# Carbon Pricing in Practice: Lessons from International Experience

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Section 10
ECON 1661 / API-135: Spring 2022

April 8, 2022

# Announcements

- Office hours today from 3:00-5:00pm EDT
- Problem set #4 due next Wednesday, April 13 at 12:00pm EDT
- Final exam: Saturday, May 7 from 9:00am - 12:00pm EDT in Science Center D

# Outline

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- Both have key attributes that make them less costly than alternative policies:
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  - Encourage conservation (demand-side responses)
  - (Possibly) generate revenue

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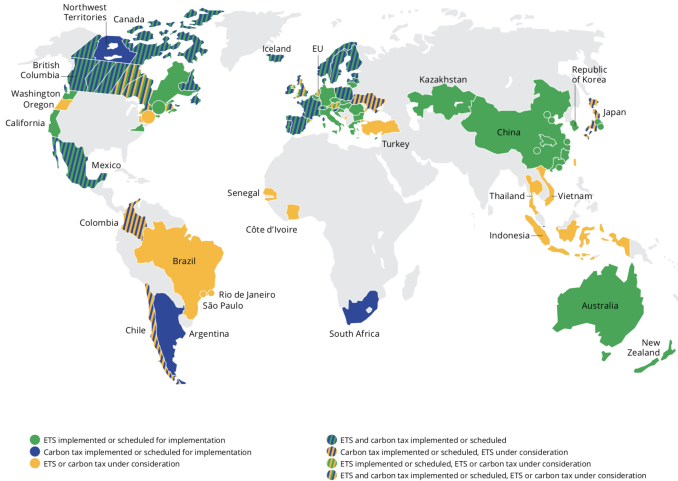
- False dichotomy in practice: specific design of carbon taxes and cap-and-trade programs is more consequential than the choice between the two instruments

# Carbon pricing in practice




- Through 2020: 61 carbon pricing initiatives implemented/scheduled
- 31 ETS, 30 carbon taxes
- 46 national, 32 subnational jurisdictions
- Covers 22% of global GHG emissions (12 $GtCO_2e$)

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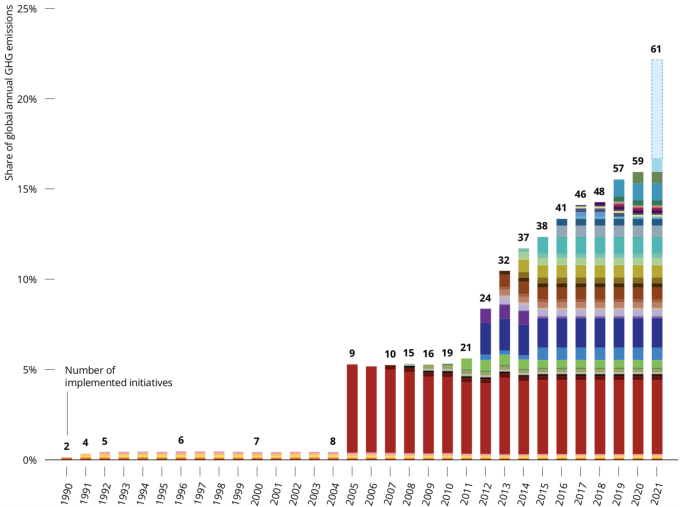


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# Lessons from experience

Today we will examine more closely what we have learned from carbon pricing in practice in terms of the following:

1. Leakage and competitiveness concerns
2. Distributional impacts
3. Political economy

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1. Leakage and competitiveness concerns $\longrightarrow$ *RGGI, EU ETS+*
2. Distributional impacts $\longrightarrow$ *RECLAIM, AB-32*
3. Political economy $\longrightarrow$ *British Columbia, Washington State*

# Outline

# Leakage and competitiveness concerns

- Emissions leakage: carbon pricing (or any policy inreasing the shadow price on $CO_2$ emissions) can lead to increased emissions in regions not covered by the policy
  - $\rightarrow$ Reduces effectiveness of the policy: some emissions reductions achieved by policy are offset by increases elsewhere

