

# Overview of Economy-Wide Charge, White Papers, and Memos

Presentation to Economy-Wide Modeling Science Advisory Board Panel

July 15, 2015

# Science Advisory Board (SAB) Panel

- Assist EPA “in improving its capability to assess economy-wide impacts from the benefits and costs of its regulatory proposals.”
  - Advantages and limitations of economy-wide models to capture how benefits and costs ripple through the economy
  - Broad measures of macroeconomic performance such as employment levels, labor productivity, and energy price impacts.
  - If current modeling approaches are not adequate, advice on technical options and strategies for addressing research gaps
- Focus of panel is on technical merits and challenges of using economy wide models to analyze air regulations

# SAB Panel

- Typically, SAB Panel is convened to review a draft EPA report and provide comments on its technical accuracy and defensibility before it is finalized and used as guidance
- In this case, not asking the SAB to help EPA finalize a technical report. Instead, Panel's discussion is intended to be exploratory
- SAB responses to the charge will help EPA to determine next steps and priorities for identifying and developing potential economy-wide approaches for regulatory analyses going forward

# Main topic areas for charge questions

- When does it make analytic sense for EPA to evaluate the **social costs** of an environmental regulation in an economy-wide model?
- When and how does it make analytic sense for EPA to include the **social benefits** of an environmental regulation in an economy-wide model?
- Can EPA use economy-wide models to inform **economic impacts** analysis?
- Is it defensible for EPA to **directly compare estimates of social costs, benefits, and economic impacts** generated through different approaches when estimating economic effects of regulation?

# A Few Highlights from the Charge

# Use in Benefit Cost Analysis

- In the context of air quality regulations, using CGE models to evaluate economic effects can pose particular technical challenges
- Aggregate nature of CGE models may miss details about compliance with air regulations that matter when estimating costs
  - Linking partial and general equilibrium approaches may help bridge this gap but introduces a host of new challenges
- CGE models that do not include benefits yield an incomplete picture of the effects of a regulation on the economy and economic welfare
  - For example, recognizes potentially important role of the tax interaction effect on the cost side but ignores potential benefit-side effects via changes in labor productivity or real income

# Use in Benefit Cost Analysis

- Even when benefits have been incorporated into CGE models, they typically only represent a small subset of the full range of benefits from an air regulation
  - Similar to other studies, EPA's Prospective study of the CAA included changes in household time endowment from pollution-related mortality and morbidity effects and medical expenditures associated with pollution-related morbidity
- Analysts have little guidance regarding:
  - What criteria to use when evaluating whether to use an economy-wide approach;
  - How to interpret results from CGE model that only partially represents costs and/or benefits;
  - How to compare results from a CGE model to other engineering or PE approaches used to estimate costs or benefits that may or may not be captured in the CGE analysis
  - Whether other economy-wide modeling approaches offer added value,
    - For example, in their ability to estimate aspects of economic welfare missed by CGE models or to differentiate between short and long run welfare effects

# Use in Economic Impact Analysis

- Interest in expanding ability to inform decision makers and the public about short run economic impacts given less than full employment and fluctuating oil prices over last few years
  - Short-run time horizons may be particularly important when estimating economic impacts, but most CGE models are long run models
  - Partial representation of costs and/or benefits in CGE models may affect their ability to describe the full effects of some types of economic impacts
  - Transfers netted out in benefit-cost analysis may matter when evaluating economic impacts
- Analysts have little guidance regarding:
  - Whether CGE models are useful for evaluating economic impacts and, if so, for which types;
  - Whether CGE models can shed light on short run or only longer run impacts;
  - How to interpret results from a CGE model to other engineering or PE approaches used to estimate economic impacts that may or may not be captured in a CGE analysis;
  - How to ensure consistency in assumptions across benefit-cost and economic impact analyses when using different modeling approaches.

