



Energy and climate policies: coping with carbon leakage

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Resources for the Future and *FEEM*

Economics for Energy Meeting
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Carbon Leakage

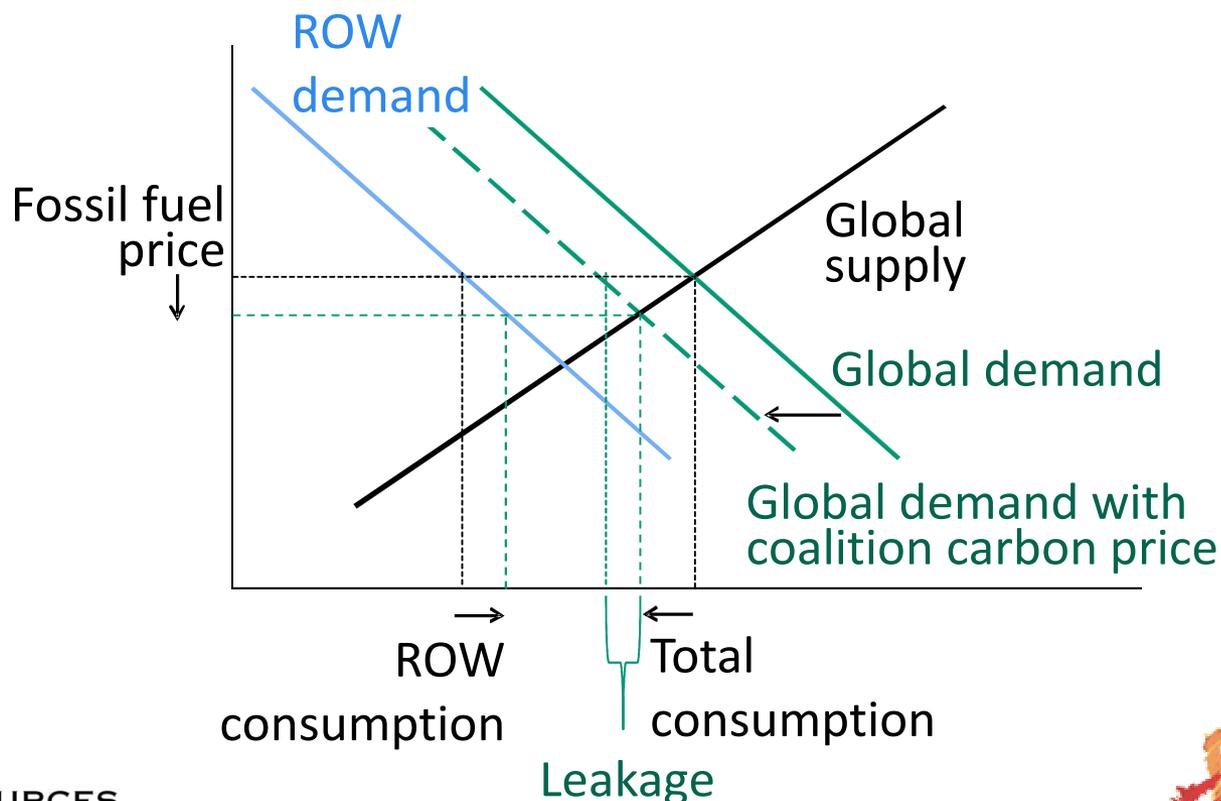
- Increase in foreign emissions as a consequence of domestic regulations
- Important because GHGs are a *global* pollutant



Channels

1. Global energy markets

- Reduced demand drives down global fuel prices encouraging more fuel use and emissions abroad



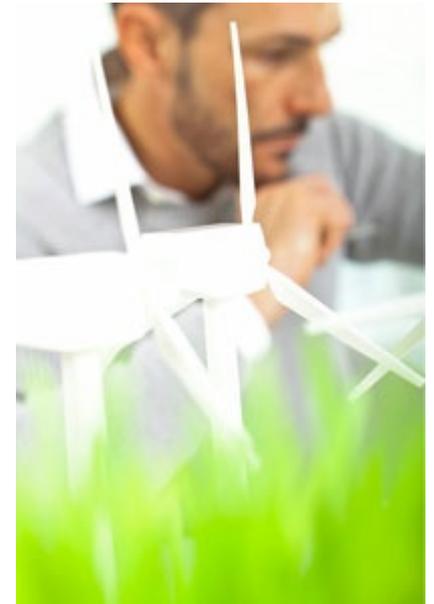
Channels

1. Global energy markets
2. “Competitiveness”
 - Shifting of economic activity and production (Fischer and Fox 2012) and investment (Zhou et al, 2009)
 - Energy-intensive trade-exposed (EITE)
 - Work by Monjon, Quirion, Ponsard, Climate Strategies, etc. on steel and cement



Channels

1. Global energy markets
2. “Competitiveness”
3. Technology spillovers from induced innovation
 - Lower cost clean energy technologies developed for countries with carbon regulations can diffuse globally
 - Potential for “negative leakage”
 - Gerlagh and Kuik 2014; Barker et al., 2007; Fischer 2015.



Carbon Leakage Estimates

- Range from 14 to 130%!
- Most in range of 5-30% for economy-wide leakage
 - Energy Modeling Forum (EMF) model comparison study for BCA (*Energy Economics* 34 Supplement 2)
- Highly sensitive to assumptions about energy supply responses
- Higher for smaller and cleaner coalitions
 - Boehringer, Fischer and Rosendahl (2014)
- Intertemporal leakage occurs when resource owners respond by lowering scarcity rents on exhaustible resources
 - “Green Paradox”

Options for addressing all channels

- Global carbon pricing
 - Most recommended by economists!



United Nations
Framework Convention on
Climate Change



Global Carbon Pricing We Will If You Will

Peter Cramton, David J.C. MacKay, Axel Ockenfels, and Steven Stoft

[Linked Table of Contents](#)

Includes recent climate policy papers by

David J. C. MacKay

Richard Cooper

Joseph Stiglitz

William Nordhaus

Martin L. Weitzman

Christian Gollier & Jean Tirole

Stéphane Dion & Éloi Laurent

Peter Cramton, Axel Ockenfels & Steven Stoft

Version 1.12 — 22 October 2015

Please check for updates before citing.
carbon-price.com

Options for addressing all channels

- Global carbon pricing
- Withdraw fossil energy supplies
 - Keeps fossil fuel prices from falling (Harstad 2012)

The screenshot shows a news article from The Guardian. The article title is "Ecuador signs \$3.6bn deal not to exploit oil-rich Amazon reserve". Below the title is a sub-headline: "Pioneering deal signed with UN sets up trust fund by wealthy countries worth half expected earnings from potential sale of oil". The main image shows two indigenous people from the Huaorani tribe in the Amazon rainforest. To the right of the article, there is a "Most popular" section with three items: "Strong earthquake in Afghanistan shakes south Asia", "Pakistan, India and Afghanistan rocked by earthquake - live updates", and "Pakistan v England: second Test, day five - live!".

Options for addressing all channels

- Global carbon pricing
- Withdraw fossil energy supplies
- Weakening policies
 - Misses lower-cost opportunities for reductions



Options for addressing competitiveness

- Sectoral agreements
 - Trade partners also have incentives then (Barrett 2008)



Unilateral options for addressing competitiveness

- Exempting susceptible sectors



- Lose all incentives
 - Boehringer, Carbone and Rutherford
- Doesn't address costs from indirect emissions
 - E.g., aluminum, which uses electricity intensively

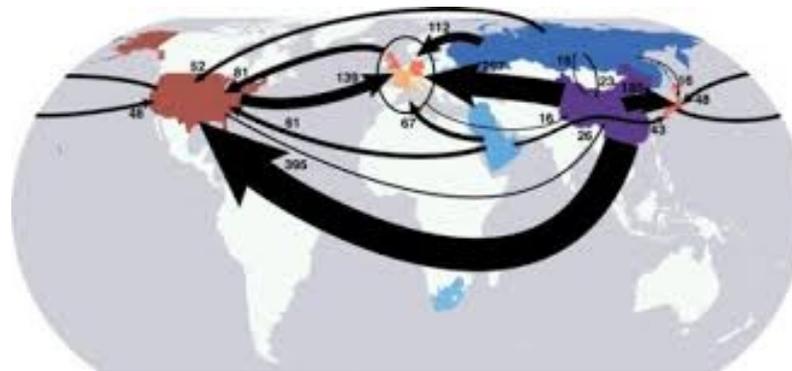
Unilateral options for addressing competitiveness

- Exempting susceptible sectors
- Free allocation / “benchmarking”
 - Output-based rebating retains incentive to reduce emissions intensity, but embodied carbon cost not passed on to consumers of energy-intensive products (Fischer and Fox 2007)



Unilateral options for addressing competitiveness

- Exempting susceptible sectors
- Free allocation / “benchmarking”

