



Coping with carbon leakage

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Resources for the Future and *FEEM*

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Towards a Workable and Effective Climate Regime

December 2015, Books



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Carbon Leakage

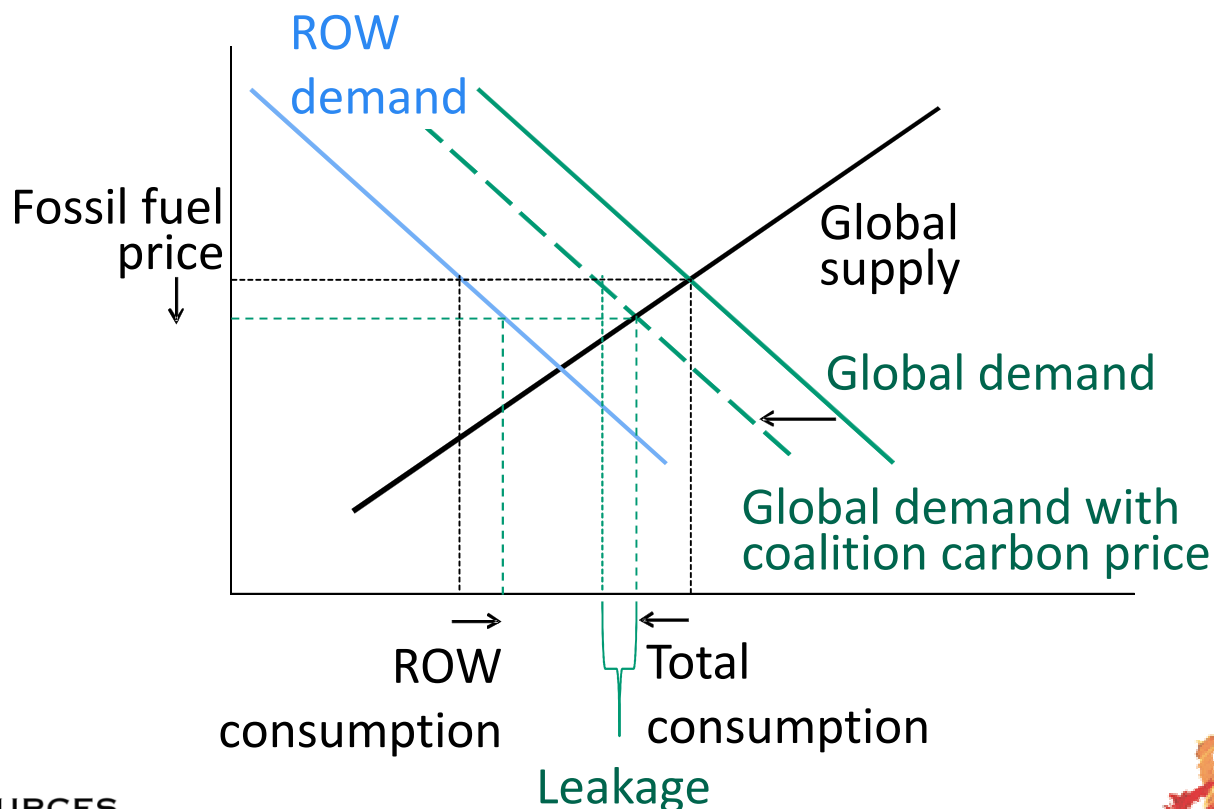
- Increase in foreign emissions as a consequence of domestic regulations
- Important because GHGs are a *global* pollutant



Channels

1. Global energy markets

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



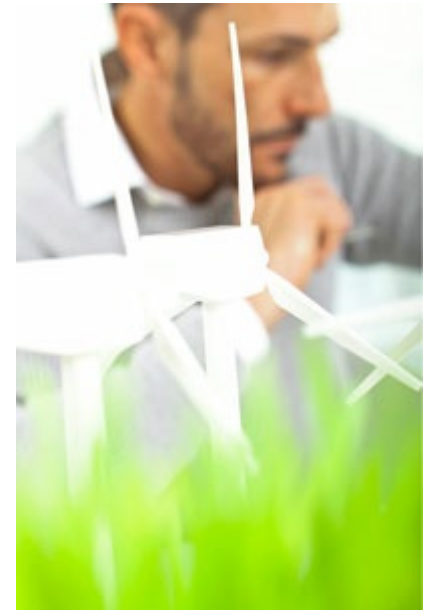
Channels

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 energy elasticity assumptions
- 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” presentation by Withagen

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

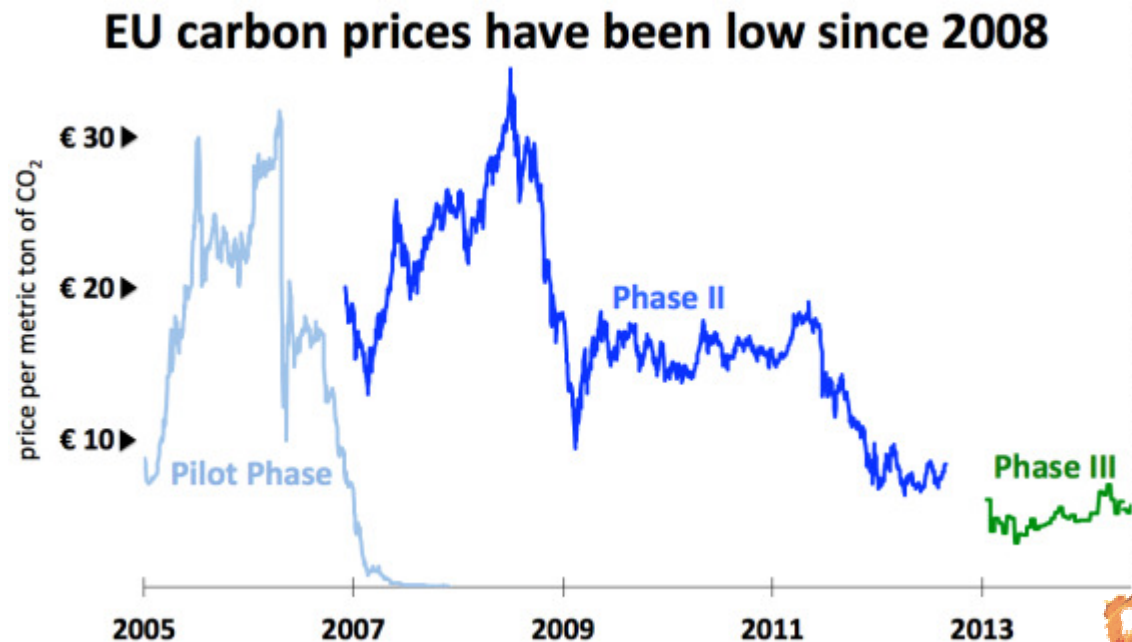
Options for addressing all channels

- 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". The sub-headline reads: "Pioneering deal signed with UN sets up trust fund by wealthy countries worth half expected earnings from potential sale of oil". Below the text is a photograph of two indigenous people from the Huaorani tribe in the Amazon rainforest. To the right of the main 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