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- What is going on? Economic activity in the regulated region being displaced by economic activity in a non-regulated region
  - Cost of inputs increase under climate policies, reducing competitiveness of firms subject to the policy relative to firms in other jurisdictions
  - Economic activity (and emissions) shift to other areas, particularly in emissions-intensive/tradable sectors
  - Related concept: "pollution haven hypothesis"

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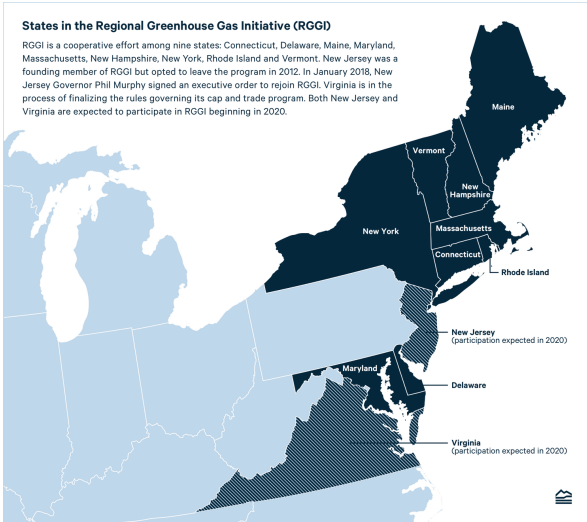
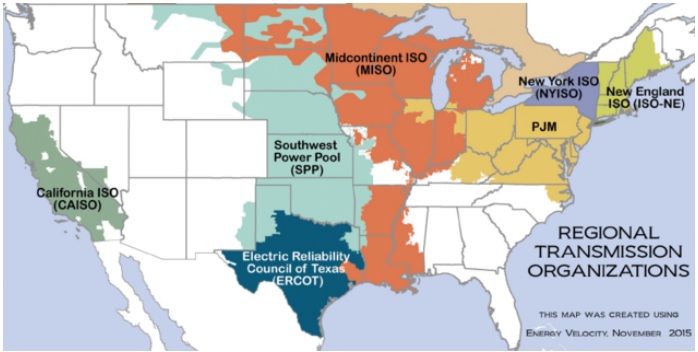
- How important is leakage in practice?
  - What are the competitive effects of carbon pricing?
  - What can we do to reduce leakage/competitiveness concerns?

# Regional Greenhouse Gas Initiative (RGGI)




- Covers 11 states in U.S.
- Compliance obligation began in 2009
- Cap-and-trade program covering power sector $CO_2$ emissions
- Initial permits allocated via auction
- Modest, but increasing stringency

# Leakage under RGGI: Fell and Maniloff (2018)[1]




- Use electricity market data for U.S. to examine impact of RGGI on generation
- RGGI led to a reduction in coal-fired generation in RGGI states and an increase in natural gas generation in surrounding region
- Leakage to Ohio and Pennsylvania led to nearly 50% leakage rate

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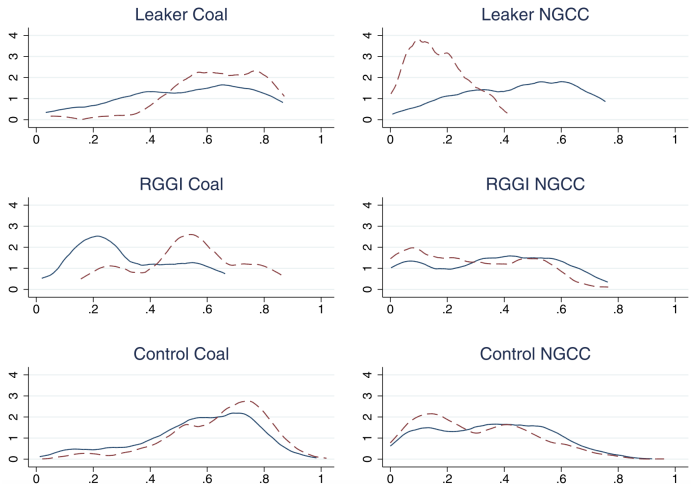