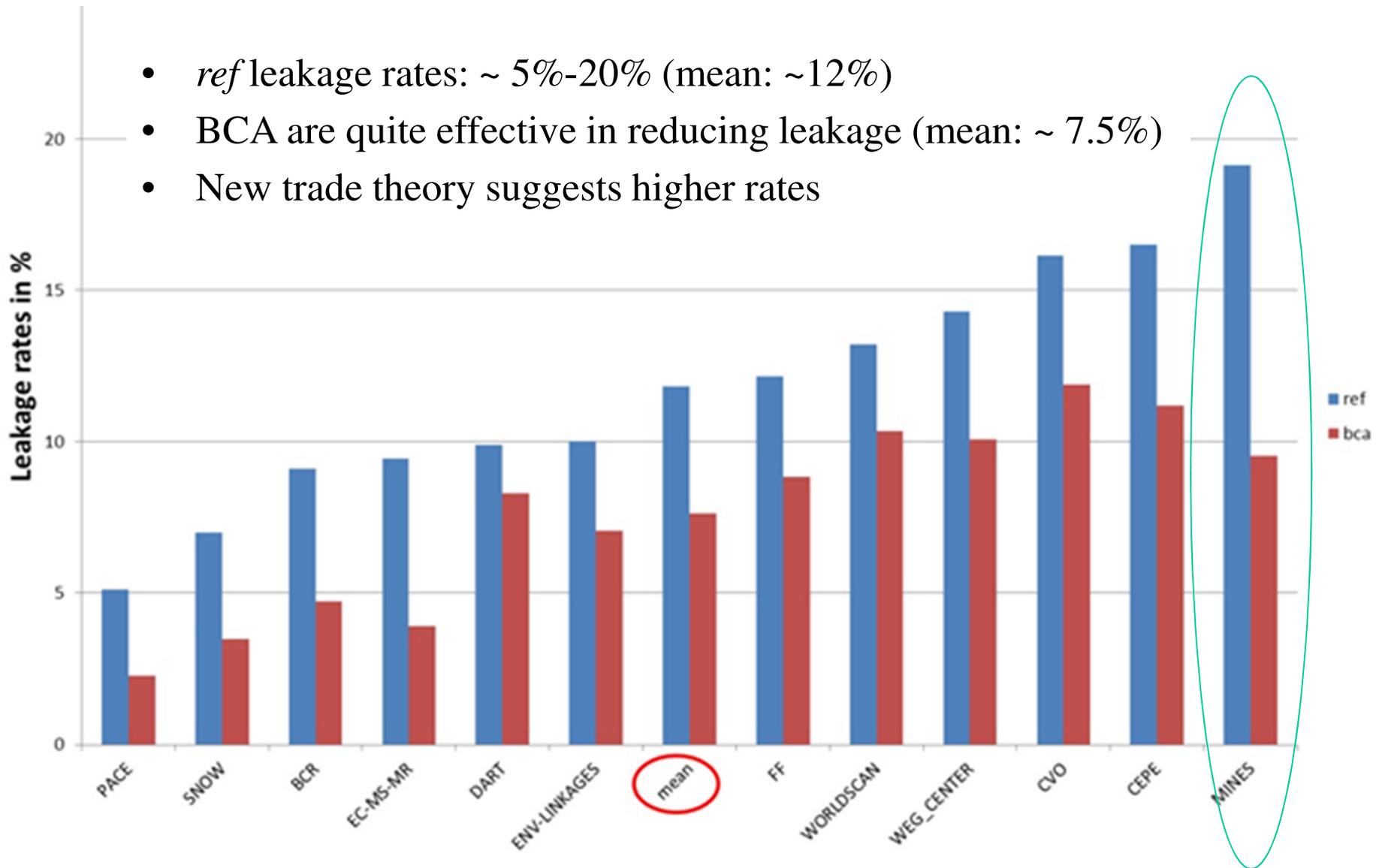


- Border carbon adjustment (BCA)
 - charge on imports based on a measure of carbon content, ensure consumers face consistent

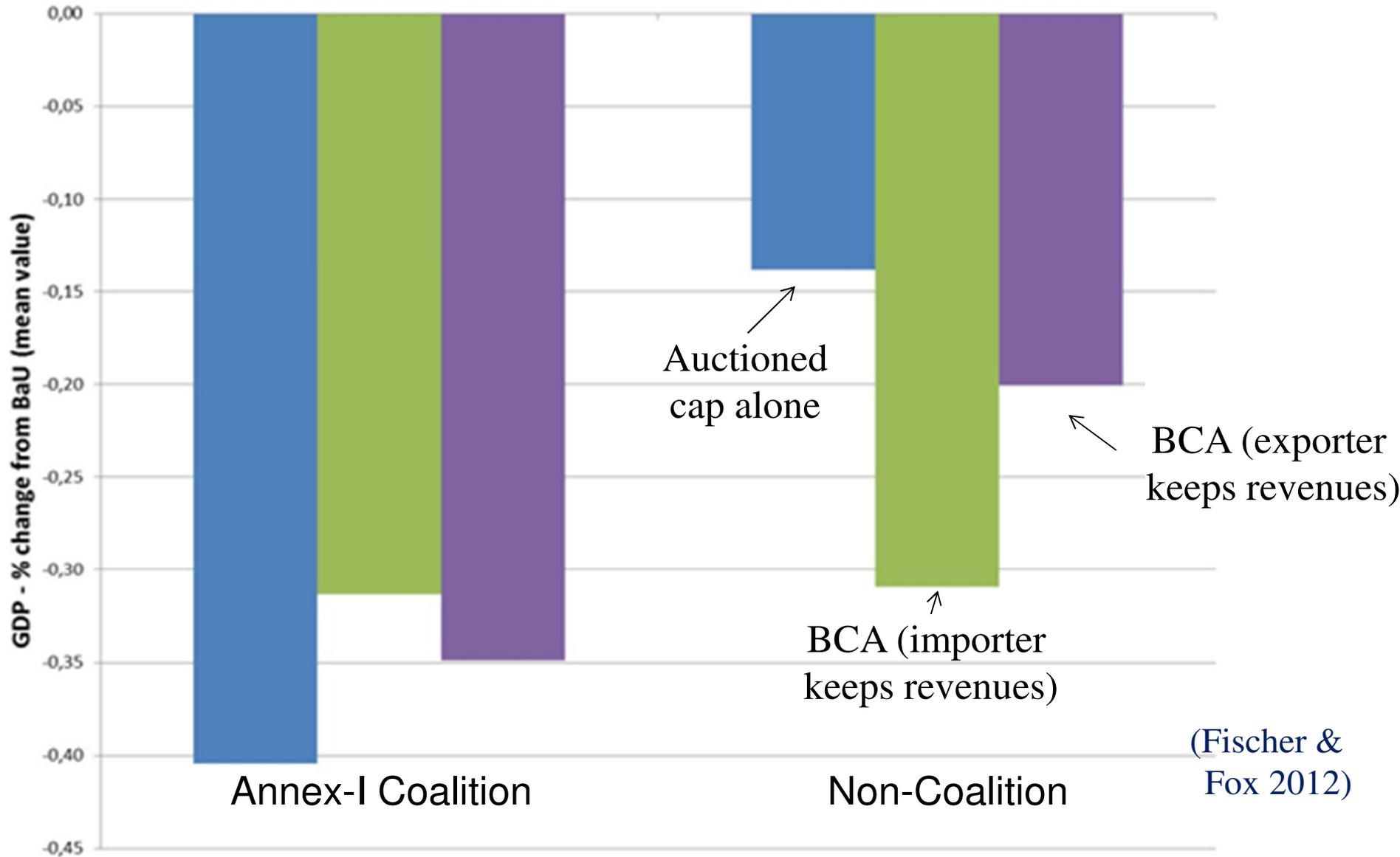
Leakage Rates

(Annex I; EMF study)

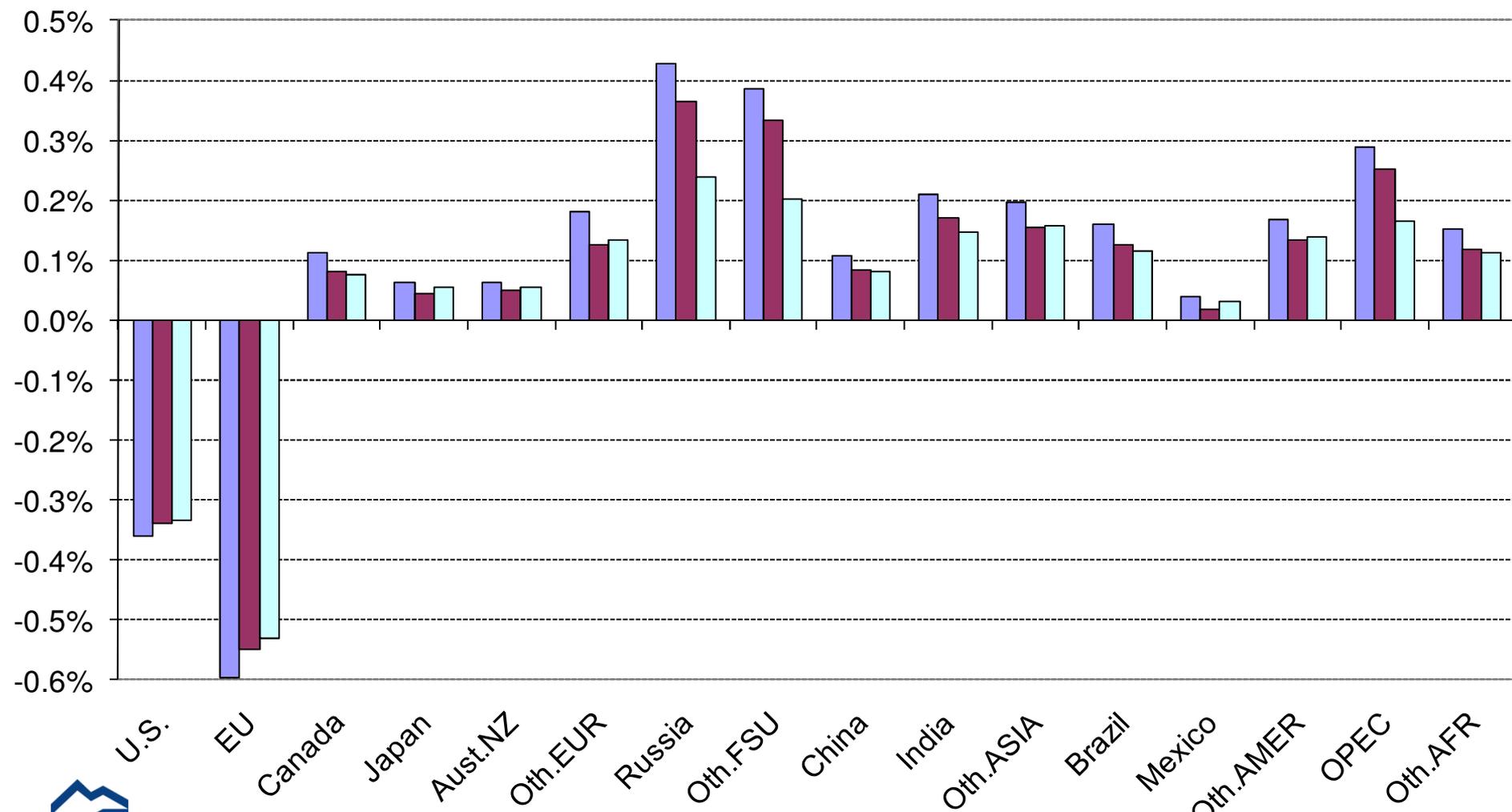
- *ref* leakage rates: ~ 5%-20% (mean: ~12%)
- BCA are quite effective in reducing leakage (mean: ~ 7.5%)
- New trade theory suggests higher rates



