Carbon Pricing in Practice: Lessons from International Experience

Jacob Bradt
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

Outline

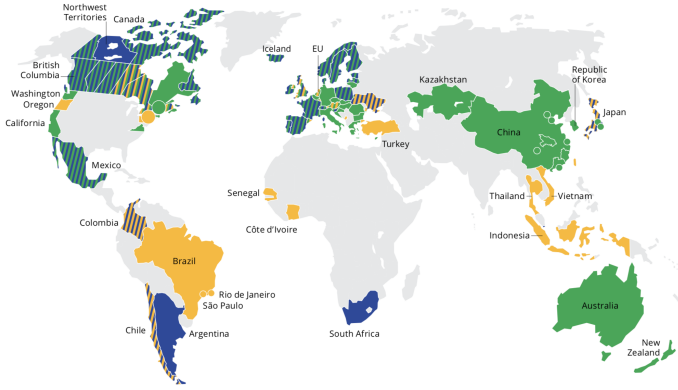
Review: carbon pricing instruments

- At a high level:
  - A carbon tax is a price set per ton of carbon or, more commonly, per ton of CO_2 emitted
  - A cap-and-trade program limits the total amount of CO_2 that can be emitted by certain facilities by issuing a fixed number of emissions allowances (permits)

- Both have key attributes that make them less costly than alternative policies:
  - Provide abatement flexibility
  - Achieve least-cost abatement (equal marginal costs of abatement)
  - Encourage conservation (demand-side responses)
  - (Possibly) generate revenue

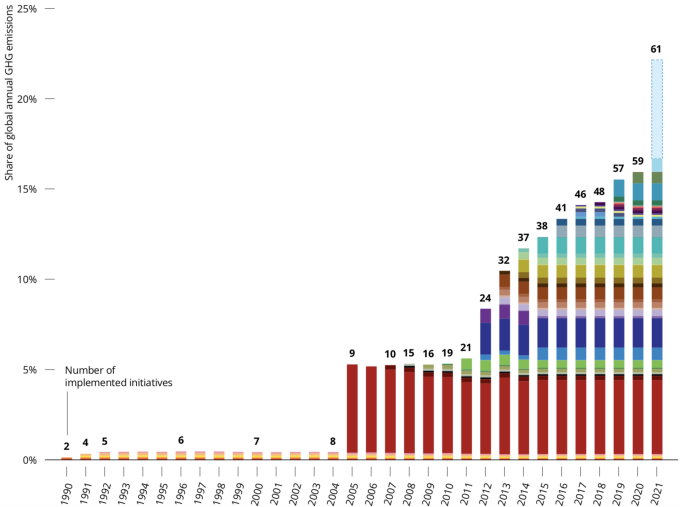
- False dichotomy in practice: specific design of carbon taxes and cap-and-trade programs is more consequential than the choice between the two instruments

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 $GtCO_2e$)

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 $GtCO_2e$)

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

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

Outline

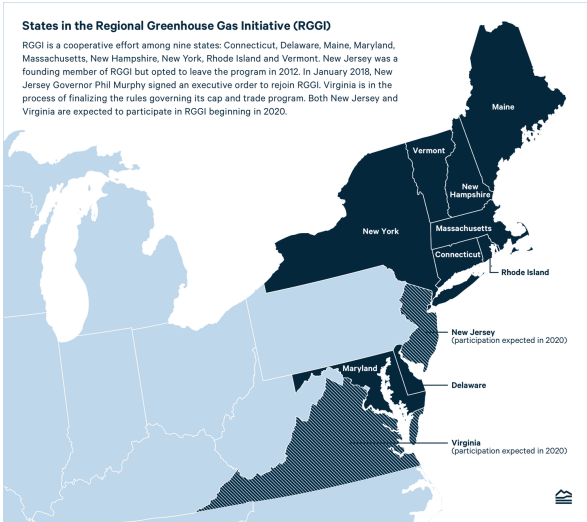
Leakage and competitiveness concerns

- 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
  - → Reduces effectiveness of the policy: some emissions reductions achieved by policy are offset by increases elsewhere