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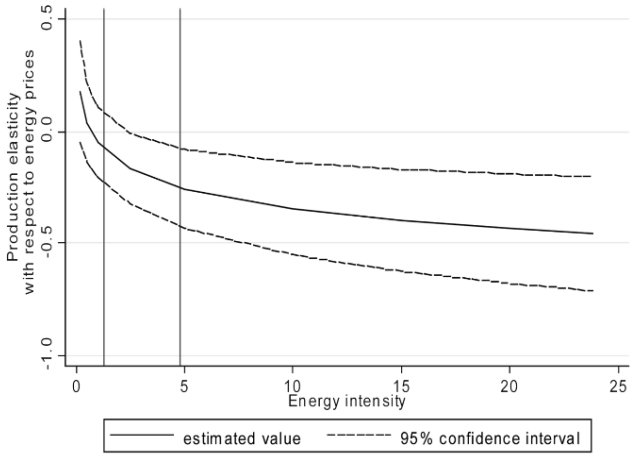
# Competitiveness concerns: industry-level evidence[2]




- Estimate effect of energy prices on production and net imports for 450 US manufacturing industries over 35 years
- Change in net imports = competitiveness effects for an industry
- Simulate \$15/ton $CO_2$ price
- Find that competitiveness effects are small: consistently no more than 1% of production

[2] Aldy, J.E. and W.A. Pizer. 2015. "The Competitiveness Impacts of Climate Change Mitigation Policies." *JAERE*, 2(4): 565-595

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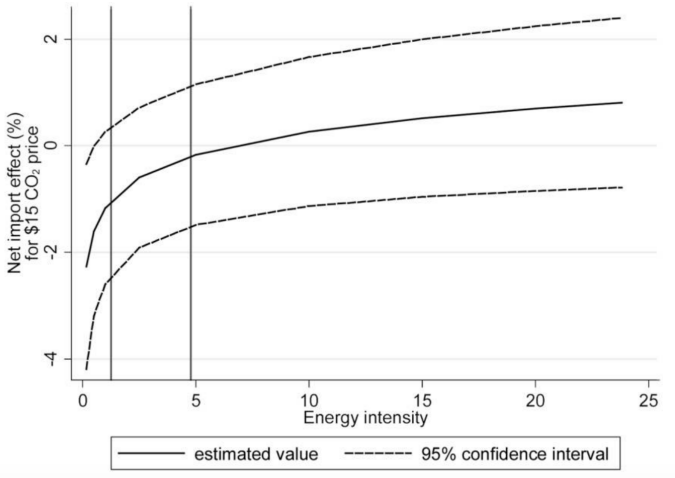


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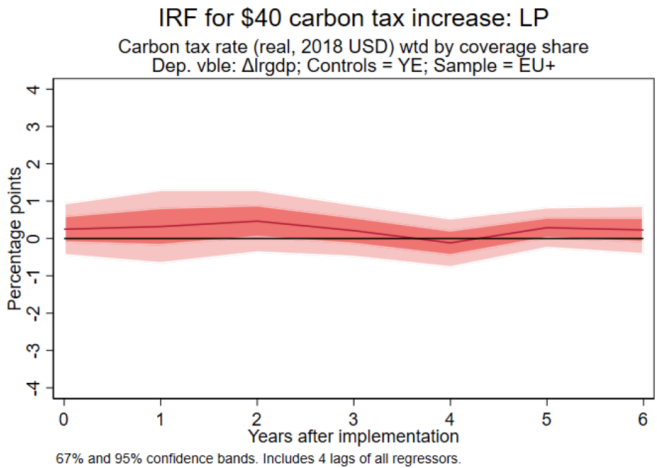


- Of 31 EU ETS countries, 15 have carbon tax in place
- Use variation in taxes to examine impact of tax level on GDP
- Find positive effect of tax on emissions reductions; estimate zero impact on GDP and total employment growth rates
- Potential driver: revenue use to offset other distortionary taxes

[3] Metcalf, G.E. and J.H. Stock. 2020. "The Macroeconomic Impact of Europe's Carbon Taxes." NBER Working Paper No. 27488.

# Addressing leakage/competitiveness concerns

- Leakage can be a substantial concern, particularly with small jurisdictions; competitiveness concerns may be large for certain (politically important) sectors

[4] Palmer, K., D. Burtraw, A. Paul and H. Yin. 2017. "Using Production Incentives to Avoid Emissions Leakage." *Energy Economics*, 68: 45-56.