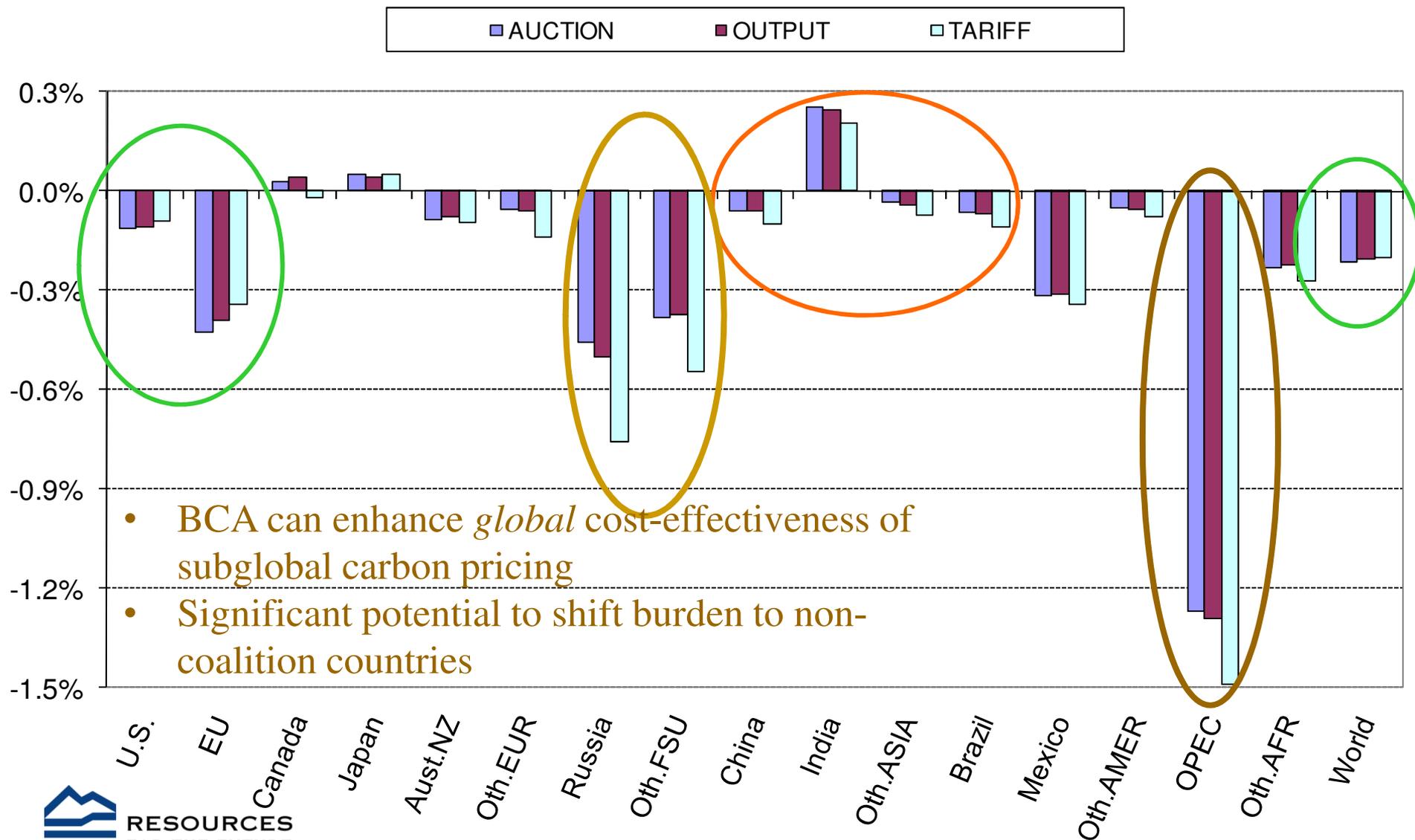
Changes in Burdens: Use of BCA Revenues



Percentage Change in Total Production, by Region (US and EU Caps) (BFR 2010 *BEJEAP*)

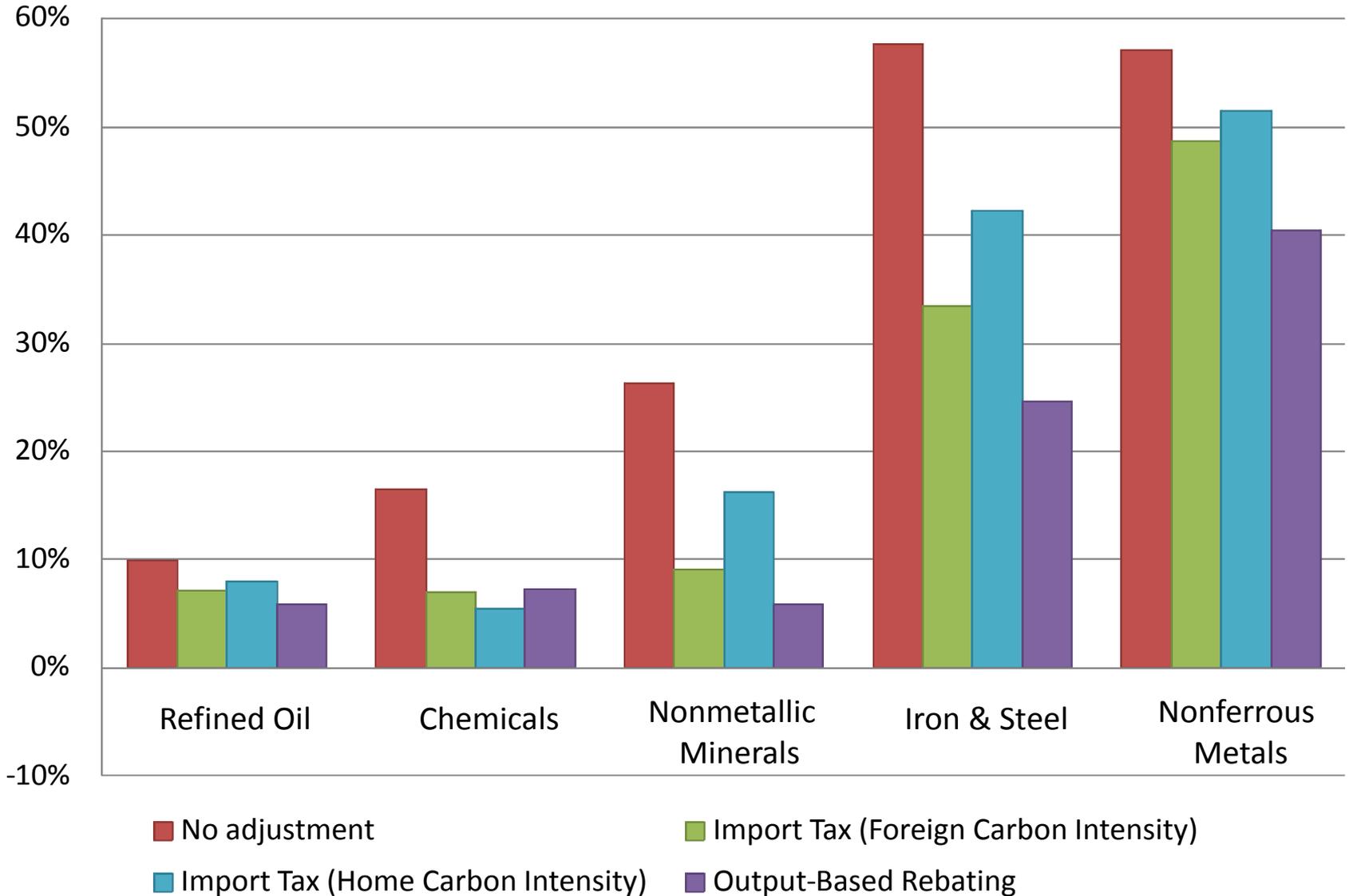


Consumption Effects of Joint U.S. and EU Action by Policy Option (BFR 2010 *BEJEAP*)



Leakage by Sector

(U.S. Policy; Fischer and Fox 2012, *JEEM*)



Addressing Competitiveness

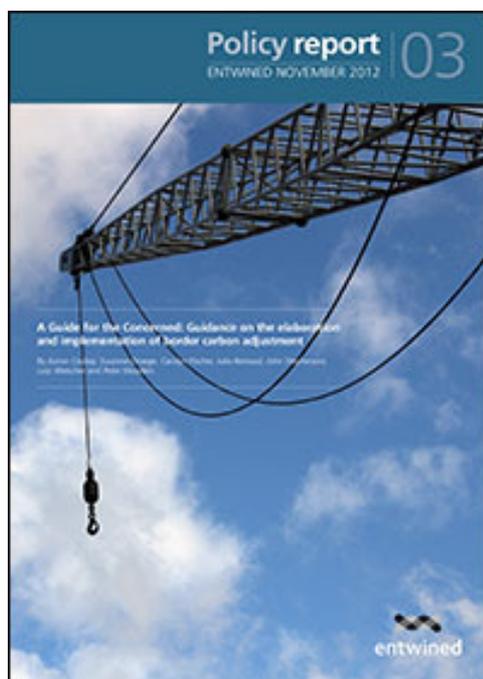
- Politically most important channel
- Leakage is associated with trade intensity
 - But so is protectionism