- 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"

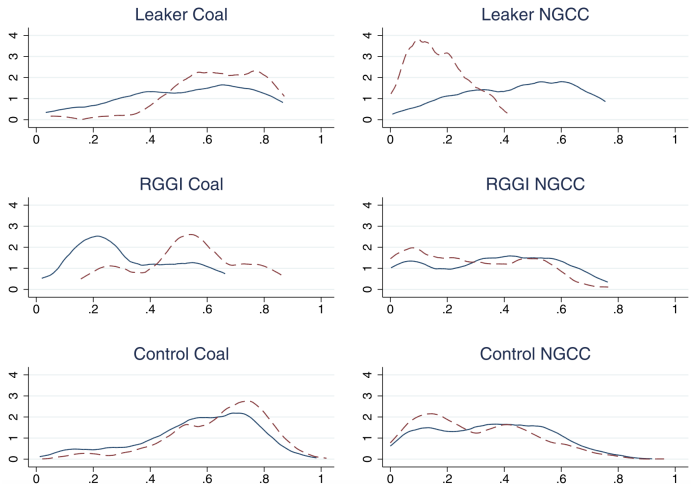
- How important is leakage in practice?
  - What are the competitive effects of carbon pricing?
  - What can we do to reduce leakage/competitiveness concerns?

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

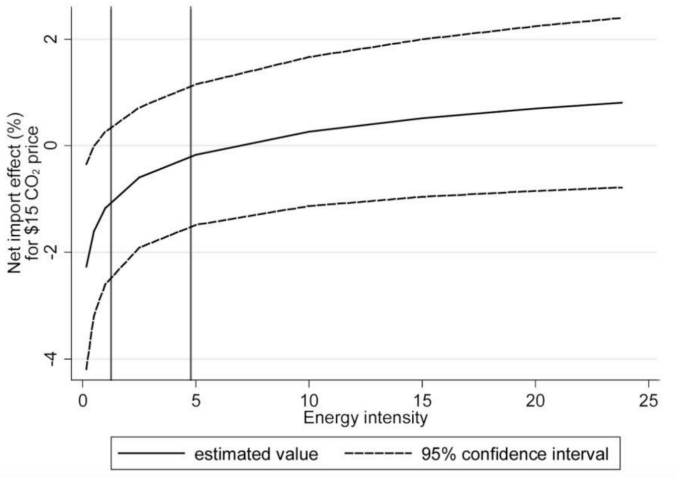
Leakage under RGGI: Fell and Maniloff (2018)[1]



- 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

[1] Fell, H. and P. Maniloff. 2018. "Leakage in regional environmental policy: The case of the regional greenhouse gas initiative." *Journal of Environmental Economics and Management*, 87: 1-23.

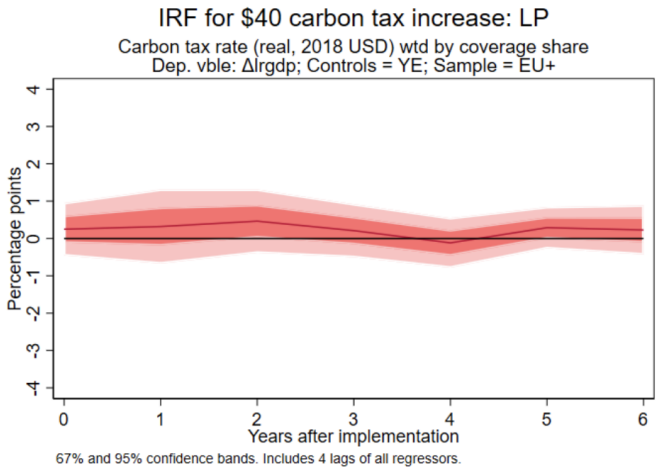
Competitiveness concerns: industry-level evidence[2]



- 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

Competitiveness concerns: macroeconomic evidence[3]



- 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

- Palmer et al. (2017)[4]:
  - 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%

- 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

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

[5] Fischer, C. and A.K. Fox. 2012. "Comparing policies to combat emissions leakage: Border carbon adjustments versus rebates." *JEEM*, 64: 199-216.

