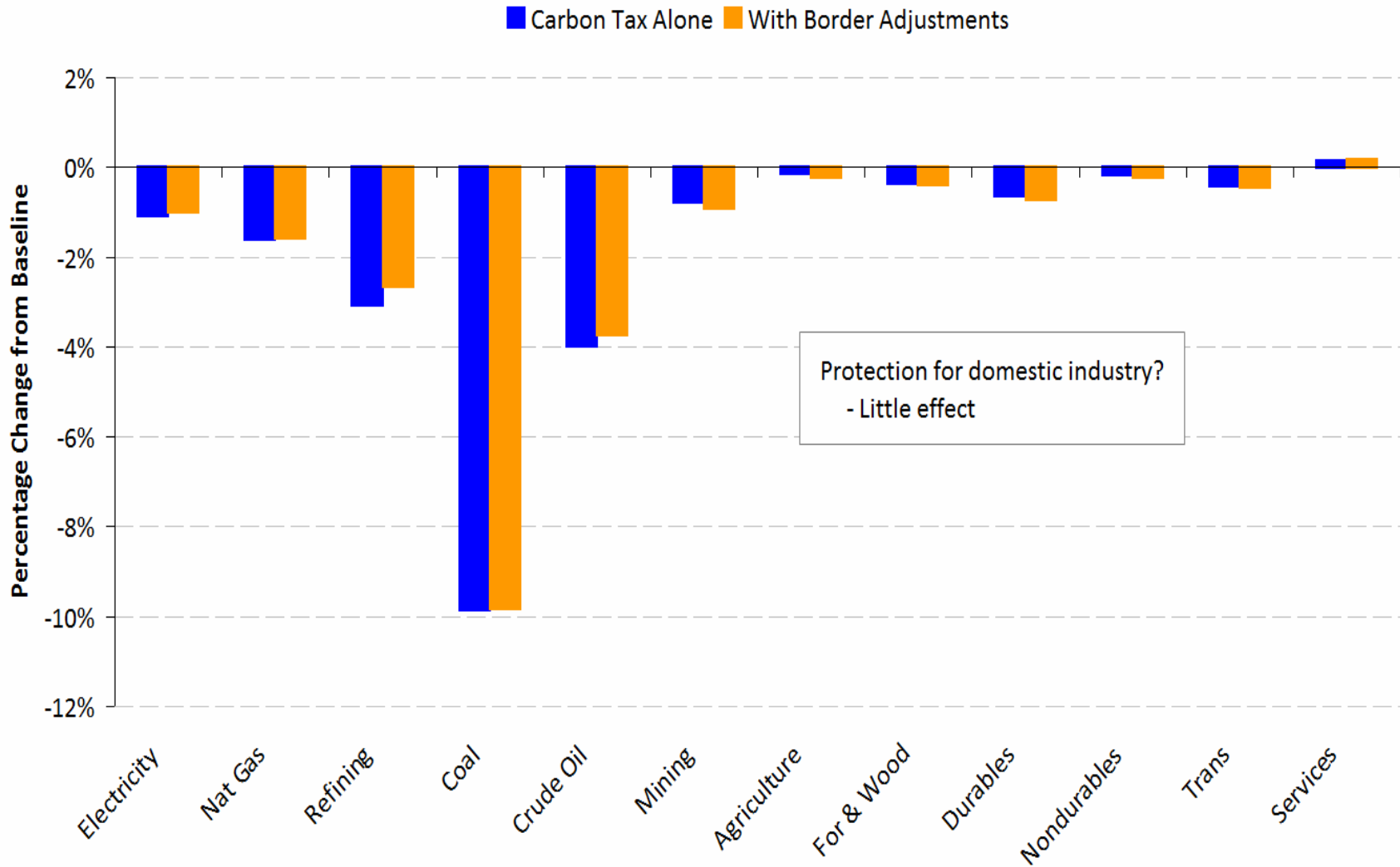
Real GDP in 2020 under a European Carbon Tax

Now add European border tax adjustments...

- Scenario 1b

Change in World Carbon Emissions in 2020 under European Policies

■ Carbon Tax Alone   ■ With Border Adjustments

With border adjustments:
- Less reduction in Europe
- Less leakage to US, LDC, EEFSU
- Sharp reduction in EEFSU
- Greater world reduction

Output in Europe in 2020 under European Policies

■ Carbon Tax Alone ■ With Border Adjustments

Protection for domestic industry?
- Little effect

Y-axis: Percentage Change from Baseline

X-axis categories: Electricity, Nat Gas, Refining, Coal, Crude Oil, Mining, Agriculture, For & Wood, Durables, Nondurables, Trans, Services

Summary of results

- Border tax adjustments are small at this level of aggregation
    - Would be larger for some narrow industries: e.g., aluminum

- Carbon tax drives most of the effects

- Effects due to border taxes:
    - Modest reduction in leakage
    - Very little protective effect on domestic output

Policy implications

- Border tax adjustments would be difficult to administer
  - Vary by country of origin?
  - Account for production scattered across countries?
  - Tracking energy sources precisely: hydro vs. coal?

- Not much effect on leakage
  - Emissions from electricity and domestic transportation
  - Most traded goods not very energy intensive

- Are the gains are worth it?