International legal principles and unilateral measures

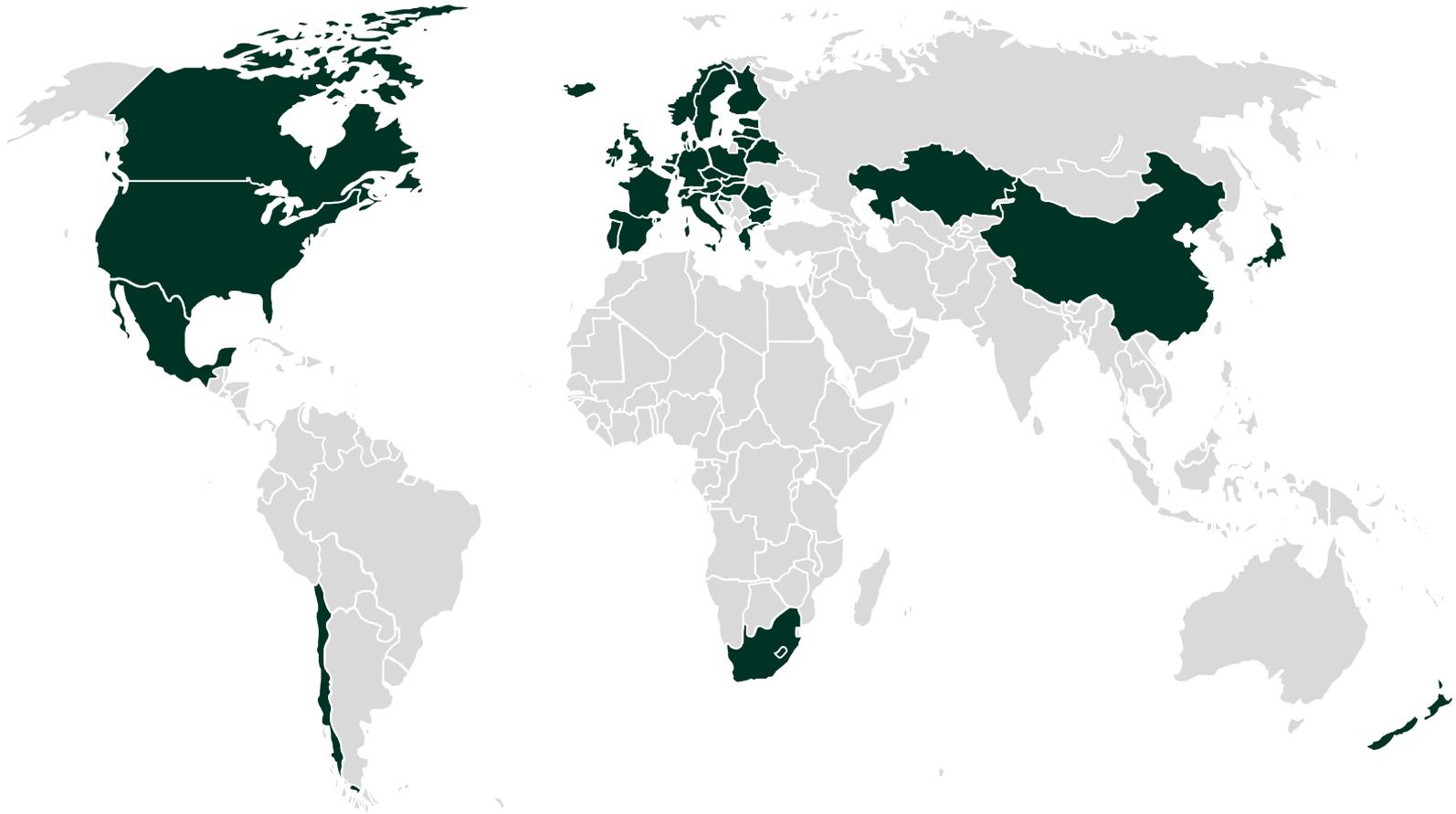
- Common but Differentiated Responsibilities (CBDR)
 - Should not aim to bring about equivalent national policies or unfairly burden LDCs
- WTO Obligations
 - Non-discrimination and most-favored nation principles
 - prohibit discrimination among like goods on the basis of their country of origin
 - Article XX
 - allows states to take otherwise-illegal measures that are aimed at, among other things, genuinely protecting the environment.
 - Subsidies Code
 - No Article XX analog

Practical recommendations



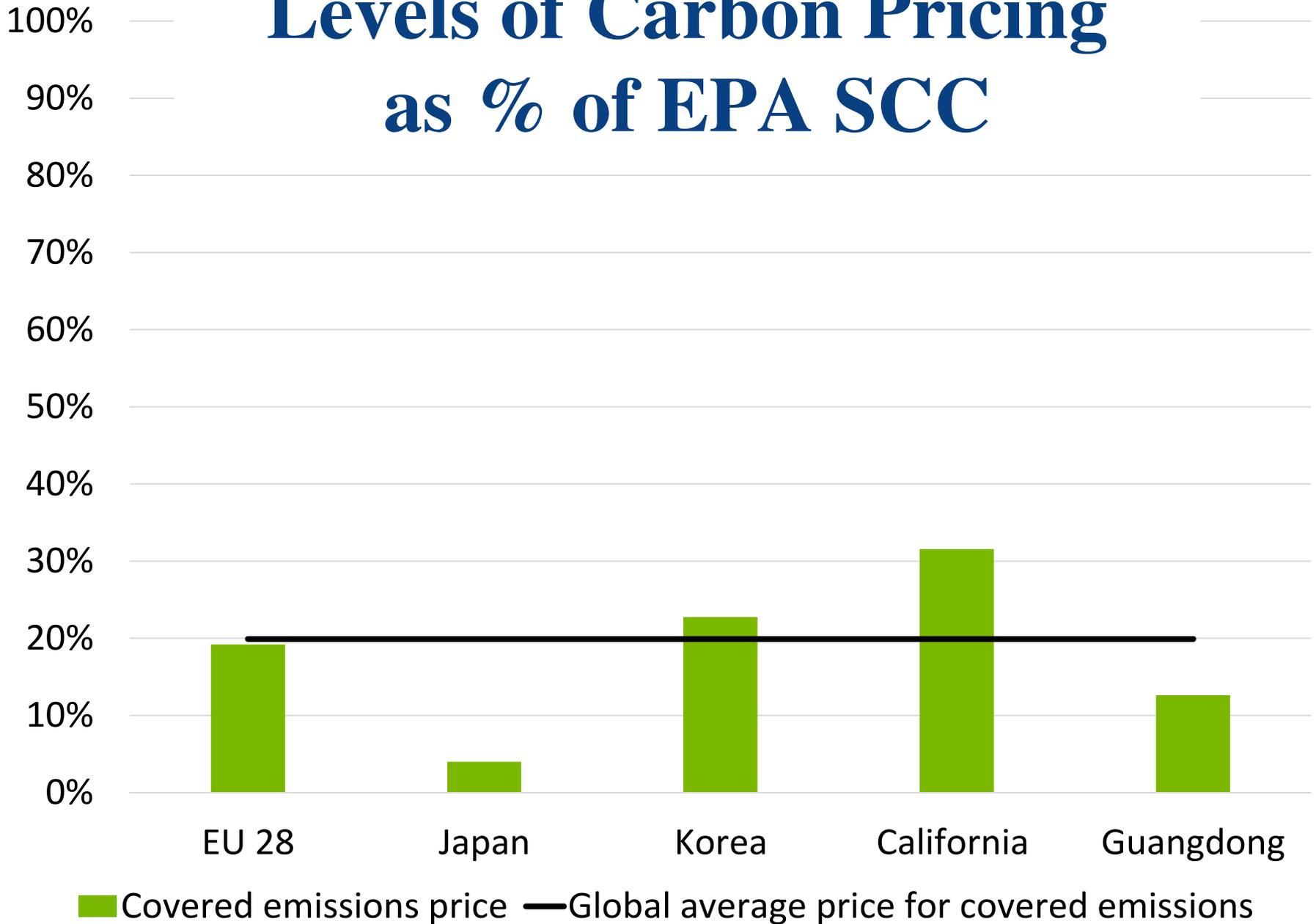
- A Guide for the Concerned: Guidance on the elaboration and implementation of border carbon adjustment
 - Aaron Cosbey, Susanne Droege, Carolyn Fischer, Julia Reinaud, John Stephenson, Lutz Weischer, Peter Wooders
 - http://www.iisd.org/sites/default/files/pdf/2012/bca_guidance.pdf

Popularity of Carbon Pricing



Countries with a national or provincial ETS or carbon tax implemented or scheduled, as of early 2015 (Source: World Bank 2015)

