

**Summary Minutes of the
U.S. Environmental Protection Agency
Science Advisory Board
Economy-Wide Modeling Panel Teleconference
May 24, 2017**

Economy-Wide Modeling

Panel Members:

Dr. Peter Wilcoxon, Chair
Dr. Edward Balistreri
Dr. Richard Belzer
Dr. Linda Bui
Dr. Jared Carbone
Dr. Karen Fisher-Vanden
Dr. Alan Fox
Dr. Don Fullerton
Dr. Thomas Hertel
Dr. Edward Leamer
Dr. W. David Montgomery (on phone)
Dr. Nick Muller
Dr. Sergey Paltsev
Dr. Lorenz Rhomberg
Dr. Adam Rose
Dr. V. Kerry Smith
Dr. Mort Webster
Dr. Ian Sue Wing
Dr. Robertson Williams

Purpose: The Economy-Wide Modeling Panel discussed its draft responses to charge questions on social costs, social benefits, impacts and comparability.

Designated Federal Officer: Dr. Holly Stallworth, Designated Federal Officer

Other EPA Staff: Ann Wolverton, David A. Evans, Richard Garbaccio, Gloria Helfand (by phone), Michael Shelby, Jim McFarland, Enesta Jones (by phone), Dana Jackman (by phone), Tom Carpenter, Darryl Weatherhead, Carl Pasurka, Allen Fawcett, Elizabeth Miller

Public: Maria Hegstad (Inside EPA), Anthony Oliver (South Coast Air Quality Management District), Jared Woollacott (RTI International)

Meeting Materials and Meeting Webpage:

The following materials are available on the SAB website:

<https://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/fef0289d1428ecc18525809d0057c591!OpenDocument&Date=2017-05-24>

- Agenda
- National Center for Environmental Economics Comments on Panel's 4-24-17 Draft
- Draft Panel Responses to Charge Questions on Social Costs, Social Benefits, Economic Impacts and Other Considerations (April 24, 2017)
- Economy-Wide Modeling Panel Roster
- Federal Register Notice (82 FR 17257-17258, published April 11, 2017)

May 24, 2017

Dr. Holly Stallworth, Designated Federal Officer for the Economy-Wide Modeling Panel, gave her opening statement noting the compliance of the Panel with the Federal Advisory Committee Act and federal ethics laws. Ms. Khanna Johnston, Acting Deputy Director for the SAB Staff Office, also welcomed the Panel. Dr. Wilcoxon also welcomed the Panel and reviewed the agenda for the day, emphasizing the need to coalesce around recommendations for the letter to the Administrator.

National Center for Environmental Economics (NCEE) Comments on 4-24-17 Draft Report

On behalf of NCEE, Dr. Ann Wolverton presented comments on the Panel's draft report. Dr. Wolverton's specific comments (with page numbers and line numbers) may be found posted on the meeting webpage under Meeting Materials as National Center for Environmental Economics Comments on Panel's 4-24-17 Draft. The Panel's draft report may be found posted under Meeting Materials as Draft Panel Responses to Charge Questions on Social Costs, Social Benefits, Economic Impacts and Other Considerations (April 24, 2017).

Dr. Wolverton pointed out some inconsistencies between the Executive Summary and other sections of the report (minor points and additional details are provided in the written comments noted above). She noted that the application of criteria for evaluating models (such as the lack of micro-foundations and the Lucas Critique) were not applied consistently between the social cost section of the report and the economic impacts section. She also noted the Panel's comments on DSGE models were inconsistent throughout the text. Dr. Wolverton asked for more detail on when the Panel thought that identifying channels for international competitiveness effects would be important. Dr. Wolverton noted that the Panel uses various employment terms throughout the document and it is not always clear how they related to each other (e.g., structural unemployment, involuntary unemployment, frictional unemployment and full employment). She suggested adding these terms to the Glossary and using them consistently throughout the document. Dr. Wolverton asked for clarification on what the Panel meant by a "simple structural model" and whether "backcasting" was deemed feasible. In addition, Dr. Wolverton asked the panel to clarify the criteria used in rank ordering the research priorities listed in section 6.5, and to provide more discussion of the most promising options.

The Panel discussed the relative value of exploratory modeling versus modeling designed to yield measurements of costs and benefits and Dr. Wolverton noted that both approaches were important because the Agency needed to understand interactions and potential unintended consequences. Dr. Leamer emphasized that the document should focus on improving public policy rather than focusing too heavily on improving modeling.