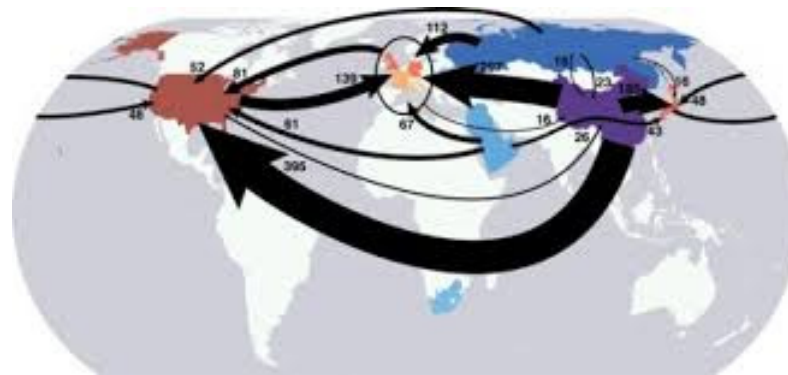
Unilateral options for addressing competitiveness

- 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

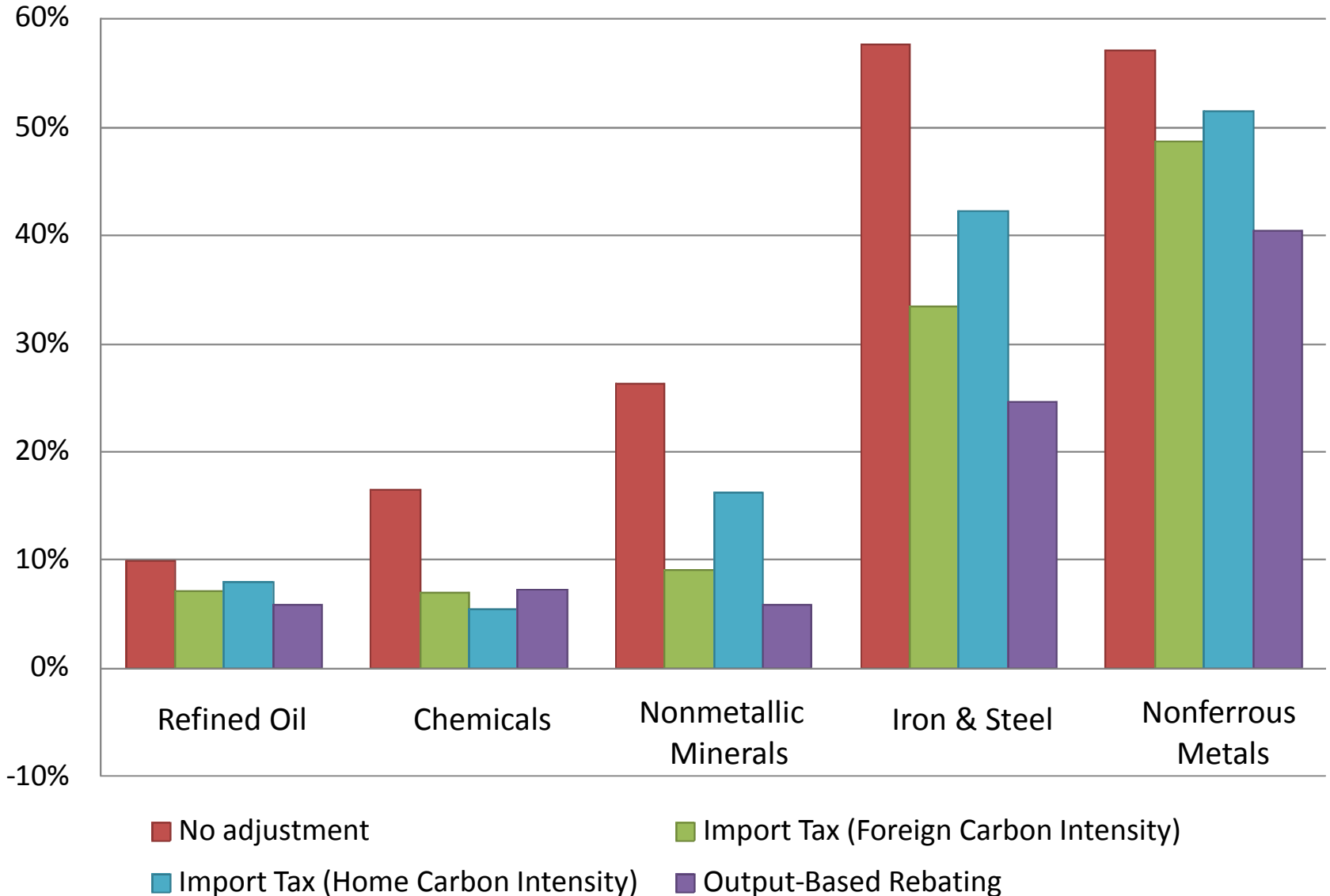
- Exempting susceptible sectors
- Free allocation / “benchmarking”



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

Leakage by Sector

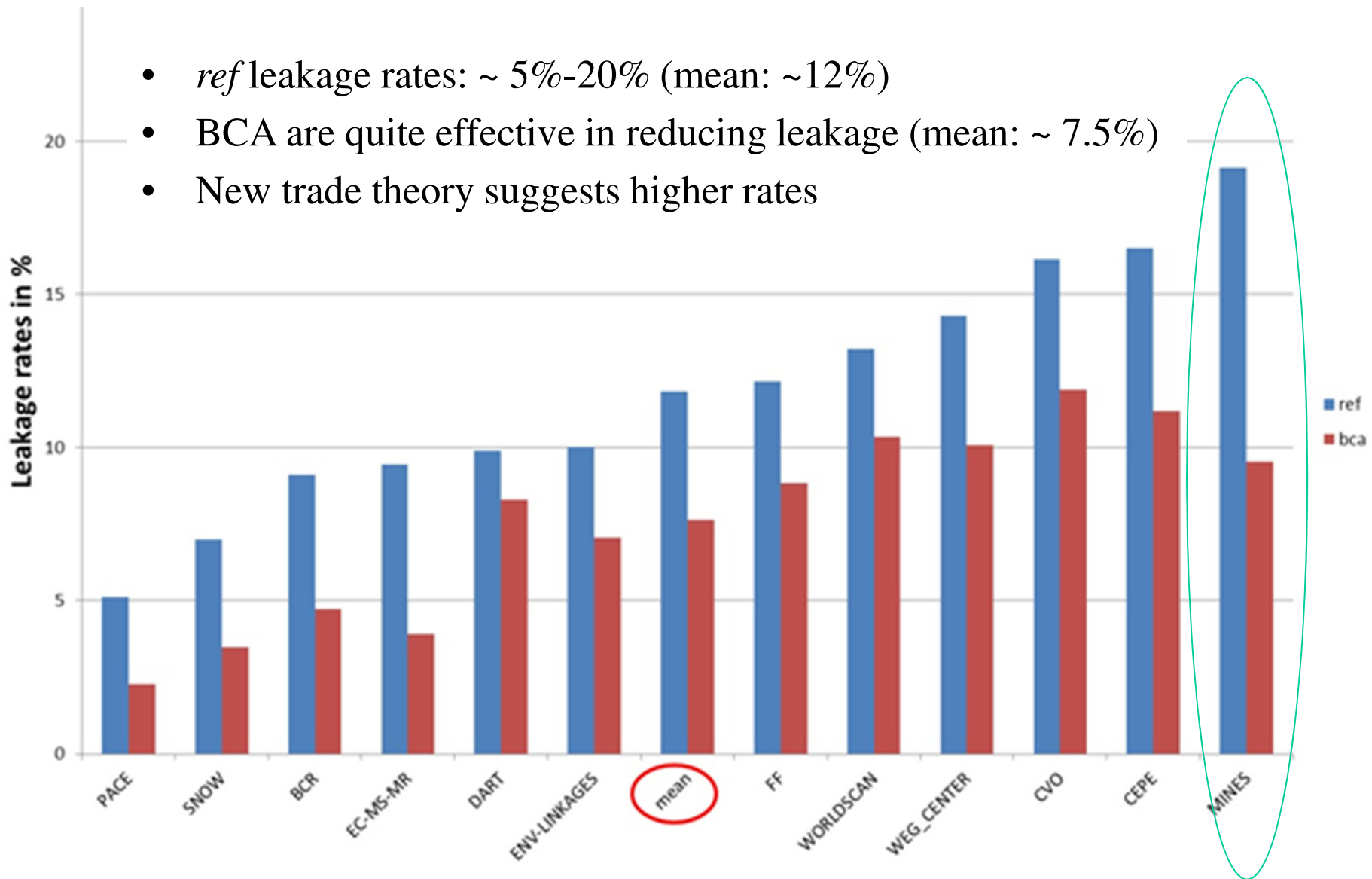
(U.S. Policy; Fischer and Fox 2012, *JEEM*)