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  - Examine the use of emissions allowances as production incentives to reduce leakage under the proposed Clean Power Plan (US)
  - Free allocation using fixed amounts can lead to severe leakage
  - Output based free allocation can reduce leakage by up to 70%

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- Fischer and Fox (2012)[5]:
  - Examine the impact of border adjustments and output-based rebates on leakage
  - Find that all policies help domestic production, but do not fully address environmental impacts of leakage
  - Across sectors in the US, Canada, and Europe, simulations suggest full border adjustment and output-based rebates are most effective

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# Outline

# Distributional effects of market-based environmental policy

- Environmental justice movement concerned with disproportionate burdens from environmental harms on low-income and minority communities
  - Section 7 discussed environmental justice in detail, including potential causes of disproportionate exposures
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  → Equity implications of market-based environmental policies depend on location of facilities with different marginal abatement costs

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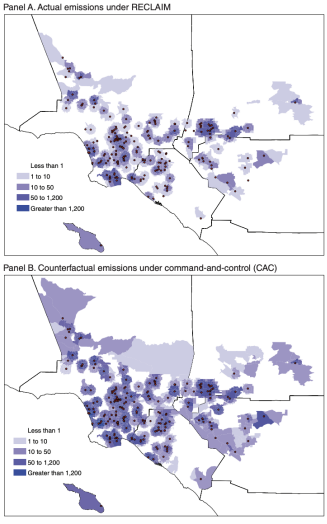
- Market-based instruments do not guarantee emissions reductions in all communities
  → Equity implications of market-based environmental policies depend on location of facilities with different marginal abatement costs

- GHGs are global pollutants so what do you mean by disproportionate exposure?
  → Remember the importance of correlated local air pollutants!

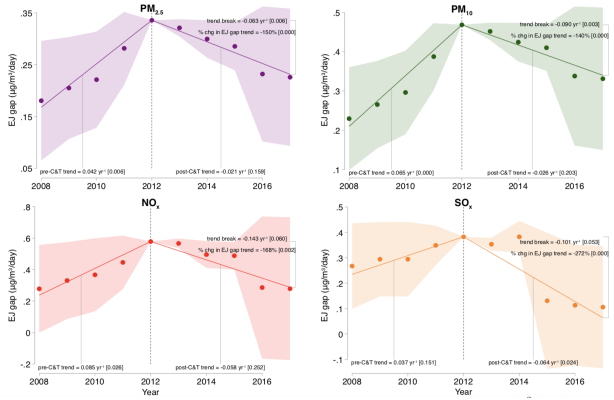
# Non-climate C&T example: Fowlie et al. (2012)[6]




- RECLAIM: $NO_x$ cap-and-trade program covering 392 facilities in southern California
- Introduced in 1994, reduced aggregate emissions cap by 70% in first 10 years
- Find that emissions fell 20% on average at RECLAIM facilities
- No relationship between emissions changes and demographic characteristics

[6] Fowlie, M., S.P. Holland, and E.T. Mansur. 2012. "What Do Emissions Markets Deliver and to Whom? Evidence from Southern California's $NO_x$ Trading Program." *American Economic Review*, 102(2): 965-993.

# Distributional impact of AB-32: Hernandez-Cortes and Meng (2021)[7]




- Calculate gap in exposure to correlated air pollutants between "disadvantaged" and non-disadvantaged communities
- Estimate facility-level emissions effect of AB-32 C&T program
- Use this to estimate zip code level changes in emissions
- Find that the EJ gap has fallen after the introduction of AB-32 C&T program

[7] Hernandez-Cortes, D. and K.C. Meng. 2021. "Do Environmental Markets Cause Environmental Injustice? Evidence from California's Carbon Market." NBER Working Paper No. 27205.