Panel Discussion of Draft Responses on Economic Impacts (Section 5)

Dr. Wilcoxon walked the Panel through Section 5 - Evaluating Economic Impacts. Dr. Sue Wing noted that it could be useful to make a distinction between the CGE model and the discipline and craft of thinking through economy-wide problems since the latter could be useful without the former. In discussing the section on international competitiveness, panelists discussed Melitz models which allow firm heterogeneity and in which trade patterns are determined by market size, technology and trade barriers versus the Armington specification which imposes a particular structure on trade elasticities. Dr. Leamer questioned the value of adding the detailed structure of firms in modeling international trade. Dr. Balistreri said Melitz allows researchers to capture some impacts that aren't available in the Armington model. Dr. Wilcoxon wryly noted that the Armington elasticities are not the only parameter in the models that could be improved. He suggested that trade elasticities and firm structure are a piece of the research frontier that is important but it may not be at the top of the list of research priorities. In response to Dr. Hertel calling for econometricians to improve parameter estimates in CGE models (e.g., consumer demand, labor-capital elasticities), Dr. Wilcoxon noted that one recommendation is for EPA to consider funding a data repository. Dr. Balistreri again noted his research showed competitive selection is critically important when considering competitiveness effects. Dr. Montgomery agreed and noted that the Melitz approach may help shed light on which plants within an industry are at greatest risk of closing.

In discussing the section on other economy-wide approaches for modeling short-run impacts, Dr. Smith noted that a drawback of these other types of models, aside from CGE, is that they do not allow for consideration of feedbacks between benefits of a policy and the economy. He advocated revising the text to say when non-market services are introduced in a non-separable way to structural relationships in the model, it allows feedbacks between decisions made outside the market to decisions made inside the market.

Dr. Wilcoxon noted that the charge question (Section 5.6) said "Are there other economy-wide modeling approaches that EPA could *consider* in conjunction with CGE models to evaluate short run implications of an air regulation?" (emphasis added). The Panel discussed to what extent it should make specific recommendations regarding the use or non-use of these types of models. Dr. Leamer questioned the utility of Dynamic Stochastic General Equilibrium (DSGE) models given the failure of macroeconomists to forecast the 2008 crash. Dr. Montgomery disagreed with this characterization, stating that he found DSGE models to be empirically well-grounded and intuitive. He requested that someone on the panel familiar with DSGE models review this section of the report. Dr. Wilcoxon noted DSGE models were way too aggregated for EPA's needs thus the Panel's recommendation could say that DSGE models are something EPA could monitor for their potential use in the narrow context of evaluating changes during a business cycle.

Dr. Williams suggested that the text of section 5.6 should be coordinated with section 3.7 to clarify why there could be differences between models used for social costs and models used for impacts.

Panel Discussion of Draft Responses on Comparability (Section 6)

In discussing Section 6 - Considerations for Economy-wide Analysis of Air Regulations, Dr. Belzer warned panelists that there were lots of places in the draft that referred to Section 6.1 for further discussion. According to Dr. Belzer, it would be useful to check that the section delivers what is promised in these various cross-references. A discussion ensued on the draft report's mention (Section 6.1.3 – Interactions Between Costs and Benefits) of the discrepancy between a CGE-calculated result for net benefits of the Clean Air Act (8.7% of GDP) compared to a PE-calculated result (0.08% of GDP). Dr. Williams said his understanding of the difference is that CGE models use a change in labor endowment (in response to mortality risk changes from air quality regulations) whereas a PE approach uses a different Value of Statistical Life (VSL). In other words, differences in model results are driven by more than just the GE versus PE framework. Dr. Carbone suggesting linking this section (Section 6.1.3) to Section 4.2 where the Panel discussed how to use VSL information in CGE models. Dr. Wilcoxon suggested inserting language in Section 6 that refers to the earlier parts of the draft that discusses willingness to pay for mortality risk reduction while making the case for research that enables CGE models to capture more benefits.

In reference to Section 6.2.2 - Absolute Measures or Relative Comparisons, Dr. Montgomery challenged some text that emphasized the importance of the reference scenario in comparing model estimates.