# Use in Economic Impact Analysis

- Other economy-wide approaches that do not estimate economic welfare could potentially yield information regarding impacts in input markets or other sectors
  - Input-output models map flows of goods and factors of production between sectors but assume fixed prices and technologies; also there are no supply constraints
  - Many macro models lack a micro-theoretic foundation; econometric basis raises question of whether useful for evaluating behavioral changes due to new policy (i.e., what is out of sample?)
  - OMB guidance indicates that macroeconomic models may be best for capturing very large policy changes; individual EPA air quality regulation falls far below recommended threshold
- Dynamic stochastic general equilibrium have micro foundations but are used even less frequently than CGE models in literature and by EPA to evaluate effects of regulations
- Analysts have little guidance regarding:
  - Whether other economy-wide modeling approaches are feasible and may add value, for example capturing shorter run labor market or energy price impacts;
  - How to ensure consistency in assumptions across analyses when using different modeling approaches.

# Characterizing Results

- EPA has a lot of experience with using and evaluating results from engineering and partial equilibrium models in a regulatory context; understand how to
  - Verify and validate results;
  - Conduct sensitivity and formal uncertainty analyses to test key model assumptions; and
  - Characterize key limitations of these modeling approaches
- EPA has used CGE models infrequently in a regulatory context; even less experience with other economy-wide approaches to evaluate changes in welfare or economic impacts
- Analysts have little guidance regarding:
  - How to verify and validate their own results from CGE or other economy-wide models;
  - How to verify and validate results from outside organizations that use CGE or other economy-wide approaches to evaluate EPA air quality regulations;
  - How to characterize and communicate results from CGE or other economy-wide approaches.

# Moving Forward

- Given current and future resource constraints, as well as, consideration of other modeling tools in EPA's toolbox,
  - What are the technical merits or challenges of using CGE or other economy-wide models for regulatory analysis based on their current capabilities?
  - Are there priorities to consider for longer term research goals with respect to improving capabilities of CGE or other economy-wide models to evaluate social costs, benefits, and/or economic impacts of air quality regulations?

# Overview of Economy-Wide White Papers and Memos

# White Papers & Memos

- OP-OAR staff are drafting a series of white papers and short memos, not for formal review, but as starting point for broader SAB discussion when responding to the charge
- White papers correspond to each main session:
  - Social cost in CGE models
  - Social benefits in CGE models
  - Economic impacts in CGE models
  - Uncertainty in economy-wide models
- In addition, two shorter memos on specific topics:
  - Potential usefulness of macroeconomic models for evaluating social cost
  - Competitiveness effects in CGE models

# Overview of White Papers

- Social Costs

- Overview of social cost framework in a regulatory setting
- Overview of air regulations
- How to represent an air regulation in a CGE framework
- Sensitivity of social costs to rule representation
- Sensitivity of social costs to model structure
- Characterizing social costs (e.g., welfare vs. GDP)
- Overview of key attributes of CGE models
- Linking CGE and sector models

- Social Benefits

- Air quality benefits - *conventional treatment in BCA*
- Incorporating air quality benefits in CGE models - *Section 812 prospective study and literature review*
- Additional benefits of air quality improvements and potential for incorporation in CGE models
- Spatial issues in benefits assessment

# Overview of White Papers

- Economic Impacts
  - Economic impacts of interest and potential for evaluating in economy-wide context
  - EPA evaluation of economic impacts using CGE models
  - Analyses of EPA rules by outside organizations using economy-wide approaches
  - Approaches and issues in evaluating economic impacts in the literature (including economy-wide approaches other than CGE)
- Treatment of Uncertainty in Economy-Wide Modeling
  - Sensitivity analysis
  - Comparative statics
  - Probabilistic analysis
  - Inter-model comparisons
  - Validation exercises
  - Uncertainty in benefits estimates

# Overview of Memos

- Other economy-wide approaches to estimating social cost memo
  - Comparison of CGE to other economy-wide approaches
  - Guidance on using macro models for policy analysis
  - Main types of alternative economy wide approaches (E.g., macro-econometric, input-output, DGSE)
  - Applications of other economy-wide approaches for estimating social costs
- Competitiveness memo
  - Competitiveness - *pollution havens hypothesis and emissions leakage*
  - Model requirements
  - Model limitations
  - Select studies - *Interagency Competitiveness Analysis and Energy Modeling Forum Study (EMF29)*

Thank you!