



April 25, 2013

## Understanding the Distributional Effects of a Carbon Tax

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

Terry M. Dinan  
Senior Advisor

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)

# Researchers Have Used a Variety of Methods of Examining Distributional Effects (continued)

---

- 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

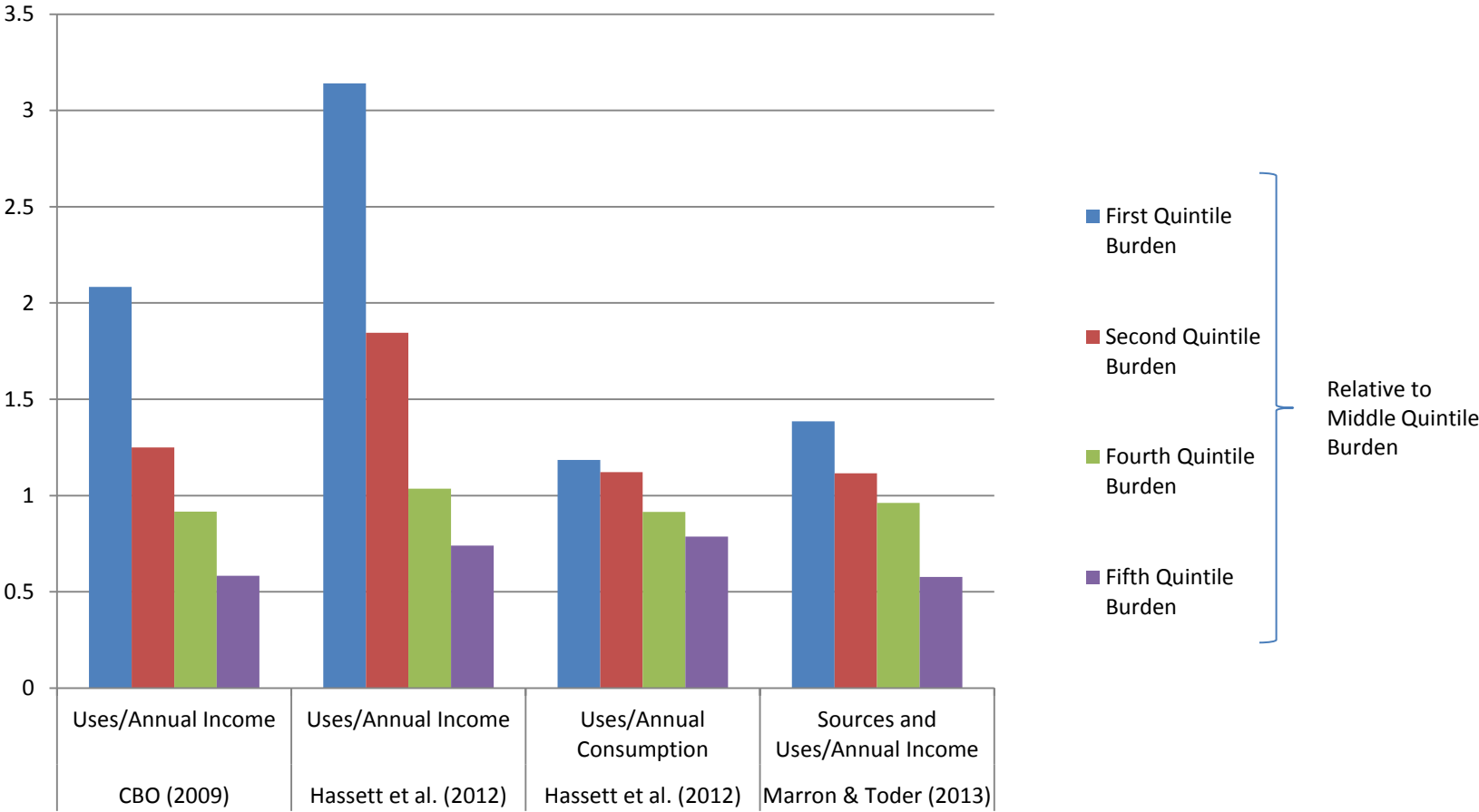


# Data Requirements are Significant (continued)

---

- 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



# 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

Policy Option	Percentage of Lowest Quintile Affected	Larger Benefit for Lower Income?	Significant Increase in Administrative Cost?	Increase Incentives to Work or Invest?	Reduce Incentive to Cut CO <sub>2</sub> Emissions?
Income Tax Credit	74	Yes	Yes*	No	No
Income Tax Rate Cut	30	No	No	Yes	No
SNAP Supplement	18	Yes	No	No	No
Increase LIHEAP	7	Yes	No	No	Yes

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

# References

---

Burtraw, Dallas et al., “Distributional Impacts of Carbon Pricing Policies in the Electricity Sector” in Gilbert Metcalf, ed. *U.S. Energy Tax Policy*, (Cambridge University Press, 2011)

Congressional Budget Office, *The Economic Effects of Legislation to Reduce Greenhouse-Gas Emissions* (September 2009), [www.cbo.gov/publication/41266](http://www.cbo.gov/publication/41266)

Dinan, Terry, *Offsetting a Carbon Tax’s Costs on Low-Income Households*, CBO Working Paper 2012-16 (November 2012), [www.cbo.gov/publication/43713](http://www.cbo.gov/publication/43713)

Hassett, Kevin et al., “The Incidence of a U.S. Carbon Tax: A Lifetime and Regional Analysis”, *The Energy Journal*, vol. 30, no.2 (2009), pp. 155-177,  
[www.iaee.org/en/publications/ejarticle.aspx?id=2309](http://www.iaee.org/en/publications/ejarticle.aspx?id=2309)

Hassett, Kevin et al., *A Carbon Pollution Tax in the Context of Broader Tax Reform: Design and Distributional Issues* (November 13, 2012), [www.aei.org/files/2012/11/14/-marthur-aei-presentation\\_152525804426.pdf](http://www.aei.org/files/2012/11/14/-marthur-aei-presentation_152525804426.pdf)

Rausch, Sebastian et al., “Distributional Impacts of a U.S. Greenhouse Gas Policy: A General Equilibrium Analysis of Carbon Pricing” in Gilbert Metcalf, ed. *U.S. Energy Tax Policy*, (Cambridge University Press, 2011)

Marron, Donald and Eric Toder, *Carbon Taxes and Corporate Tax Reform* The Urban Urban-Brookings Tax Policy Center (February 11, 2013),  
[www.taxpolicycenter.org/publications/url.cfm?ID=412744](http://www.taxpolicycenter.org/publications/url.cfm?ID=412744)