Panelists debated whether, given the difficulties of forecasting, they should advise backcasting. Dr. Smith suggested the Panel not use the word “backcast” but instead talk about validating model’ ability to describe what happened in the past. Dr. Williams noted that CGE models are designed to predict changes in economic variables that result from a policy, not levels. This could complicate a “backcasting” exercise. Dr. Fullerton noted that, in addition, to changing the wording to avoid the word “backcast,” it would be advisable to try to answer the question posed by the Panel, including why this would be a difficult exercise and therefore would not be routinely done. Dr. Hertel added that failing to account for exogenous factors that have changed since the original prediction could lead to the wrong answer: it might appear that the model did not do a good job predicting when in fact it was given incorrect data for the exogenous factors that had also changed. Dr. Fisher-Vanden pointed out that the more complexity that is added to the model, the less insights are available.

Panelists turned their attention to Dr. Wolverton’s request that the Panel define “public vetting” (Section 6.3 – Presenting Results). Dr. Smith cited the example of William Nordhaus at Yale University who put his Dynamic Integrated Climate Economy (DICE) model on a website and through it had a great deal of influence on the literature as people adopted his model and offered improvements. Dr. Leamer suggested that a key benefit from public vetting is to expose the decision-making behind the analysis. Dr. Smith suggested EPA should control the research agenda by making its models and data available to everyone. Dr. Williams suggested just citing some examples of public vetting that were beneficial. He noted that an Energy Modeling Forum (EMF) exercise might be a part of that vetting process but that vetting would require more than model comparison exercises. Dr. Montgomery stated that he thinks an EMF-like exercise offers value because it allows for a critical look at the model in a way that is more holistic than just releasing source code to the public. Dr. Smith agreed that an EMF-like exercise might be one way to start a vetting process.

In reference to Section 6.4 - Uncertainty and Economy-Wide Modeling, Dr. Leamer noted that “model ambiguity” would be a better term than “model uncertainty” when discussing things left out of a model.

Discussion of Section 6.5 – Research Priorities was deferred until later in the day.

Panel Discussion of Draft Responses on Social Costs (Section 3)

With respect to Section 3.2 - Factors Affecting the Merits of an Economy-Wide Approach, Dr. Rose noted that it was written as if CGE was the only approach. Dr. Williams said he thought the discussion of perfect foresight (Section 3.2.5 – Appropriate Degree of Foresight) was a little harsh about perfect foresight and he would offer some edits. In reference in Section 3.4 – Challenges in Modeling Regulations, Dr. Carbone said he wasn’t convinced that the challenges of modeling non-price regulations were not shared by price-based regulations. Dr. Sue Wing talked about the need to model the underlying stock for a price-based program like “cash for clunkers.”

On Section 3.5 - Appropriate Metrics for Social Costs, Dr. Balistreri gave it a “green light” but suggested a few more sentences to acknowledge the additional discussion of a model’s numeraire that is needed when presenting GDP results. He also noted that using Equivalent Variation (EV) to capture social welfare is less vulnerable to this concern since the evaluation is done at the original set of prices. Other panelists suggested that the section should emphasize more strongly that GDP is not a measure of welfare (although it could be useful for other purposes).

The remaining portions of Section 3 were also given “green lights.”

Panel Discussion of Draft Responses on Social Benefits (Section 4)

Dr. Montgomery raised an issue in Section 4.2 - Equivalent Variation and Willingness to Pay for Risk Reductions and asked whether it captured what the Panel really wanted to say about WTP for risk reduction based on environmental quality. Dr. Wilcoxon suggested moving text from another section (6.1.3, discussed earlier) into this section.

Dr. Belzer pointed out a contradiction in Section 4.5 – Other Representations of Mortality and Morbidity where the Panel posed questions about damage function research whose answers seemed to contradict earlier statements of support for hedonic property value models. Dr. Wilcoxon suggested hedonic property value data should be used but with caveats but Dr. Smith worried about the resolution available in CGE models to use this data. Dr. Belzer voiced his concerns about using the term “plausibility analysis” in Section 4.5.1 - Empirical Research to Support Other Representations of Direct Impacts based on a concern that it would be used as a substitute for a higher quality analysis. Dr. Smith said he would clarify his use of the term “plausibility analysis.”

With respect to Section 4.5.3 – Approaches for Incorporating Health Effects, Dr. Belzer said he did not think the Panel had answered the last question of under what circumstances would the

expected effects be too small to noticeably affect the quantitative results.