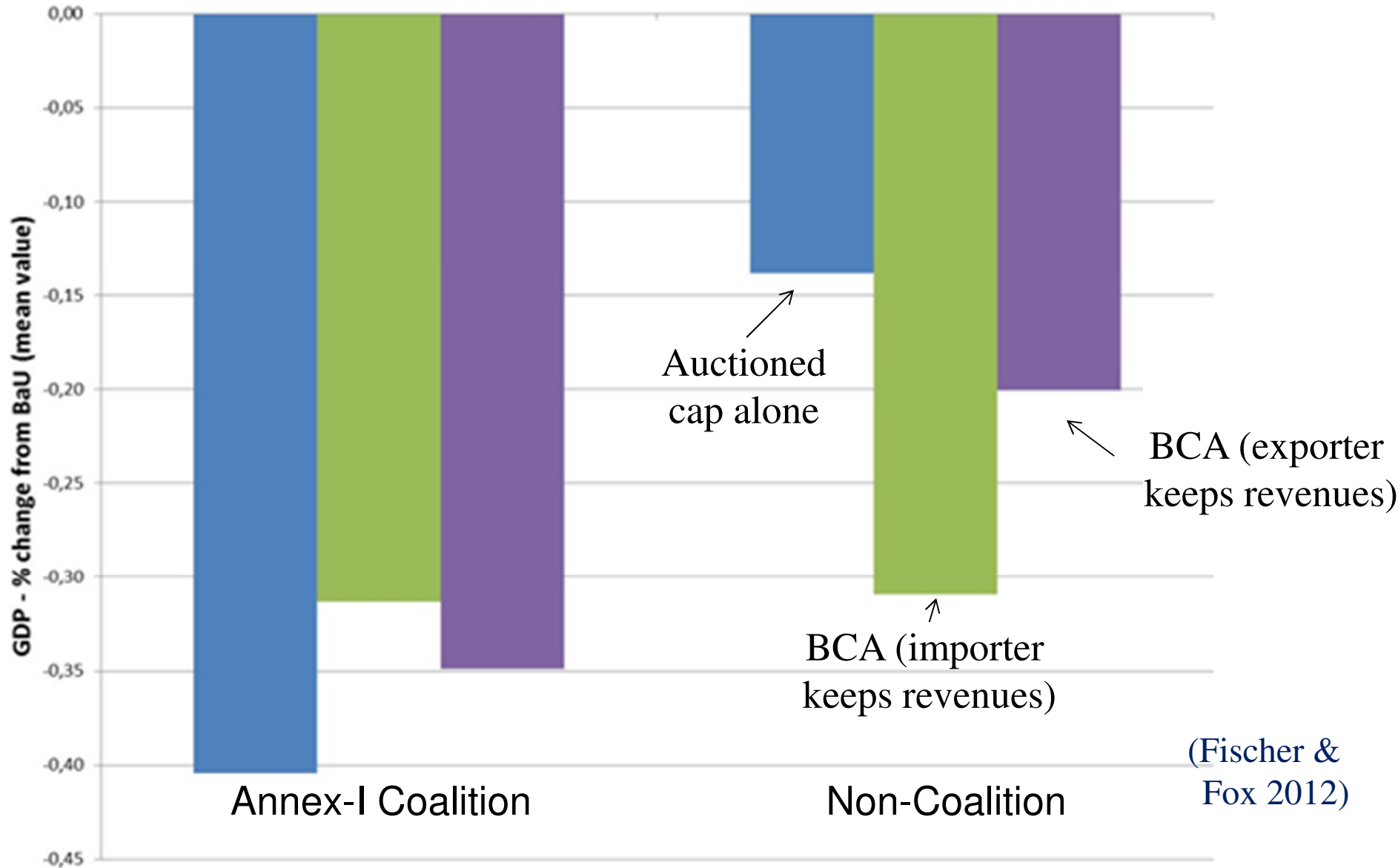
Leakage Rates

(Annex I; EMF study)

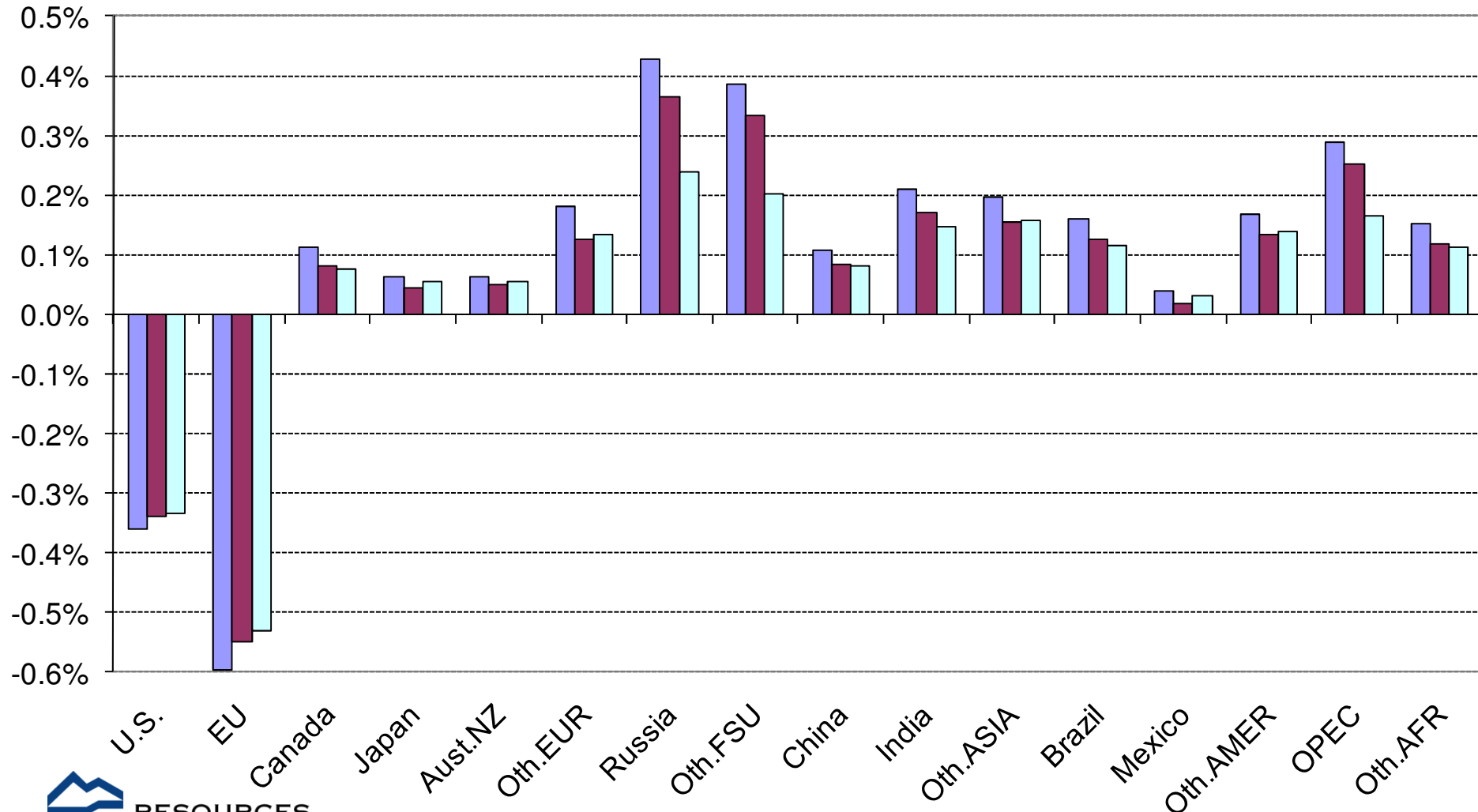
- *ref* leakage rates: ~ 5%-20% (mean: ~12%)
- BCA are quite effective in reducing leakage (mean: ~ 7.5%)
- New trade theory suggests higher rates



