Economic Growth

Seminar 6: Climate Change

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Questions

1. Briefly define carbon taxes. What is the appeal of carbon taxes?
2. Define static abatement costs and give examples of static abatement costs from Gillingham and Stock (2018). Be sure to provide cost of estimates of your examples.
3. According to the authors, is there a ‘free lunch’ in reducing carbon emissions? Briefly explain.
4. Define dynamic abatement costs and provide examples of dynamics abatements costs from Gillingham and Stock (2018). Be sure to provide cost estimates of your examples.
5. Give examples of actions of taken today that with high static costs but low dynamic costs.

Gillingham, K., & Stock, J. H. (2018). The cost of reducing greenhouse gas emissions. Journal of Economic Perspectives, 32(4), 53-72

Research question

What is the most economically efficient way to reduce greenhouse gas emissions?

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- A carbon tax is a Pigouvian tax levied on carbon emissions.

- Gillingham and Stock (2018):

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- With Pigouvian taxes, markets find the most efficient way of reducing greenhouse gas emissions.

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Static abatement costs: cost of a project compared to a benchmark technology over the life of the project, ignoring spillovers.

- blending corn ethanol into gasoline up to a 10 percent ratio
- replacing coal-fired electricity generation with natural gas
- wide range of cost estimates
- wide range of cost estimates within a policy

Table 2

Static Costs of Policies based on a Compilation of Economic Studies
(ordered from lowest to highest cost)

Policy	*Estimate (\$2017/ton CO_{2e})*
Behavioral energy efficiency	–190
Corn starch ethanol (US)	–18 to +310
Renewable Portfolio Standards	0–190
Reforestation	1–10
Wind energy subsidies	2–260
Clean Power Plan	11
Gasoline tax	18–47
Methane flaring regulation	20
Reducing federal coal leasing	33–68
CAFE Standards	48–310
Agricultural emissions policies	50–65
National Clean Energy Standard	51–110
Soil management	57
Livestock management policies	71
Concentrating solar power expansion (China & India)	100
Renewable fuel subsidies	100
Low carbon fuel standard	100–2,900
Solar photovoltaics subsidies	140–2,100
Biodiesel	150–250
Energy efficiency programs (China)	250–300
Cash for Clunkers	270–420
Weatherization assistance program	350
Dedicated battery electric vehicle subsidy	350–640

Note: Figures are rounded to two significant digits. We have converted all estimates to 2017 dollars for comparability. See Appendix Table A-1 for sources and methods. CO_{2e} denotes conversion of tons of non-CO_2 greenhouse gases to their CO_2 equivalent based on their global warming potential.

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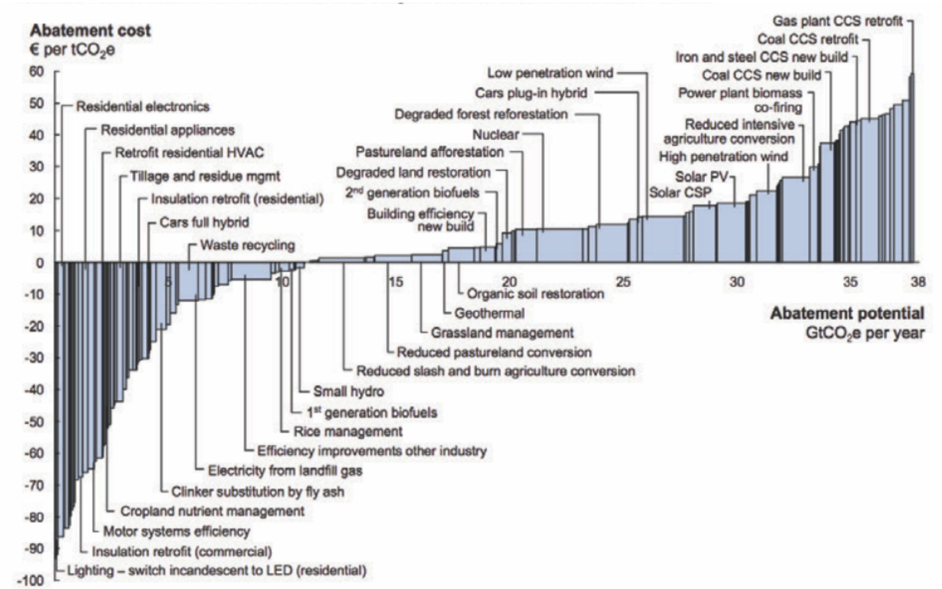
- Yes, but the examples from the McKinsey is not necessarily accurate.
  - Ignores behavioral responses, engineering estimates might also be wrong
- Behavioral changes (negative cost)
  - but limited impact on the total greenhouse gas emissions
- blending corn ethanol into gasoline up to a 10 percent ratio

Figure 1

The McKinsey (2009) Marginal Abatement Cost Curve: “Global GHG Abatement Cost Curve Beyond Business-As-Usual-2030”



Source: Global GHG Abatement Cost Curve v2.0. Figure and notes reproduced with permission from McKinsey (2009).
Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