Levels of Carbon Pricing as % of EPA SCC

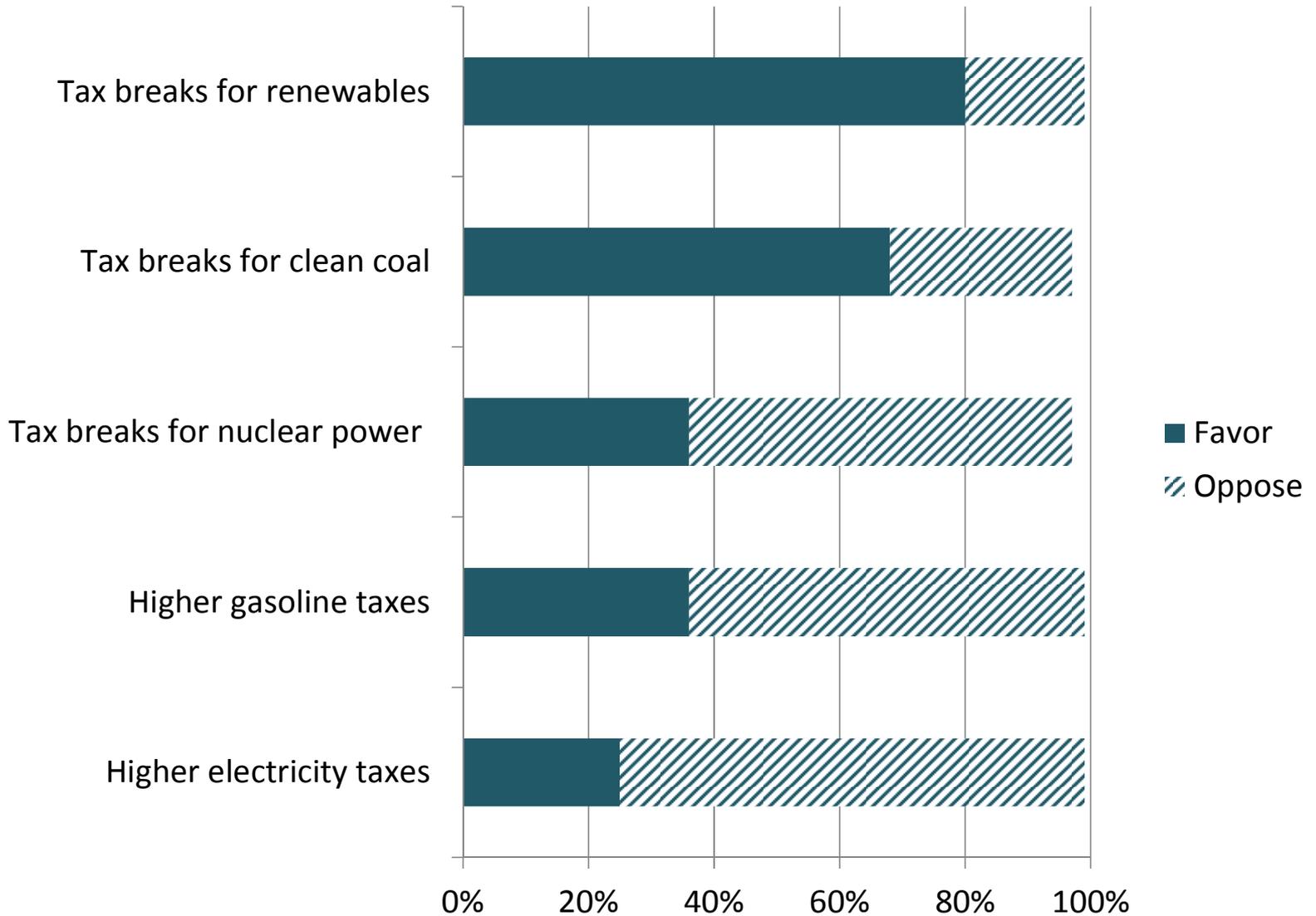


Popularity of Renewable Energy Incentives



Countries with national or provincial renewable energy policies or targets in place, as of early 2015 (Source: REN21 2015)

RFF/Stanford/NYT Poll (2015)



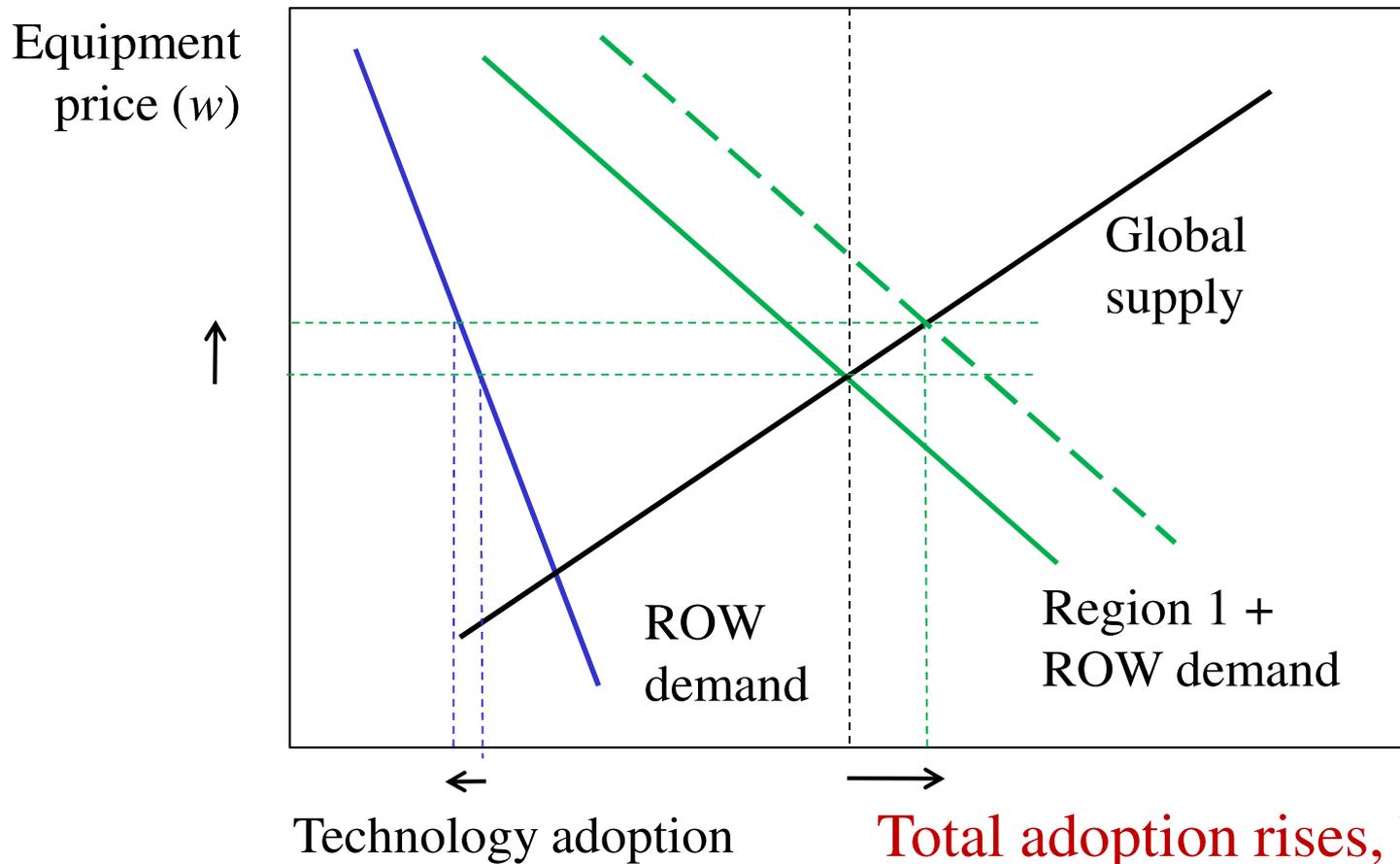
Options for coping with leakage

- Global carbon pricing
- Withdrawing fossil fuel supplies
- Weakening policies / exempting sectors
- Sectoral agreements
- Free allocation / benchmarking
- Border carbon adjustment (BCA)
- Global diffusion of lower-cost clean energy technology
 - Lowers everyone's emissions and makes it less costly to regulate carbon

“Strategic subsidies for green goods”

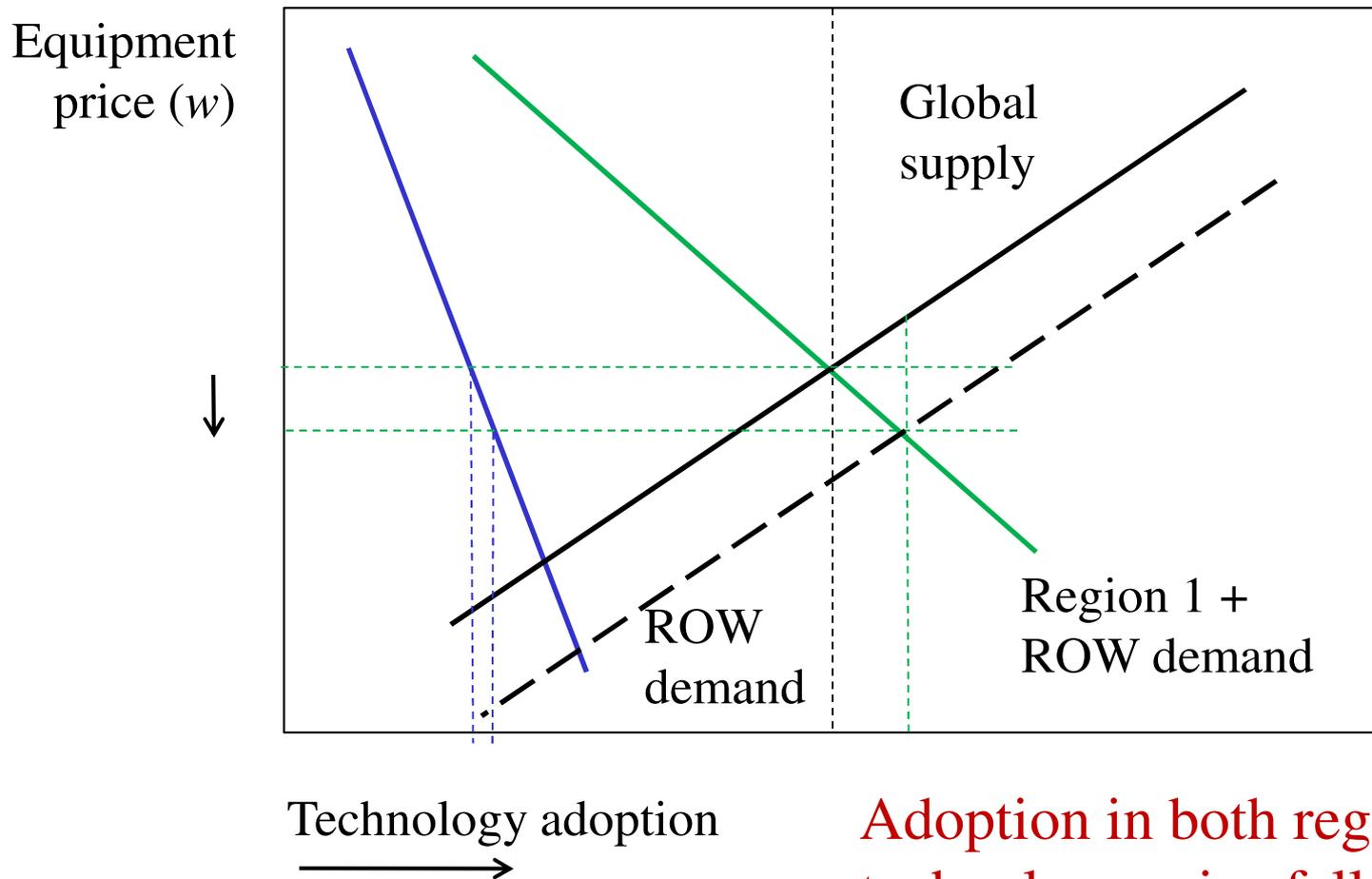
- Rationales for supporting alternative energy technologies, even with carbon pricing
 - Upstream market failures
 - Imperfect competition
 - New industries
 - Patented technologies
 - Network / scale / learning externalities
 - Downstream market failures
 - Unpriced emissions
 - carbon leakage
- Should subsidies be targeted to production or consumption of renewable technologies?