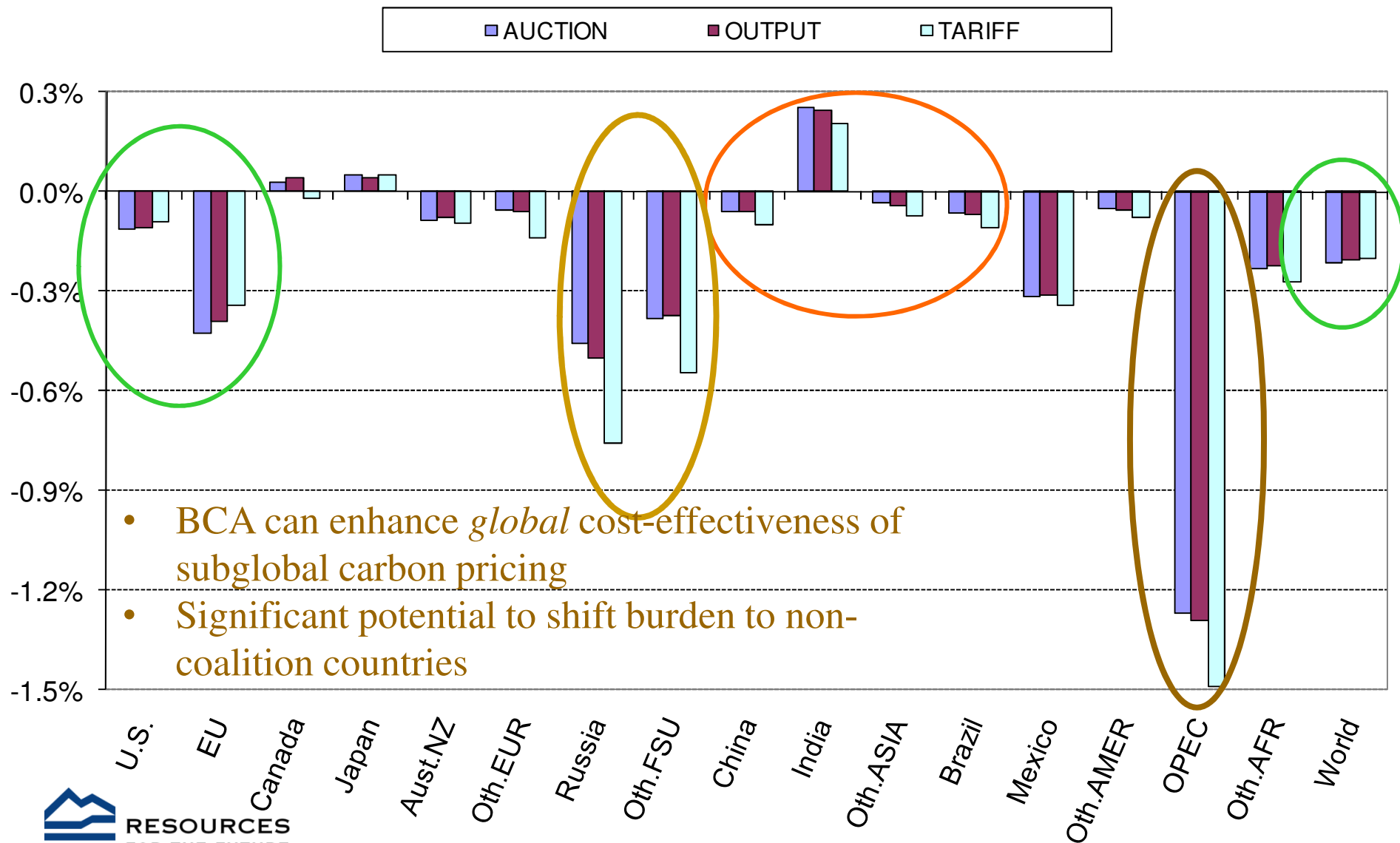
Changes in Burdens: Use of BCA Revenues



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*)