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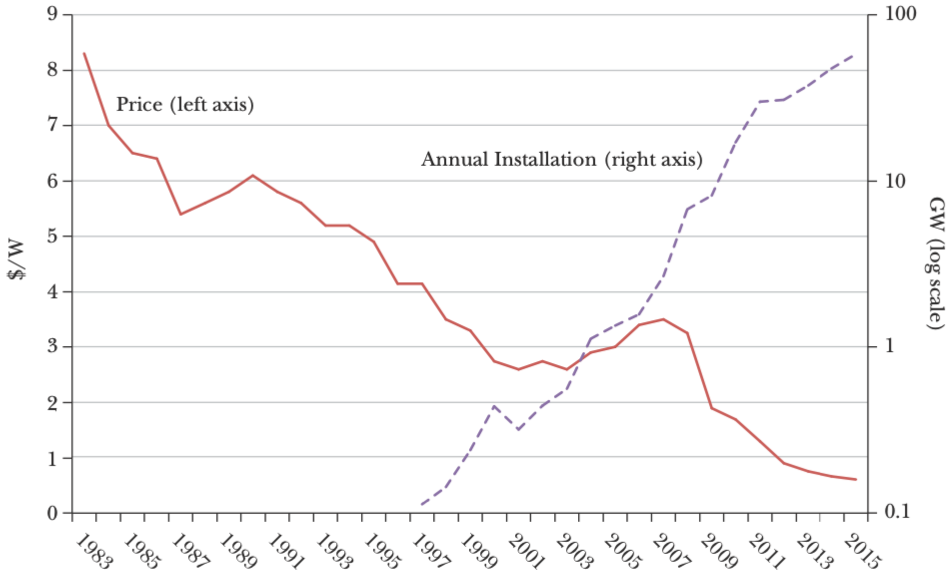
- Dynamic abatement costs include not only a project's static costs but also the project's effects on future emissions.
  - Gains in production efficiency as a result of production (learning by doing)
  - Research and development spillovers. Current demand for the project ⇒ R&D ⇒ Reduces costs and more emission reductions in the future
  - Network externalitiy: an expenditure today influences available options in the future
  - Irreversible components of energy investments

Solar power

Static costs: $140 - $2,100

- Feed-in tariff in Germany and other subsidies around the world
- Subsidies induced innovation effects (Gerarden, 2018)
- Learning by doing and economies of scale
    - Not a justification for subsidies in itself, but without subsidies (or carbon tax) companies wouldn't reach the cost efficient point of production.

Figure 2
Solar Panel Price Indexes Excluding Subsidies and Cumulative Worldwide Installed Capacity, 1983–2015



Source: International Energy Agency (2017), Navigant Consulting (2009), and Gerarden (2018).

Podcasts!

n p r

share

planet money

How Solar Got Cheap

listen 17:31

Kenny Malone/NPR

n p r

share

planet money

Das Green Old Deal

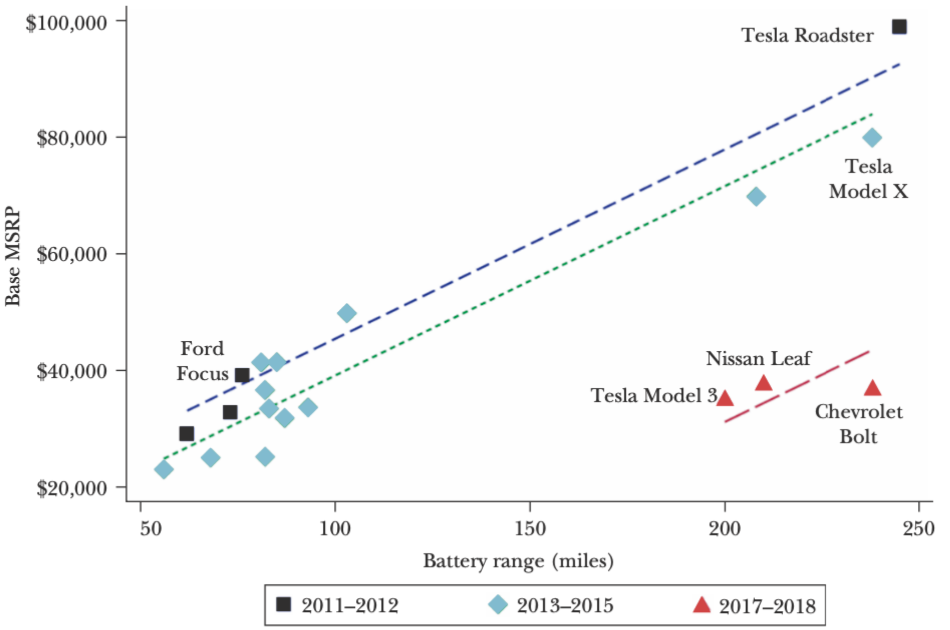
listen 20:39

Electric vehicles

Static cost: $350 - $450

- Tax credits, regulation led to an increase in demand
- Induced innovation, learning-by-doing, economies of scale, network effects

Figure 3
Electric Vehicle Manufacturers Suggested Retail Price (MSRP) Plotted against the Battery Range Shows Impressive Technology Improvements within a Short Time



Source: J. Li (2017) and authors' calculations.
Note: Dates indicate year the model is introduced. Regression lines are fit with a common slope and different intercept for each group of model years.

5. Give examples of actions taken today that with high static costs but low dynamic costs.

- Solar power, electric vehicles
- Natural gas (on the other hand) low static cost, high dynamic cost. Why?