Organizing Committee:

Glenn Rudebusch (Brookings Institution)
Michael Bauer (Federal Reserve Bank of San Francisco)
Stephie Fried (Federal Reserve Bank of San Francisco)
Òscar Jordà (UC Davis, Federal Reserve Bank of San Francisco)
Fernanda Nechio (Federal Reserve Bank of San Francisco)
Toan Phan (Federal Reserve Bank of Richmond)

Carbon Taxes: Many strengths, but key weaknesses

Roger Gordon
UCSD

Strong support for use of a carbon tax

- By my reading, there is a clear consensus among economists that the best way to address global warming is through the global use of a carbon tax on CO_2 emissions.
- The recommended carbon tax rate equals the present value of the global negative externalities resulting from an extra unit of CO_2 emissions.
  - Large past literature estimating the size of these costs.
  - With such a tax, prices provide appropriate incentives.
  - Markets should then generate efficient outcomes.

Not the policy response we've seen

- In spite of this consensus among economists favoring use of a carbon tax, the Kyoto and Paris accords on climate change instead established "quantity" emissions caps for each participating country.
  - Each country has pledged to cut back its emissions by some stated percent by a particular date.

Economists continue to prefer use of a carbon tax

- Reacting to the Kyoto protocol, Nordhaus (2006) emphasizes a long list of reasons why a carbon tax would have been a better approach
  - At that time, quantity caps had largely been implemented with use of pollution permits.
  - Nordhaus observed that prior attempts to make use of pollution permits to cap emissions had led to dramatic variation in permit prices both across countries and over time, implying inefficient patterns of abatement.

Aim of this talk

- My aim is to provide the perspective of a public-finance economist on the use of a carbon ***tax***.
  - Every year during my career, I taught models examining the use of "Pigovian" taxes to correct for generic externalities, models building on Pigou (1920).
  - A carbon tax is a particularly important example of a Pigovian tax.

Outline of presentation

- Start by showing that a "Pigovian" tax targeting just ***domestic*** externalities in theory should work well.
- Next, show that a tax targeting ***global*** externalities leads to excessive abatement from a domestic perspective (marginal costs of abatement exceed marginal ***domestic*** benefits).
  - Any policy that lessens the resulting "excess" abatement will then to that extent look more attractive, undercutting the intended abatement.
- Then show that use of quantity caps on emissions do not share these problems.

Another public finance issue: Tax incidence

- Argue that the incidence of a carbon tax would likely fall heavily on the fossil-fuel industries, reducing the value of their known reserves.
  - Countries vary dramatically in the size of their fossil fuel industries.
  - A global carbon tax would then have large distributional effects across countries.
  - Countries with a large fossil-fuel industry can well lose on net from an agreement on a uniform carbon tax rate.
  - But quantity caps can be adjusted flexibility to assure broad participation.

Other issues
(as time allows)

- Which policy allows easier monitoring of compliance?
- Which approach is most likely to be successful in limiting global warming to 2^o Celsius?

Notation

- Governments choose
  - Carbon tax rate, τ_d , or face a treaty commitment to τ_g
  - Nonlinear personal income tax/transfer schedule, $T(Y)$
  - Focus on choice of other tax and expenditure policies, G_i
- Global CO_2 emissions denoted by E, while domestic emissions denoted by E_d
- Domestic externality costs from marginal emissions equal $C_d(E)$, while global marginal externality costs equal $C_g(E) = \sum_c C_c(E)$

Carbon taxes targeting just ***domestic*** externalities

- Paper provides assumptions under which a tax rate on domestic emissions at rate $\tau_d = C_d(E)$ leads to optimal abatement from a ***domestic*** perspective.
  - Assumes distributional effects of τ_d neutralized through adjusting the income tax schedule.
  - Various other assumptions needed, but seem viewed in the literature to be reasonable approximations.
  - One simplifying assumption: country takes as given the emissions elsewhere, implying $\frac{\partial E}{\partial E_d} = 1$.

What are the effects of a carbon tax on other policy choices G_i?

- Just to be concrete, consider the choice of expenditures on public transportation.
- Ignoring behavioral responses, the government trades off the resource costs, G_i, of providing better bus/subway/rail service with the overall resulting utility benefits to households.

Indirect effects on choice of G_i due to behavioral responses

- For example, better public transport should cause Y_i to rise and E_d to drop.
  - Ignoring externalities, such individuals choices shouldn't matter from a policy perspective.
  - But these responses do generate externalities equal to: $\sum_i \; T' \, \partial Y_i / \partial G_i + (\tau_d - C_d) \, \partial E_d / \partial G_i$
  - However, marginal changes in E_d generate no net externality when $\tau_d = C_d$
  - Having set the right price for E_d, externalities from CO_2 can be ignored when considering other policies.