Addressing Competitiveness

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



International legal principles and unilateral measures

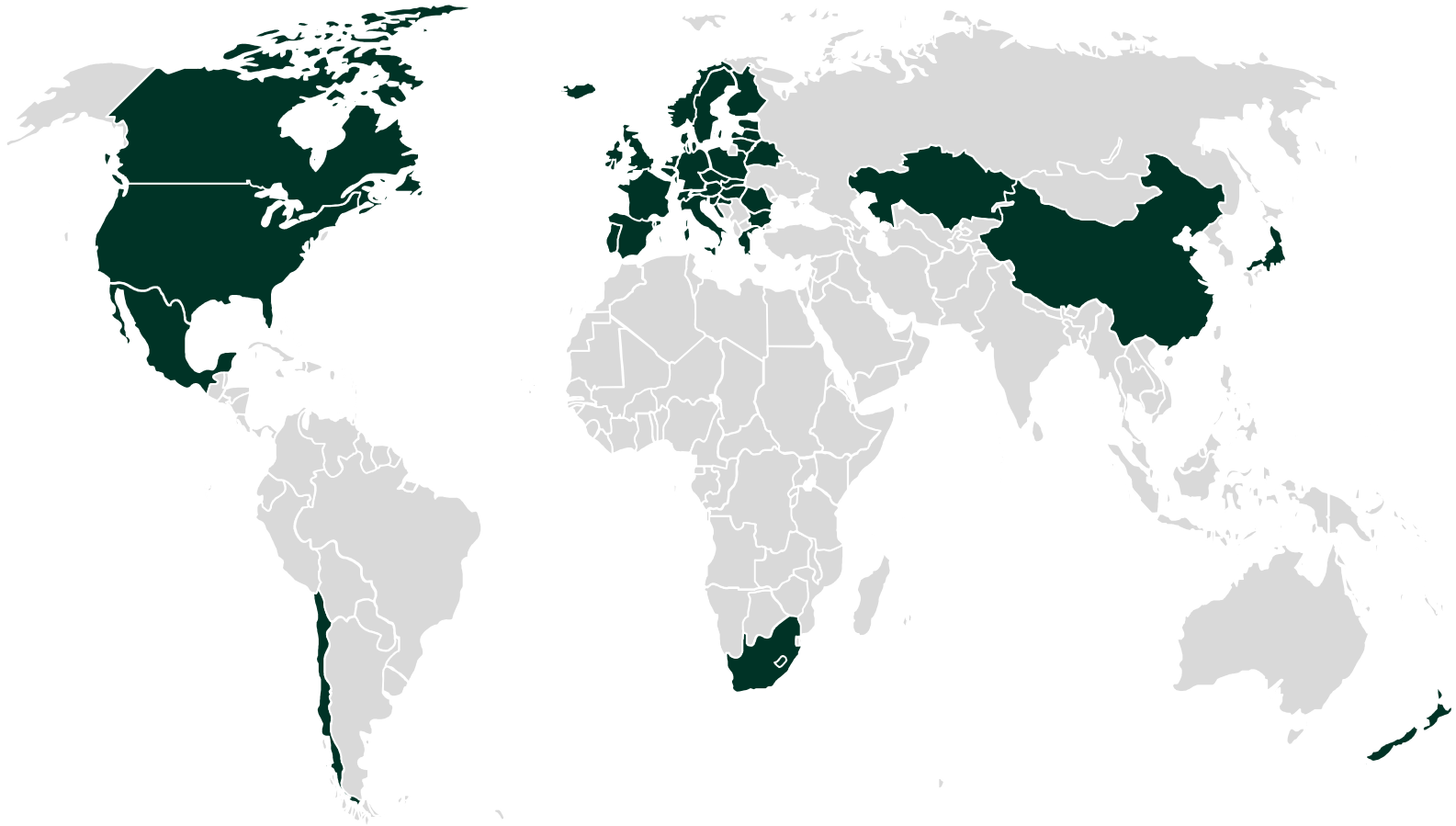
- Common but Differentiated Responsibilities (CBDR)
 - Should not aim to bring about equivalent national policies or unfairly burden LDCs
- WTO Obligations
 - Non-discrimination and most-favored nation principles
 - prohibit discrimination among like goods on the basis of their country of origin
 - Article 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)

Popularity of Renewable Energy Incentives



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

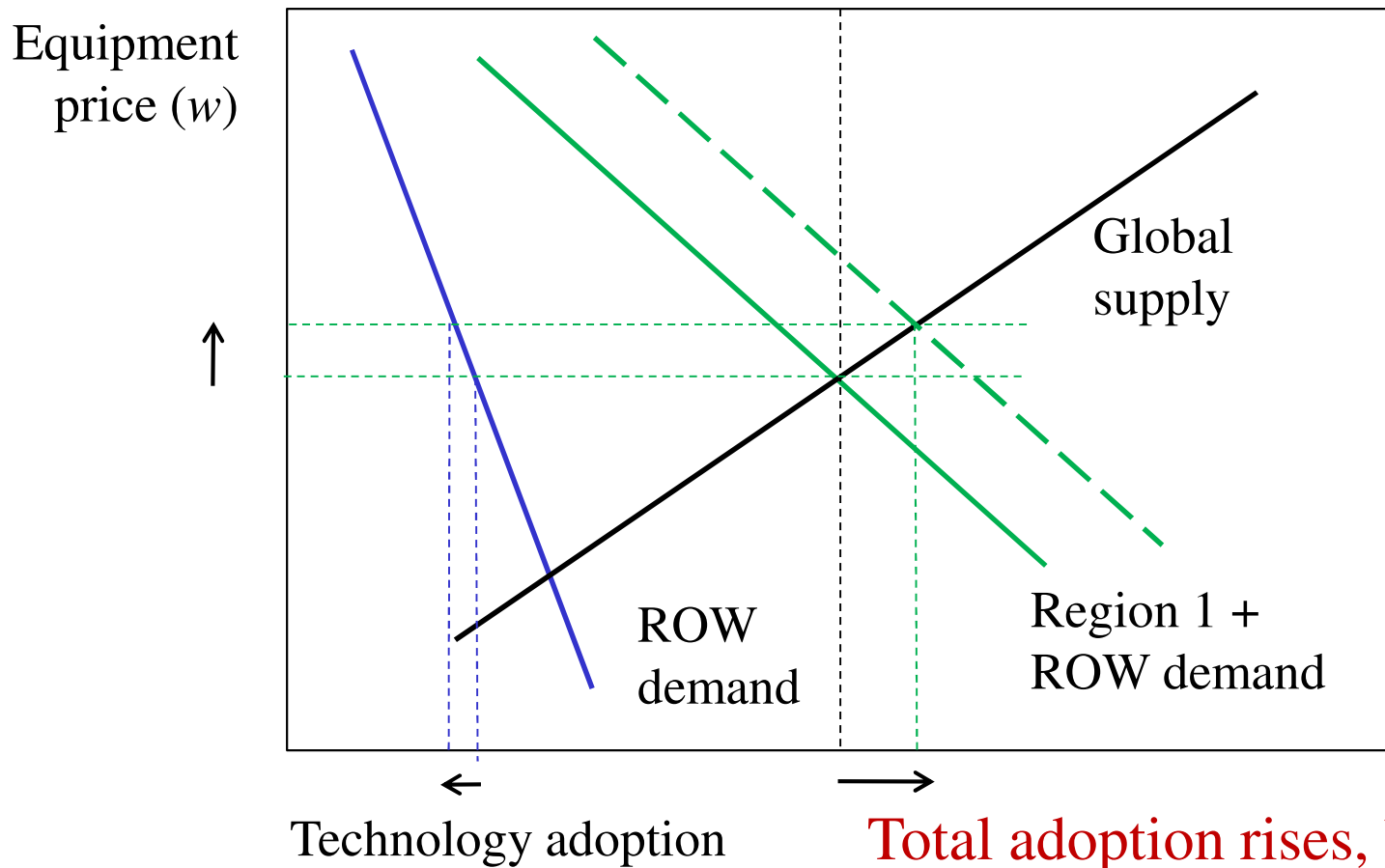
Options for coping with leakage

- 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”