# Distributional effects of market-based climate policy

- Appear to have been positive EJ effects of California's C&T program
  - Fowlie et al. (2012) and Shapiro and Walker (2021) find evidence to suggest that environmental markets do not substantially alter the equity of environmental exposures
- But this result is driven by the state's spatial distribution of polluting facilities and demographic characteristics
- In other settings, an environmental market could widen the EJ gap.
- More broadly, carbon pricing policies are intended to achieve allocative efficiency in $CO_2$ abatement; should not be used to explicitly addresss EJ concerns
- Other important distributional effects to consider as well, e.g., changes in employment

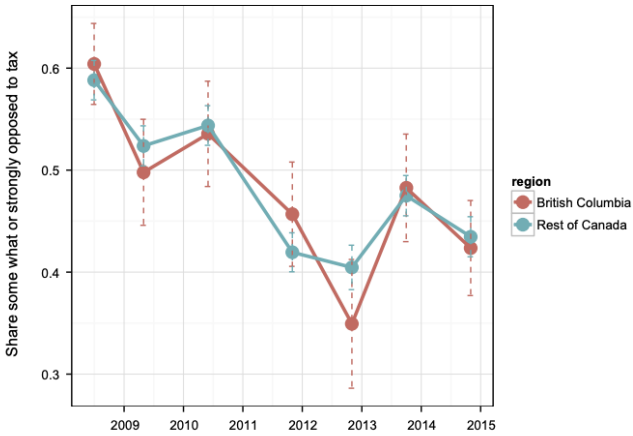
# Outline

# Politics of carbon pricing

- Hopefully you've noticed an important link between the economics and politics of carbon pricing
  - → The economic perspective helps to explain key political dynamics, particularly with distributional issues (e.g., competitiveness concerns, EJ impacts)
  - → But economists' solutions not always the most politically feasible or appealing

- Many political factors with carbon pricing come down to the distribution of costs (e.g., competitiveness concerns!)
  - → This is in part why the use of any revenues can play a large role in the political acceptability of carbon pricing

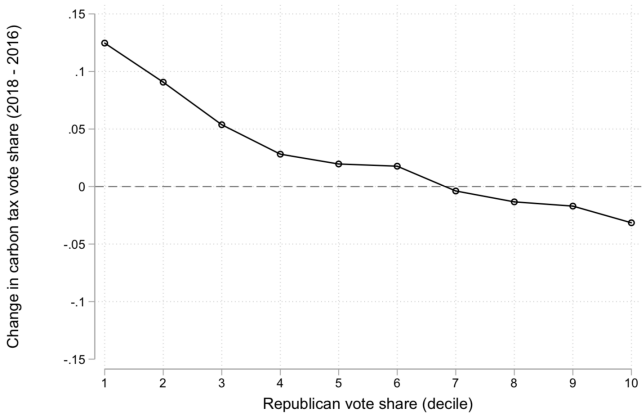
# British Columbia carbon tax: Murray and Rivers (2015)[8]




- British Columbia implemented carbon tax in 2008
- Tax rate of C\$30/t$CO_2$ by 2012, covering 3/4 of emissions
- Reduced emissions by 5-15%; negligible macroeconomic effects
- Support for tax has increased over time
  - Driven by emissions or negligible economic costs?
  - Change in revenue use?

[8] Murray, B. and N. Rivers. 2015. "British Columbia's revenue-neutral carbon tax: A review of the latesst "grand experiment" in environmental policy." *Energy Policy*, 86: 674-683.

# Washington State carbon tax initiatives: Anderson et al. (2019)[9]




- Study failed carbon tax initiatives in Washington State in 2016 and 2018
- Two policies primary difference was in revenue use
- Find that conservatives preferred the 2016 revenue-neutral policy while liberals preferred the 2018 green-spending policy
- Ideology more important: explains 91% of variation in vote

[9] Anderson, S., I. Marinescu and B. Shor. 2019. "Can Pigou at the Polls Stop Us Melting the Poles? NBER Working Paper 26146.

# Concluding thoughts

- With 61 carbon pricing initiatives implemented or scheduled, much has been learned from experience

- "Key Takeaways" from Prof. Stavins' lecture slides (Modules 9 and 10) offer a helpful starting point for general lessons
  - If you have made it this far, I also encourage you to read: Schmalensee and Stavins (2017) and Stavins (2020) [both Week 10 assigned readings!]

- Broader point: while the important underlying economic principles hold in all settings, many of what are ultimately the most important political factors are context-specific
  → E.g., the importance of leakage/competitiveness concerns, the potential EJ impacts

- Paying attention to these context-specific factors, the distribution of costs, and the use of revenues in designing carbon pricing systems can play a large role in political acceptance