Carbon taxes targeting *global* externalities

- Now assume a treaty commits each member country to a $\tau_g \gg \tau_d$
- Under ***efficient*** global policy, $\tau_g = C_g$.
  - Note the lack of a global income tax to offset resulting distributional effects.
  - Standard presumption is that each country would retain the revenue from its own carbon tax
- Behavioral responses in a country to a change in any G_i now generate externalities equal to:

$$\sum_i \; T' \partial Y_i / \partial G_i + (\tau_g - C_d) \partial E_d / \partial G_i$$

Indirect effects

- The term $\left(\tau_g - C_d\right)\frac{\partial E_d}{\partial G_i}$ now matters, since $\tau_g = \sum_c \; C_c(E) \gg C_d$. Reflects "excess" abatement.
- Given "excess" abatement, any policies that lead to higher emissions to that extent look attractive.
  - For example, the drop in emissions resulting from better public transport in itself discourages these expenditures.
- Since $\tau_g - C_d = \sum_{c \neq d} C_c$, the net gain to domestic residents from extra emissions equals the cost to others from higher E_d.

Many policies lead to higher E_d

- Tariff or non-tariff barriers on imports of goods that generate high emissions when produced domestically
- Favorable tax and regulatory treatment of high-emission industries
- Protecting high-emitting firms from competition from low-emitting firms, e.g. barriers to solar and wind farms
- Encourage use of gas vehicles through providing poor public transport, and few charging stations for EV's.
- Such responses undermine the intended abatement

Can these distortions to G_i from a carbon tax be avoided?

- Forbid (or penalize) these policy modifications explicitly as part of any climate change agreement?
  - Virtually impossible to judge the degree to which any given policy was modified by these considerations, and then to forbid such modifications.

Can these distortions to G_i from a carbon tax be avoided?

- By international agreement, require compensation payments to all foreigners to the degree they are harmed by a country's emissions.
  - With such payments, policy distortions eliminated: $\left[\tau_g - C_d - \sum_{c \neq d} C_c\right] \frac{\partial E_d}{\partial G_i} = 0$
  - However, inducing heavily-emitting countries to participate in an agreement now becomes far more challenging

What about use of quantity caps on emissions?

- In theory, any desired (efficient) pattern of emissions can be achieved as well with a particular set of national emissions caps included as part of an international agreement
- When emissions are constrained, there is no longer an opportunity to undermine abatement efforts through the choice of other government policies.

Incidence of a carbon tax

- Who bears the burden of a carbon tax?
- For purposes of discussion, assume tax is legally paid by emitters.
- Natural first instinct is that the burden falls on emitters.
- But burden on emitters offset to the degree that the price they face for fossil fuels drops or the price paid by final consumers increases.

Effects of a carbon tax on price for fossil fuels

- General rule: The burden of a tax falls more heavily on the relatively inelastic side of the market.
- Demand curve for fossil fuels likely very elastic, given that marginal costs of wind and solar are now comparable to that of fossil fuels, and a close substitute in most uses.
- In contrast, the supply curve for fossil fuels likely very inelastic, given the large existing stock of known reserves seeking a market.

Implications of tax incidence

- Forecast then that the incidence falls heavily on the fossil fuel industry, with little net effect on users of fossil fuels, or on final consumers.
- If so, countries with a large fossil fuel industry suffer a disproportionate share of the costs from any international agreement on climate change, due to adverse changes in terms of trade.

Implications of tax incidence

- With an agreement imposing a uniform global carbon tax, risk losing support from countries with large fossil fuel industries.
- With quantity targets set separately for each country, can adjust the set of targets to induce broad support, as was done in the Paris Agreement.
  - Overall abatements would still be allocated efficiently, since countries get credit for extra abatement undertaken abroad.

Compliance with carbon tax vs. quantity caps

- Satellite technology capable of measuring CO_2 emissions from any given area: “trust but verify”.
- With quantity caps, detecting excess emissions immediately shows noncompliance.
- With a global carbon tax, unclear whether any detected high emissions are due to offsetting policies, or simply due to a low elasticity.

Controlling global warming, given many sources of uncertainty

- A key policy objective seems to be to limit global warming to 2° Celsius above past temperatures.
- With quantity targets, “simply” face the uncertainties coming from the science linking emissions to temperatures.
- With carbon taxes, face uncertainty as well concerning the link between the chosen tax rate and emissions.
  - With an inelastic supply of fossil fuels, a carbon tax will lead to little or no abatement until the tax rate is sufficiently high.

Quantity targets vs. pollution permits

- The concerns of Nordhaus, described above, focus on annual use of pollution permits, constraining emissions each year.
- However, quantity caps in the Paris Agreement set targets over a much longer time period.
- Such promised abatements can be pursued in a variety of ways, as seen in the Inflation Reduction Act.
- Under both Kyoto and Paris Agreements, countries get credit for supplementary abatement undertaken in other countries, in principle equating marginal costs for whatever abatement occurs.

Summary

- Paper suggests several possible reasons why international agreements have chosen to use quantity caps rather than a carbon tax:
  - Negotiators fear the many “games” that countries can pursue to undermine the intended abatement under a carbon tax, games not feasible under quantity caps.
  - Quantity caps easier to monitor and enforce.
  - Quantity caps provide greater flexibility to achieve broad participation.
  - A key concern is to limit global warming to 2^o Celsius. No assurance that any given carbon tax rate can come close to this target.