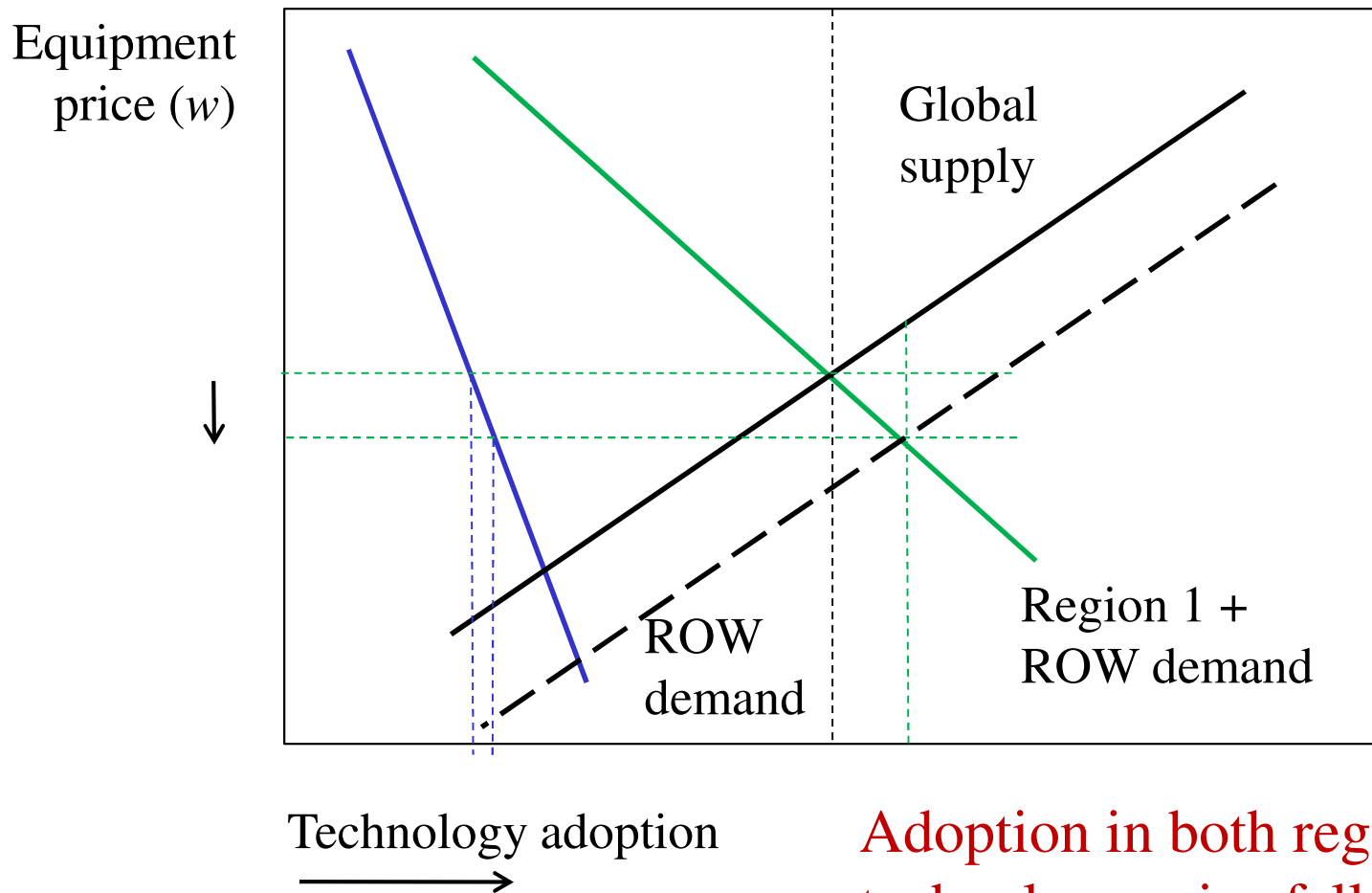
- Rationales for supporting alternative energy technologies, even with carbon pricing
 - Upstream market failures
 - Imperfect competition
 - New industries
 - Patented technologies
 - Network / scale / learning externalities
 - Downstream market failures
 - Unpriced emissions
 - carbon leakage
- Should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

Renewable Technology market: Downstream subsidy



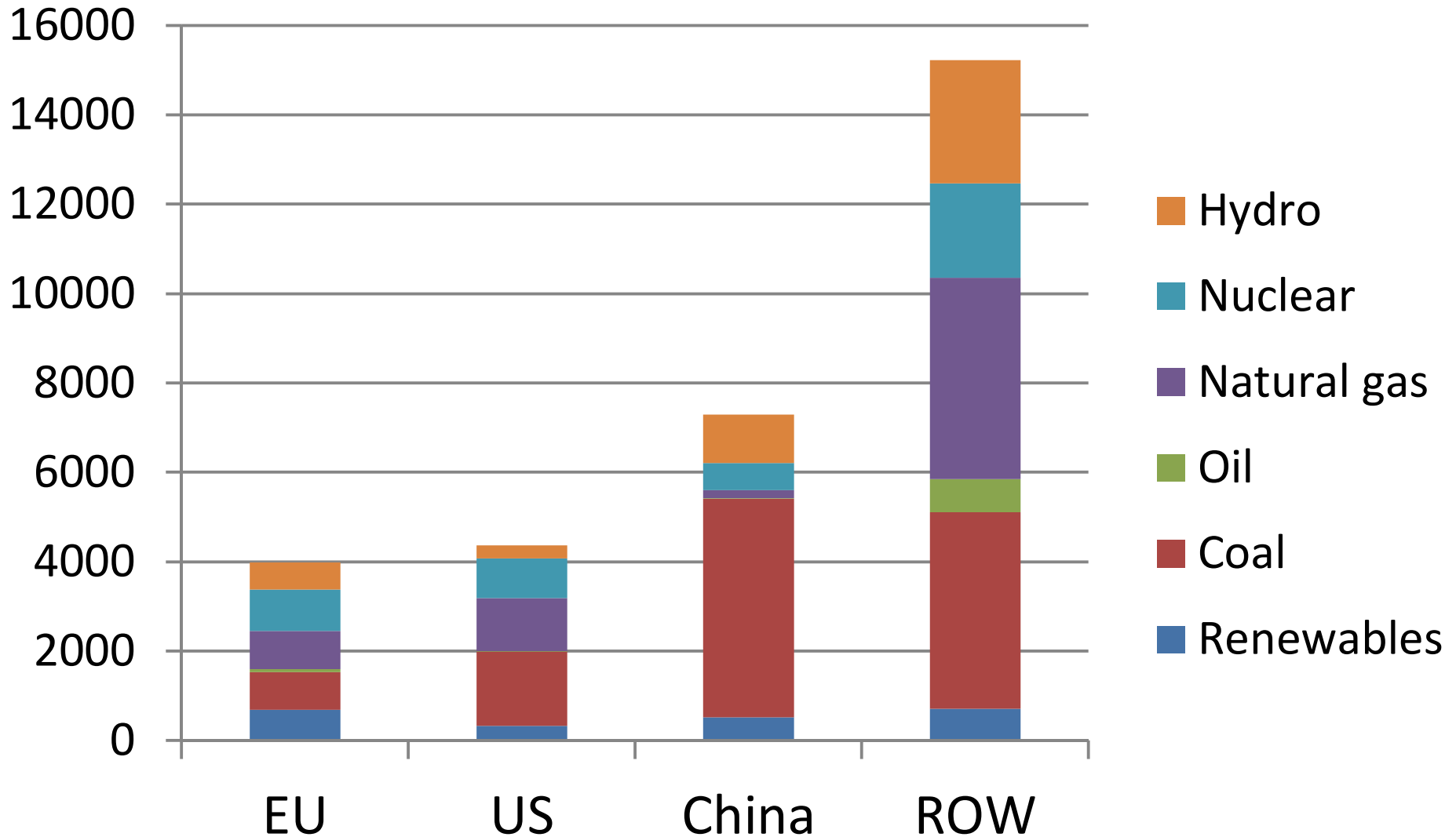
Total adoption rises, but
technology price rises too and
foreign adoption falls