Renewable Technology market: Downstream subsidy

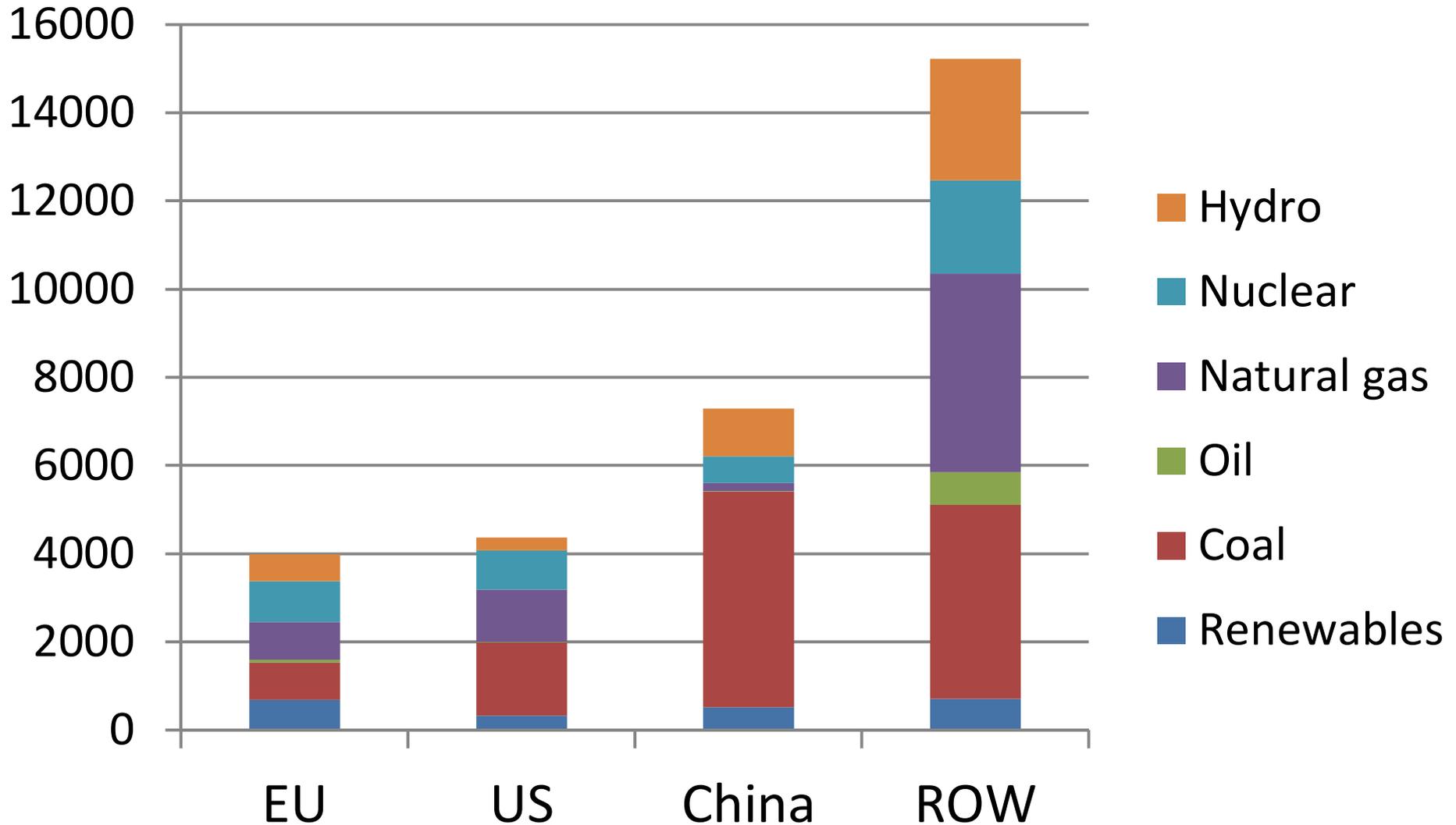


Total adoption rises, but
technology price rises too and
foreign adoption falls

Renewable technology market: Upstream subsidy

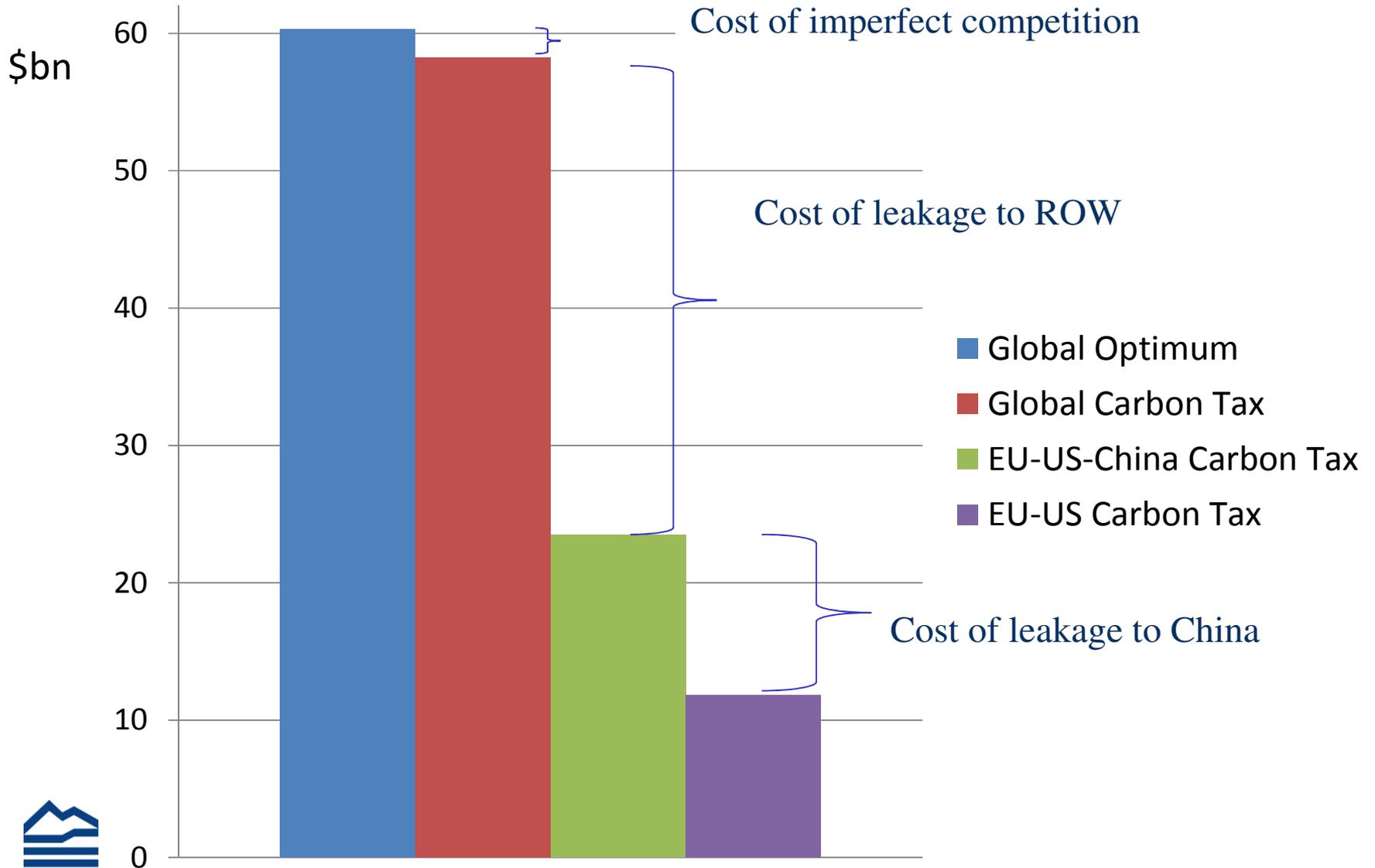


Generation in 2020 by source



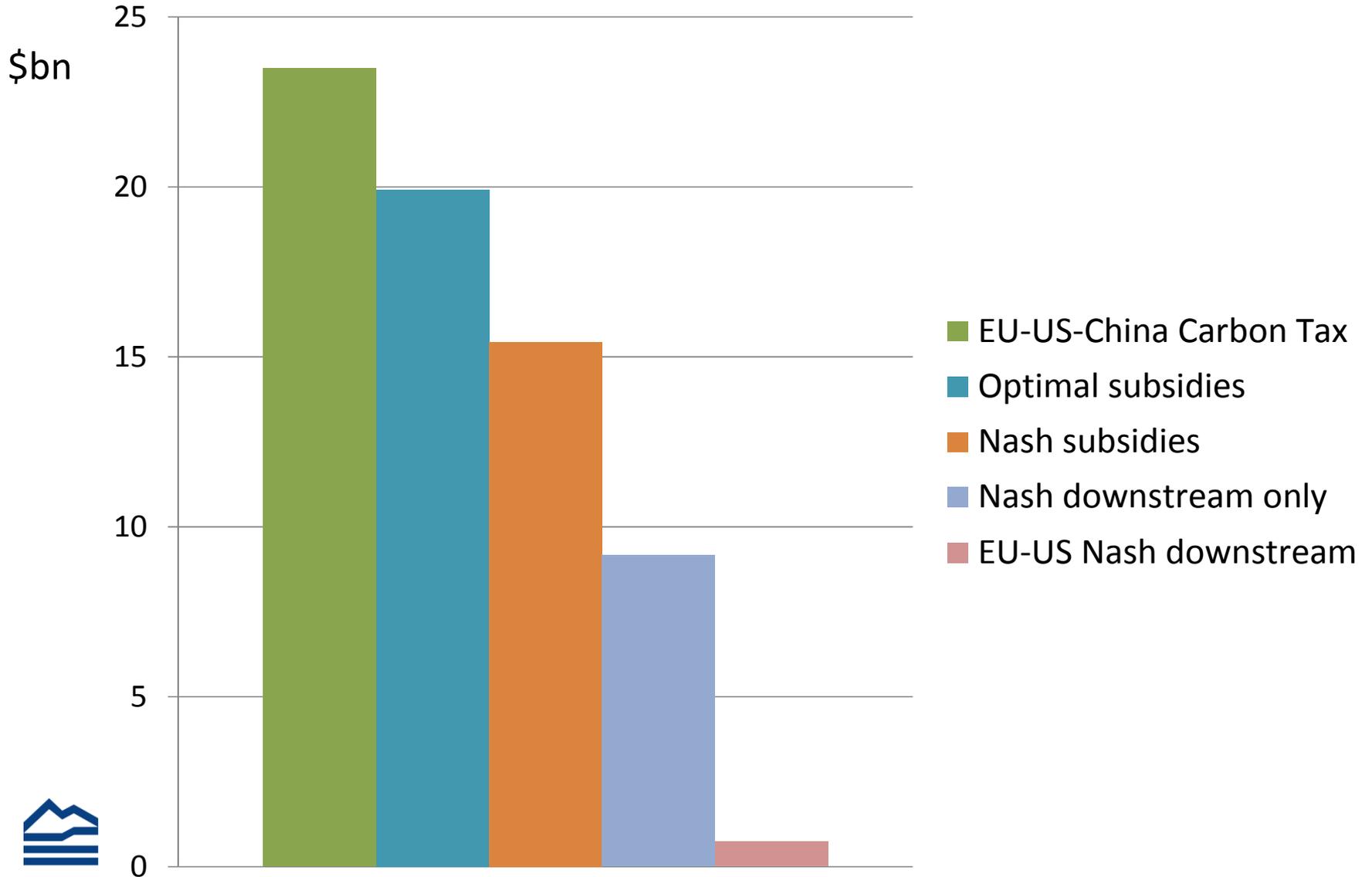
Global welfare change from No Policy

(IC and all value MB at SCC of \$30)