No additional issues were raised until Section 4.9 – Impacts on Non-Market Resources for which Dr. Leamer raised the issue of non-use values, suggesting that without a behavioral trail, such values were not appropriate for CGE modeling. Dr. Smith clarified that non-market was not intended to convey non-use. Dr. Wilcoxon suggested these terms could go in the Glossary. Dr. Wilcoxon also pointed out the question asked only whether there is sufficient research “to support the development of techniques.” Taken literally in this narrow context, he thought the answer was ‘yes’.

The remaining parts of Section 4 were approved.

Panel Discussion of Research Priorities (Section 6.5)

Dr. Wilcoxon listed the research priorities as follows:

1. Employment
2. Non-market benefits
3. Explicit treatment of mortality risk
4. Linking models
5. Model comparison exercises
6. Research on heterogeneity within industry
7. Open-sources project to build a dataset

Panelists discussed whether to rank-order the recommendations or group them and focus on low-hanging fruit. Panelists generally agreed to elevating the importance of data acquisition and dissemination and grouping the priorities.

Panel Discussion of Executive Summary (Section 1)

Dr. Wilcoxon asked panelists to look at their sections in the Executive Summary (i.e., those pertinent to the sections they authored) and let him know whether it is consistent with their key points. A discussion ensued on the portrayal of the importance of the magnitude of abatement costs (Section 1.1.2 in the Executive Summary) with Dr. Fullerton saying he did not think abatement cost should drive CGE selection. Dr. Montgomery suggested that the extent of linkages should be listed as a factor in this section. Others suggested themes like transparency, public access and economy-wide thinking (as opposed to economy-wide modeling). Dr. Rhomberg again pondered whether CGE models were more useful for measurements or insights and asked for some mention of this issue.

Panel Discussion of Letter to the Administrator (To Be Written)

Dr. Wilcoxon led the discussion by listing some major themes for the letter to the Administrator as follows: CGE modeling provides important analytical benefits that EPA needs such as consistent accounting, connections between sectors, etc. It also has some significant challenges, primarily the level of detail needed for modeling regulations and transparency. One promising approach is to link PE to GE models. Key priorities for future research would be also be

included in the letter, emphasizing the need for a sustained push in order to make progress.

Dr. Hertel suggested the need to understand changes in employment by sector (not only the directly affected sector but other sectors). Dr. Wilcoxon suggested the letter say an important research priority it to better understand employment transitions. Panelists also suggested emphasizing that CGE modeling should be a supplement to EPA's current methods, and also suggested the letter stress the importance of open source platforms. Dr. Smith suggested that the letter note that EPA has been a real leader in advancing the development and use of benefit-cost analysis and has set the standard for it becoming a credible methodology. EPA should also lead the way in developing and applying general equilibrium models in regulatory analysis.

Other points suggested for emphasis in the letter included: GE models provide internal consistency and impose budget constraints; they include explicit supplies of primary factors; they capture feedbacks between markets and agents; they are transparent about the assumptions behind the modeling of production and utility; and they capture distortions and market failures.

Timeline and SAB Process

Dr. Wilcoxon asked panelists to look at their sections in the Executive Summary and let him know in the next three weeks via email whether any edits were needed. He said he and Dr. Stallworth would draft a letter that summarizes the discussion and send it out by June 2 for the Panel's review. Dr. Wilcoxon will take the lead on revisions to the rest of the document which the Panel would see by the end of June for a one-week last round of review so that the draft could go to the chartered SAB by the end of July 2017.

Panelists joined Dr. Hertel in a warm thanks to Dr. Wilcoxon for his leadership of the project.

Dr. Stallworth adjourned the meeting.

Submitted by:

Holly Stallworth, Ph.D. /s/
Designated Federal Officer

Certified as Accurate:

Peter Wilcoxon, Ph.D. /s/
Chair, SAB Economy-Wide Modeling Panel

NOTE AND DISCLAIMER: The minutes of this public meeting reflect diverse ideas and suggestions offered by committee members during the course of deliberations within the meeting. Such ideas, suggestions, and deliberations do not necessarily reflect definitive consensus advice from the panel members. The reader is cautioned to not rely on the minutes to represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters, or reports prepared and transmitted to the EPA Administrator following the public meetings.