Understanding the Distributional Effects of a Carbon Tax

Expert Meeting: Modeling for Carbon Pricing Instruments
Sponsored by the World Bank

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The views expressed in this paper are those of the author and should not be interpreted as those of the Congressional Budget Office.
Major Economy-Wide Effects of a Carbon Tax (not accounting for how the revenue is used)

- Increase the cost of producing goods and services
  - Change relative prices: Prices of emission intensive goods and services, such as gasoline or electricity would increase the most

- Lower output and reduce real returns to workers and investors throughout the economy
  - Change relative returns to capital and labor

- Change the mix of goods and services that individuals buy and the way those goods are produced

- Ultimate economy-wide effects depend on how the carbon tax revenue is used
Economy-Wide Effects have Distributional Implications

- Effects on various households would depend on:
  - How they use their income: mix of goods and services that they consume
  - The area of the country in which they live (e.g., electricity price increases will vary)
  - The source of their income (wages, investments, transfer income)
  - The industries in which they work and invest (transitional effects)

- This talk focuses on effects of variation in uses and sources of household income, not on regional or transitional effects.

- Points made are generally applicable to a cap & trade program
  - Initial effects of a tax similar to a cap-and-trade program with similar allowance price
Measuring the “Burden” That a Carbon Tax Imposes on Households

- Analysts estimate the “burden” that a carbon tax imposes on a household as the cost it incurs relative to a measure of its ability to pay for the added cost.

- The distributional effects of the carbon tax itself are only half the picture:
  - The ultimate distributional effect of a carbon tax policy depends on how the revenue is used.
  - Policymakers could use the revenue to undertake spending programs or tax cuts that accentuate, or offset, the distributional effects of the carbon tax itself.

- Conclusions apply to cap-and-trade as well:
  - Ultimate distributional effect depends on how policymakers distribute the value of the allowances; Distributions could accentuate, or offset, initial distributional effects of the cap itself.
Distributional Effects Stem from Differences in Uses and Sources of Household Income

■ Changes in relative prices affect distribution of burdens based on variation in uses of household income
  – Burdens would tend to be larger for households that spend a relatively large share of their income on energy-intensive goods (e.g., electricity and gasoline)

■ Changes in relative returns to factors of production affect distribution of burdens based on variation in sources of household income
  – Burdens would tend to be larger for households that receive a relatively large share of their income from the factor whose return fell the most
Researchers Have Used a Variety of Methods of Examining Distributional Effects

■ Most studies focus primarily on effects caused by differences in *uses* of household income
  – Evaluate how tax increases prices for final goods and services (assuming cost of tax fully reflected in higher prices)
  – Estimate how higher prices increase cost of their purchases for households in different income groups
  – Compare cost increases to measure of ability to pay for them
  – Examples include: Metcalf (2007), CBO (2009), Hassett et al. (2009), Burtraw et al. (2011), Hassett et al. (2012)
Some studies examine effects caused by differences in both sources and uses of income:

- Follow the same steps used to determine how differences in households’ burdens depend on differences in uses of their income
- Determine how tax would affect households’ incomes
- Compare combined effect of higher consumption costs and changes in income to household’s ability to pay. See how this measure compares across households in different income groups
- Two examples, using different approaches, are Rausch et al. (2011) and Marron and Toder (2013)
Data Requirements are Significant

- For estimating higher costs that depend on uses of household income, researchers need information on:
  - Changes in relative prices due to tax
    - Typically estimated with an input-output model of the economy
    - Usually use national averages, but price changes may differ across regions
  - Expenditures by households in different income categories

- For evaluating costs that depend on sources of household income, researchers need information on:
  - Reductions in wages and returns to capital due to tax
    - Use simplifying assumptions or estimated by general equilibrium models
  - Changes in transfer income, which may be indexed to prices or wages
  - Income sources for households in different income categories
Data Requirements are Significant (continued)

- Once researchers determine a household’s costs, they need to compare it to a measure of its ability to absorb costs those costs
- No perfect measure of ability to absorb costs
  - Annual income used most often
    - May best facilitate calculation of ultimate household burden, including use of carbon tax revenue
    - May not represent households’ ability to absorb higher costs if income is temporarily high or low
  - Annual consumption typically smoother over time; may be a better proxy of lifetime income
Based on a Variety of Methods, Most Studies Find a Carbon Tax Regressive (not accounting for use of revenue); Degree Varies

<table>
<thead>
<tr>
<th>Method</th>
<th>First Quintile Burden</th>
<th>Second Quintile Burden</th>
<th>Fourth Quintile Burden</th>
<th>Fifth Quintile Burden</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBO (2009)</td>
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<td>Hassett et al. (2012)</td>
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Ultimate Distributional Effects Depends on How Policymakers Use the Revenue; They Could Weigh Numerous Factors

- What share of low-income households would benefit from it?
- Would it provide a proportionally larger benefit for lower income households (offsetting the regressivity of the tax itself)?
- Would it entail significant administrative costs?
- Would it reduce the aggregate economic cost of the carbon tax by encouraging people to work and invest?
- Would it undermine incentives to reduce emissions?

Tradeoffs are likely
## Selected Policy Options Demonstrate Trade-Offs

<table>
<thead>
<tr>
<th>Policy Option</th>
<th>Percentage of Lowest Quintile Affected</th>
<th>Larger Benefit for Lower Income?</th>
<th>Significant Increase in Administrative Cost?</th>
<th>Increase Incentives to Work or Invest?</th>
<th>Reduce Incentive to Cut CO₂ Emissions?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Tax Credit</td>
<td>74</td>
<td>Yes</td>
<td>Yes*</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Income Tax Rate Cut</td>
<td>30</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td>SNAP Supplement</td>
<td>18</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Increase LIHEAP</td>
<td>7</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

SNAP = Supplemental Nutrition Assistance Program
LIHEAP = Low Income Heating Assistance Program
* If fully refundable

For a more complete discussion and list of options, see Dinan (2012)
Key Points for Policymakers

- Carbon tax would affect households in *many ways*. No measure of distributional effects captures them all
  - Sources versus uses
  - Regional Effects
  - Transitional effects

- Evaluating distributional effects entails significant data requirements

- Measured effects for income groups mask much underlying variation stemming from individual household circumstances

- Most studies find carbon tax itself somewhat regressive but ultimate effect depends on use of revenue

- Individual uses of revenue typically entail trade-offs between competing objectives

- Policymakers could use revenue in a combination of ways to achieve multiple objectives