Global welfare change from No Policy

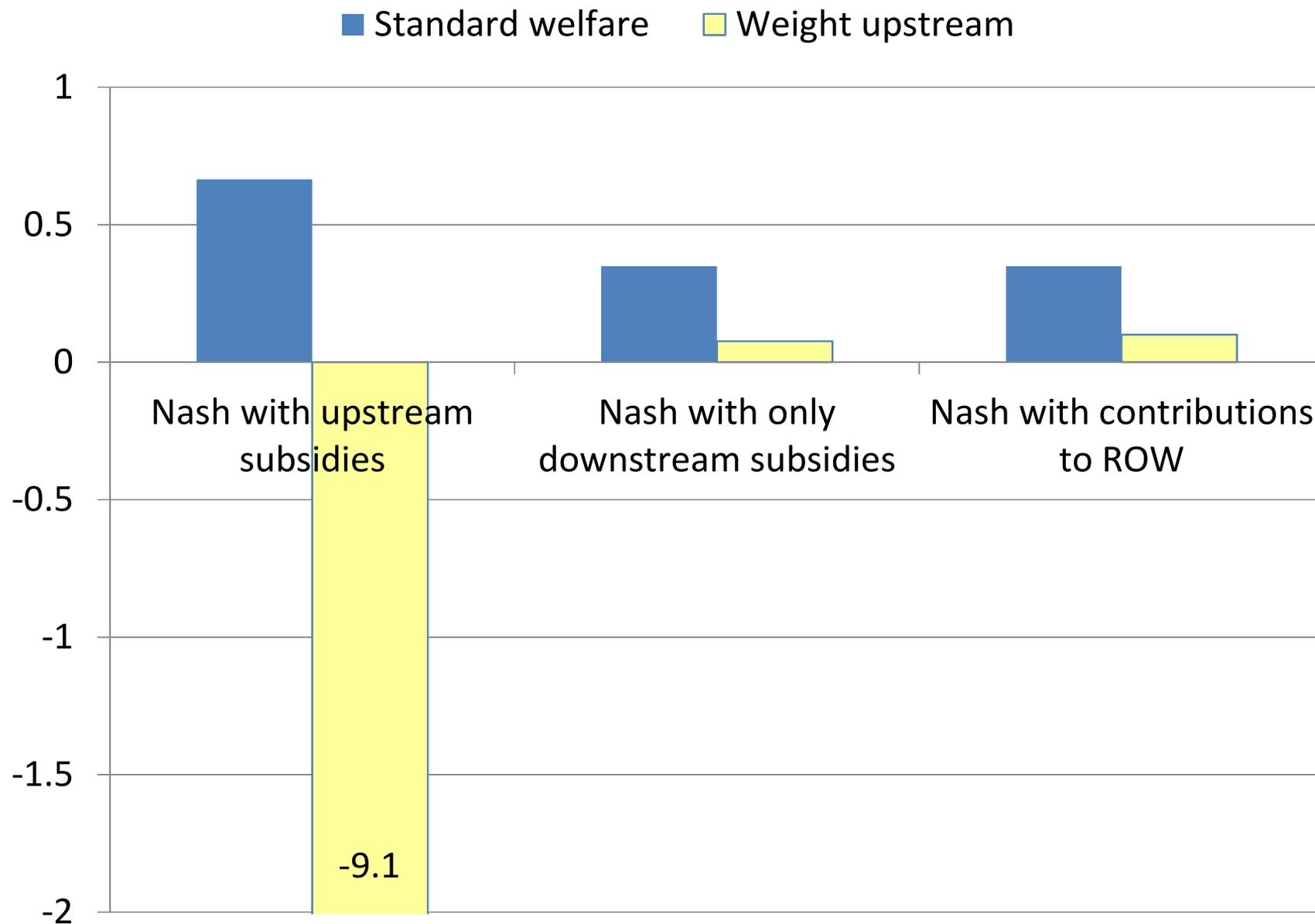
(IC and all value MB at SCC of \$30)



“Strategic green industrial policy”

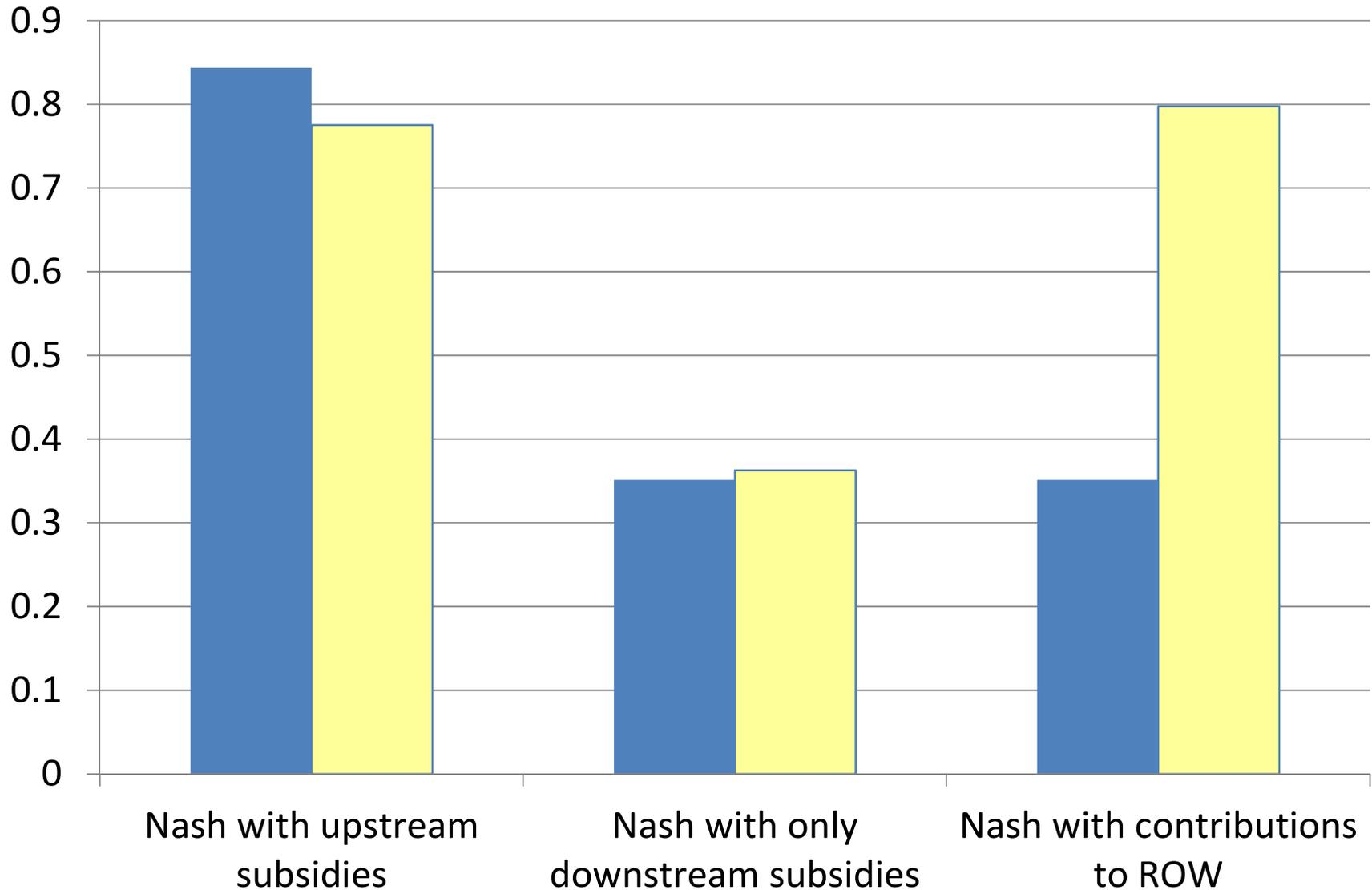
- WTO Agreement on Subsidies and Countervailing Measures disciplines use of upstream subsidies
 - No environmental exceptions (unlike GATT)
- Trade community skeptical of industrial policy with good reasons
 - Interest group lobbying distorts government decisions
- How to balance with environmental goals?
- Is climate finance an alternative?