Renewable technology market: Upstream subsidy



Adoption in both regions rises,
technology price falls

Generation in 2020 by source

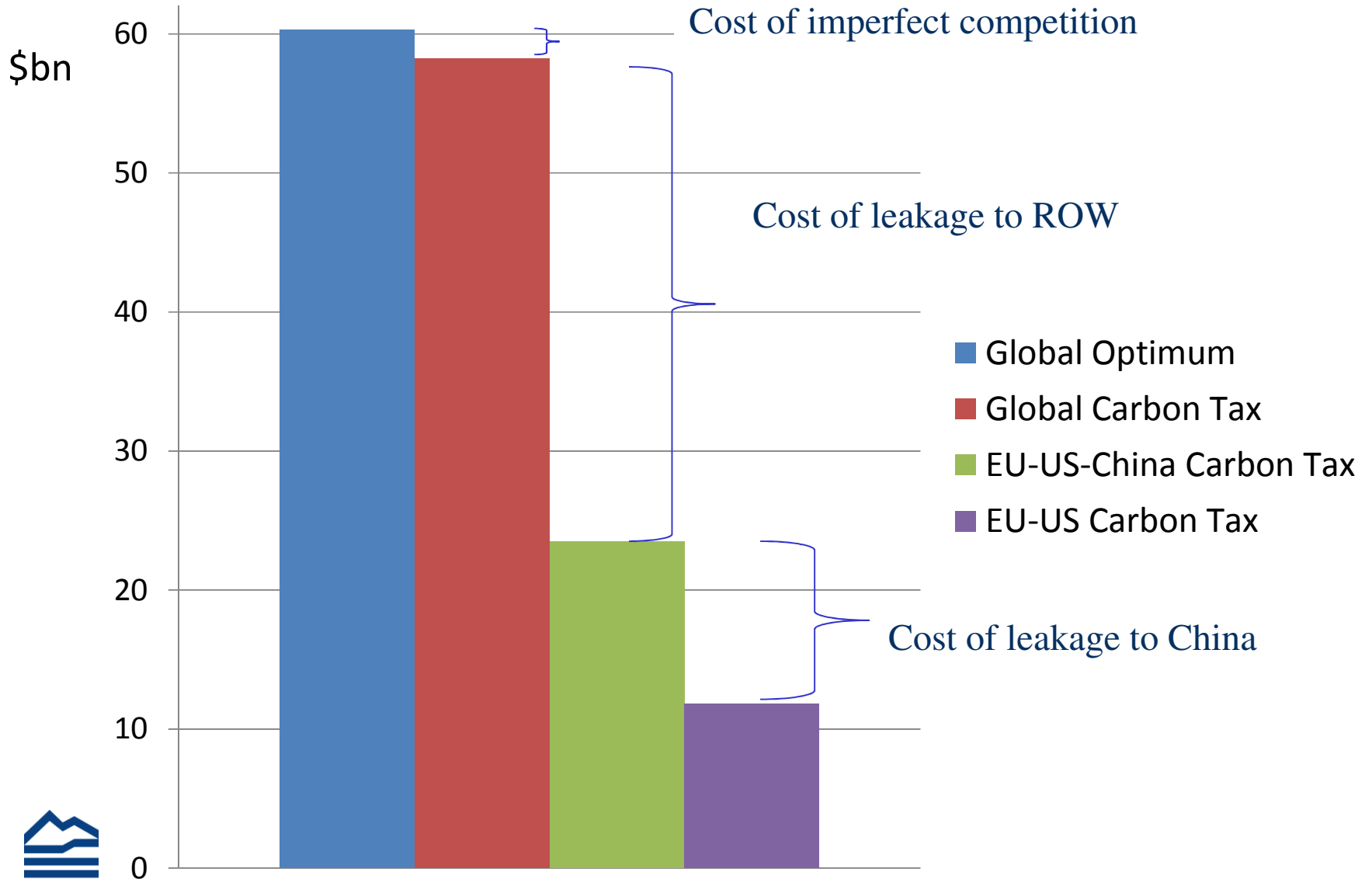


Model setup

- Spencer and Brander with global externality
 - 3 producer regions (US, EU and China) and ROW consumer region
 - Producers have n_i symmetric Cournot competitors
- Partial equilibrium model of electricity sector
 - Based on Fischer, Newell and Preonas (2013) for US, Fischer, Huebler and Schenker (2014) for EU, and IEA for scaling China and ROW
 - Number of Cournot competitors to replicate observed firm market shares of GE and Vestas (~15%) and country shares (EU share twice that of US or China)