Outline

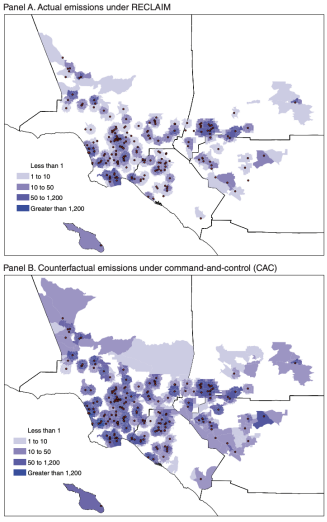
Distributional effects of market-based environmental policy

- 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
  - Today, focused on the potential for policy—particularly market-based climate policy—to drive disproportionate exposure

- 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!

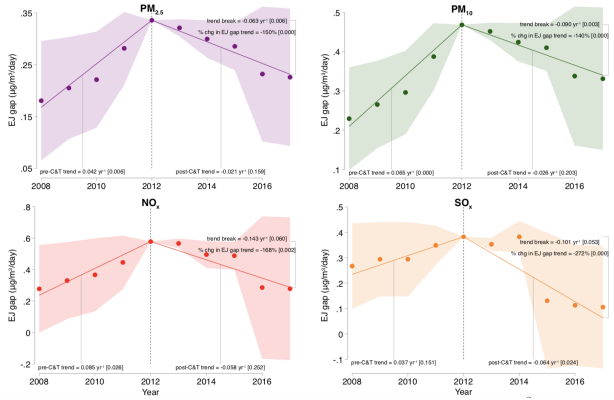
Non-climate C&T example: Fowlie et al. (2012)[6]



- 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

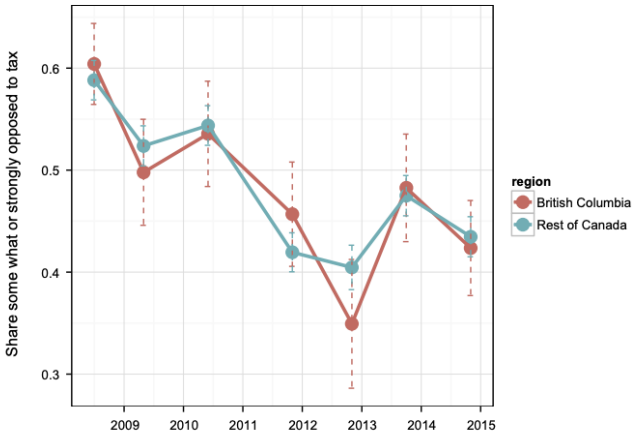
Outline

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

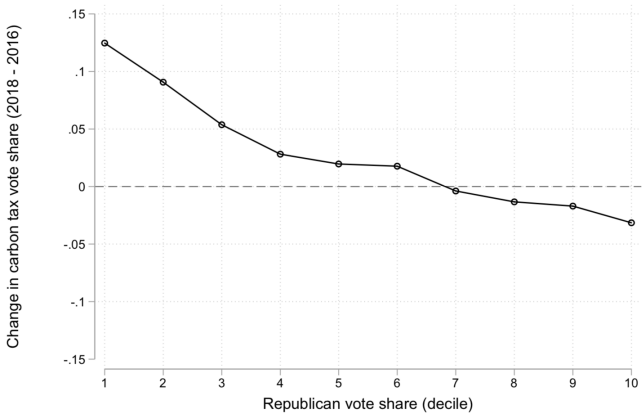
British Columbia carbon tax: Murray and Rivers (2015)[8]



- British Columbia implemented carbon tax in 2008
- Tax rate of C\$30/tCO_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