Welfare change (share of optimal), SCC=30

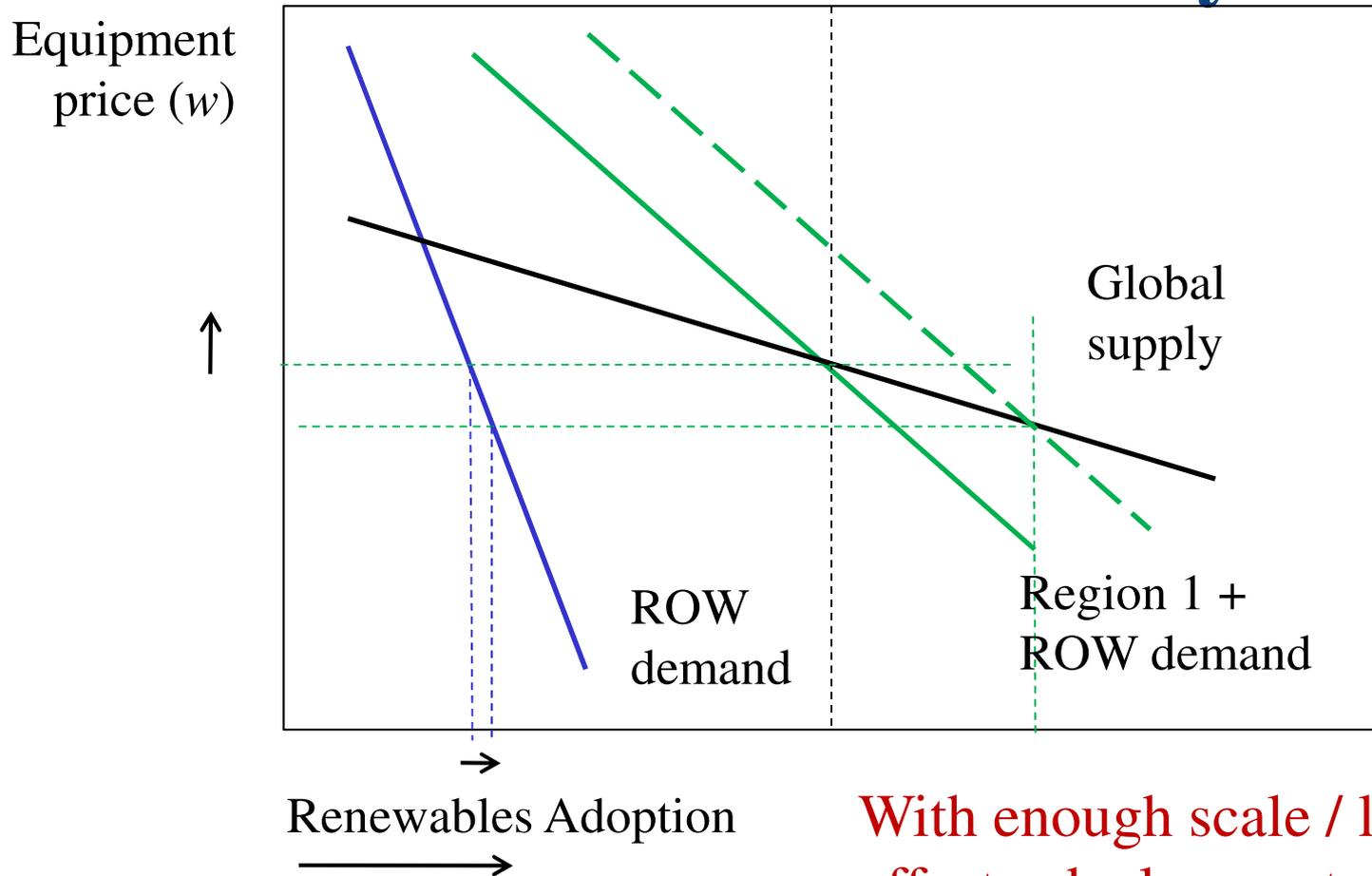


Welfare change, $SCC=100$ but $v_i = 30$

■ Standard welfare ■ Weight upstream



Renewable technology market with downward-sloping supply: Downstream subsidy



With enough scale / learning effects, deployment subsidies can crowd in foreign adoption

Conclusion

- Carbon leakage must be addressed for countries to take on significant carbon pricing
 - Most currently using free allocation, but as price pressures increase, BCAs likely to be used in some form
 - BCA can pass muster by WTO, but more likely to be accepted and less likely to be abused if some agreement (at least informal) on international norms
- Global access to cleaner, cheaper technologies can avoid carbon leakage
 - Doesn't address the competitiveness issue, so tends to substitute for stringent carbon pricing
 - Need for thoughtful WTO rules for environmentally oriented manufacturing subsidies
 - Are we using the right policies?

Thanks!



Thanks!

- EU Marie Curie Fellowship Program and hospitality of FEEM is gratefully acknowledged.
- Related research is indebted to Norwegian Research Council, Mistra Foundation INDIGO and ENTWINED programs, EPA-STAR, and SEEK program

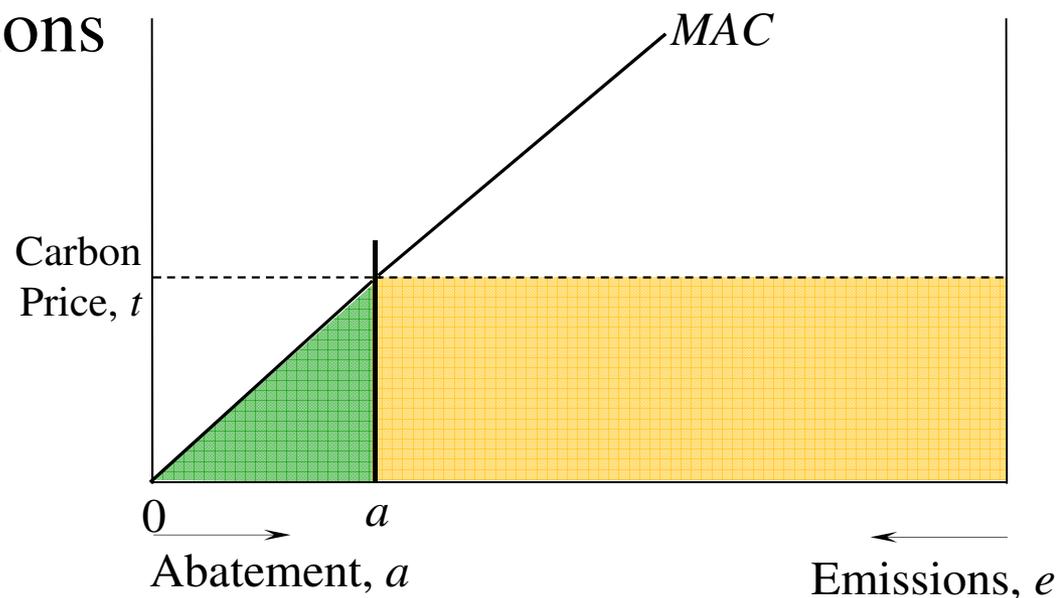


Motivations for BCA

- Preventing leakage
 - Conforms with GATT Article XX goals
- Competitiveness concerns
 - Loss of production and related jobs from relocation, diversion of investment.
 - May facilitate domestic agreement on stringent climate policy
 - Same motivation as protectionism
- Leverage:
 - Economic incentive for trade partners to take climate action
 - Karp (2010)
 - Risks poisoning international talks
 - Not compatible with CBDR

Policies eligible for adjustment

- Emissions pricing policy!
- Two components of cost increases:
 - Direct abatement costs
 - Nonmarket regulations have this too; hard to measure
 - Embodied emissions costs
 - Only emissions pricing has this
 - This is what is being adjusted



Scope of applicability: Covered products and sectors

- Issues to balance
 - Leakage avoided
 - Risks of unfair application
 - Administrative costs
 - Two criteria, used simultaneously:
 - High costs of climate regulations
(high GHG intensity of production or value added)
 - Inability to pass through costs of regulations
(trade sensitivity. Proxy: trade intensity)
- ➔ Restrict application to certain commodities
(steel, aluminum, cement, some chemicals..)
- Boehringer, Carbone and Rutherford (2013): comprehensive BCA shifts more welfare from developing countries than lowers costs

Scope of Applicability: Country-Based Exemptions

- Issues: administrative burden, leakage extent, leverage, CBDR compatibility
- Recommended exemptions for countries with
 - An effective national emissions cap
 - Taking “adequate” national actions other than caps
 - defined to achieve coherence with CBDR and trade law
 - With a sectoral cap, or by some equivalent measures such as export taxes
 - LDCs and LICs if it could be assured that this would be carved out by the WTO’s Enabling Clause;
- All need trans-shipment provisions

Scope of Applicability: Emissions Coverage

- Scope 1 emissions: all direct emissions
- Scope 2 emissions: energy-related indirect emissions
 - those arising from purchased electricity, steam or heat
- Scope 3 emissions: all indirect emissions not covered under scope 2
 - Not recommended: too complicated and minimal leakage

Determining level of adjustment

- Producers should be given the option to provide verified firm-level data on emission intensity
- Benchmarks should be product-specific, and also where appropriate specific to different production processes.
- For scope 1 (direct) emissions, use average emissions intensity in the importing country.
 - Less variance across countries
- For scope 2 emissions, use average emissions intensity in the exporting country.
 - More variance and better data availability
- Financial and technical assistance in accounting, reporting and verification, to assist foreign covered exporters in submitting verified individual data.

Credits against adjustment

- Any free allocation afforded domestic producers
- Carbon prices paid in exporting country
 - If not exempt
- No adjustment for non-price-based policies
 - Can't measure well
 - BCAs adjust for payments on remaining embodied carbon, not abatement costs

Use of Revenues

- Earmarking revenues can help respect CBDR:
 - Refund to exporter (directly or via clean fund)
 - Contribute to internationally administered adaptation fund
 - Disbursed by collecting government in ways that help developing countries cope with climate change
- Any of these probably helps with WTO compatibility
 - helps demonstrate environmental motivation.
- Could also allow exporting country to collect the equivalent revenue itself
 - e.g. in the form of export tax.

Export Rebates

- Not recommended
- Likely to be viewed as illegal subsidies
 - No Article XX exceptions
- Modeling finds import adjustments responsible for most reductions in leakage

Governance Structures

- Pre-establishment: notification for trade partners, meaningful opportunity to comment, adequate lead time.
- Official contact point established
- Methodologies public, predictable
- Calculations, parameters reviewed regularly
- Appellate procedure
- Data reporting follows international norms
- Regular assessment of regime against stated objectives
- Explicit sunset provisions

Conclusion

- BCAs likely to be used in some form
- Trade folks think BCA will be challenged but upheld in WTO
- Questions on role in climate negotiations
- More likely to be accepted and less likely to be abused if some agreement (at least informal) on international norms
 - See report “A Guide for the Concerned”
 - http://www.iisd.org/sites/default/files/pdf/2012/bca_guidance.pdf