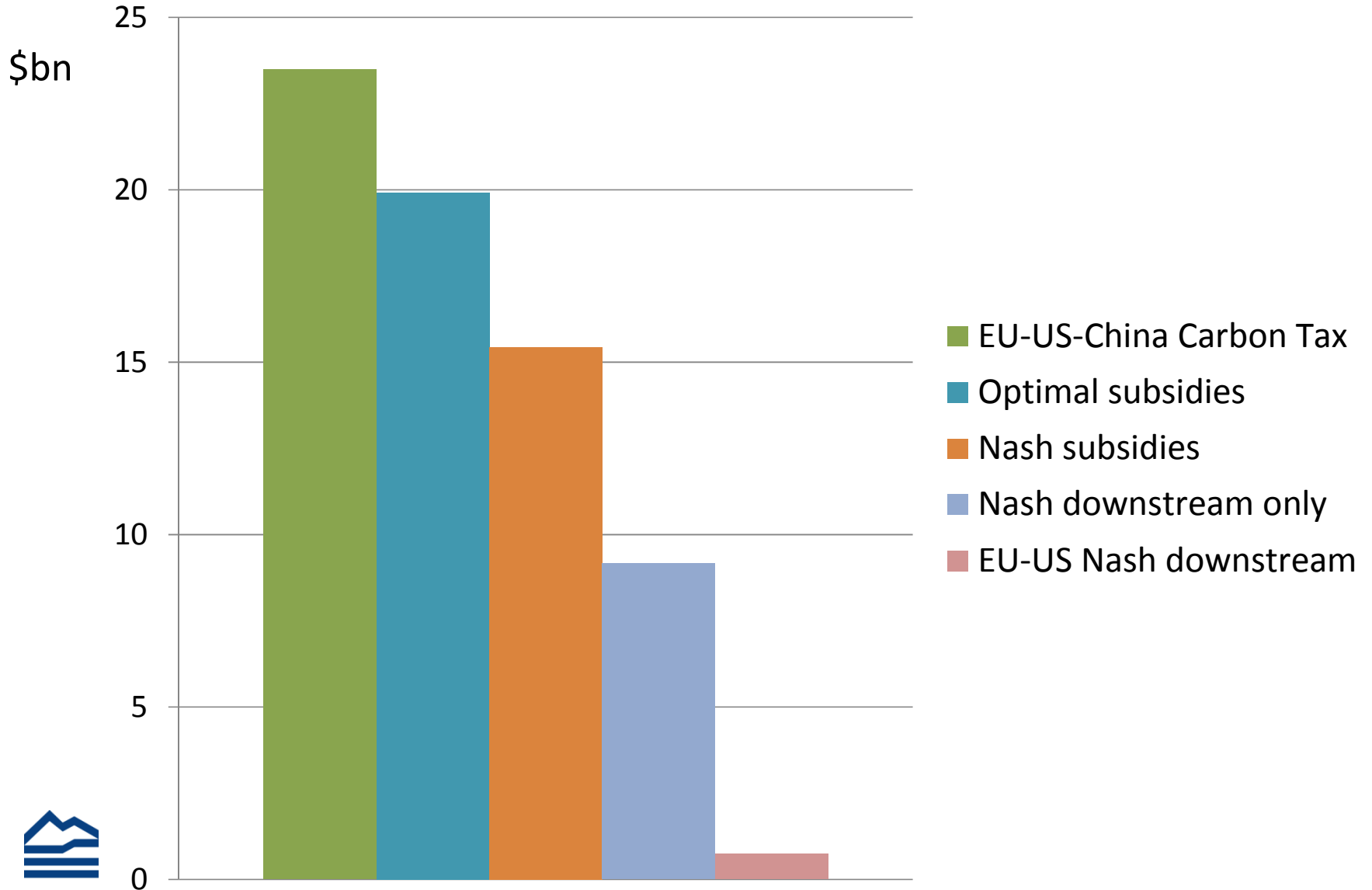
Global welfare change from No Policy

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

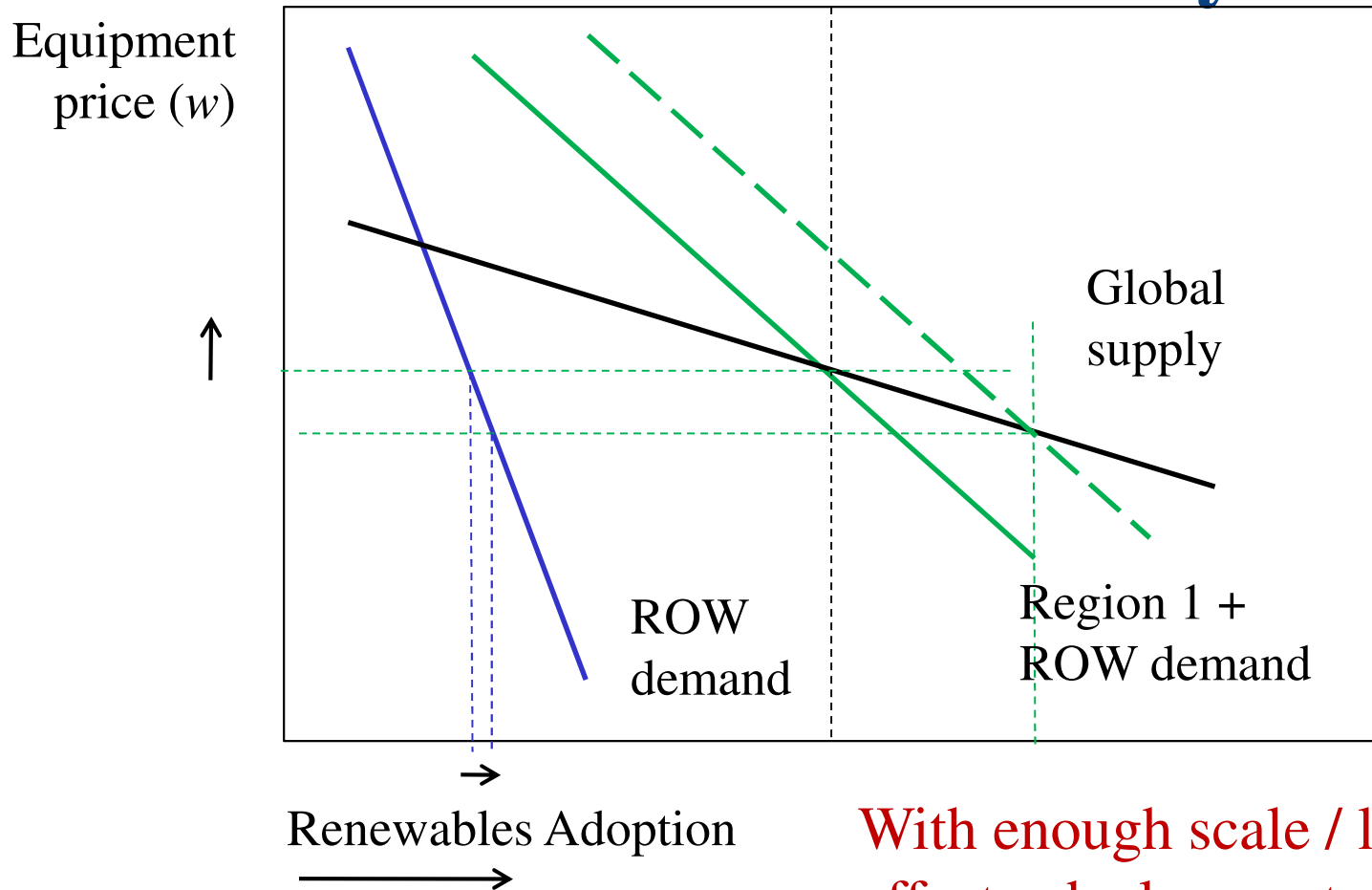


Global welfare change from No Policy

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



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

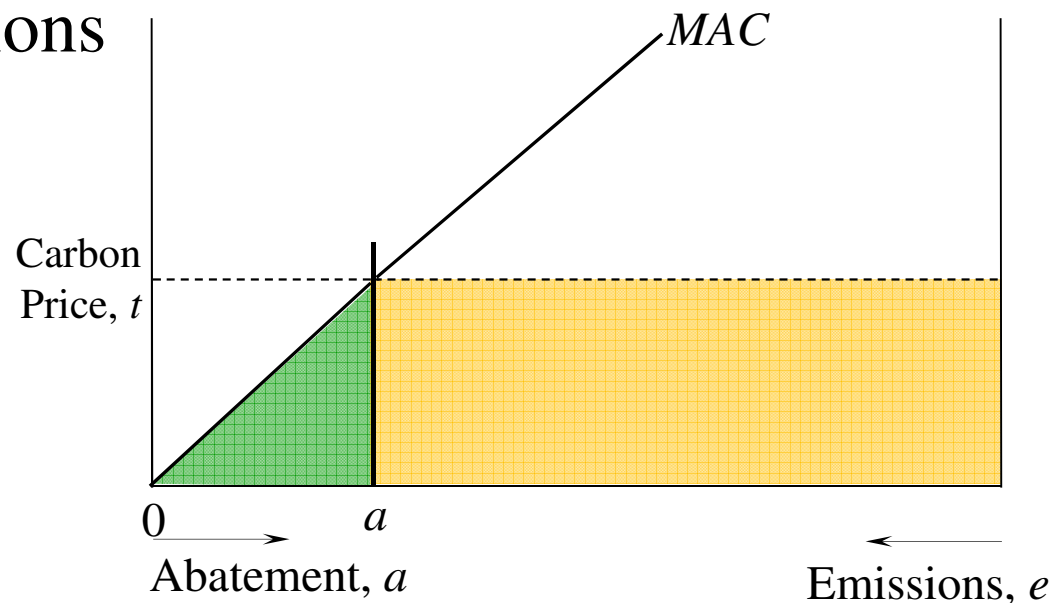


Motivations for BCA

- 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