

**Summary Minutes of the
U.S. Environmental Protection Agency
Science Advisory Board
Economy-Wide Modeling Panel Teleconference
December 7, 2016**

Economy-Wide Modeling

Panel Members:

Dr. Peter Wilcoxon, Chair
Dr. Edward Balistreri
Dr. Richard Belzer
Dr. Linda Bui
Dr. Jared Carbone
Dr. Francisco de la Chesnaye
Dr. Karen Fisher-Vanden
Dr. Alan Fox
Dr. Don Fullerton
Dr. Thomas Hertel
Dr. Edward Leamer
Dr. W. David Montgomery
Dr. Gilbert Metcalf
Dr. Nick Muller
Dr. Sergey Paltsev
Mr. Richard Revesz
Dr. Lorenz Rhomberg
Dr. Adam Rose
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: Alex Marten, Ann Wolverton, David A. Evans, Richard Garbaccio, Gloria Helfand, Charles Fulcher, Leland Deck, Michael Shelby, Jim McFarland

Public: Maria Hegstad (Inside EPA); Robert Cheren (Squire Patton Boggs); Martha Moore (American Chemistry Society); Brittany Bolen (Senate Environment and Public Works); Jared Woollacott (RTI International)

Meeting Materials and Meeting Webpage:

The Panel's draft report of November 8, 2016 and agenda may be found on the meeting webpage at:

<https://yosemite.epa.gov/sab/sabproduct.nsf/a84bfee16cc358ad85256ccd006b0b4b/1737e065ec9887ba85257ffe004f2af1!OpenDocument&Date=2016-12-07>

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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. Dr. Peter Wilcoxon, Panel Chair, reviewed the agenda and said he wanted the draft to be complete, correct, clear and usable. Dr. Wilcoxon said further revisions would be pursued after today's discussion (similar to the process used for previous drafts) but panelists would also be asked to review a charge question (written by someone else) according to the same criteria used by the chartered SAB in its quality reviews. He said this feedback would be discussed at a face-to-face meeting in March as well as the Panel's major themes for the Executive Summary and letter to the Administrator.

Discussion of Draft Responses on Social Costs and Social Benefits

During this time slot, Dr. Wilcoxon called attention to an issue in Section 3.1 where the Panel suggested the difference between the general equilibrium (GE) demand elasticity and the partial equilibrium (PE) demand elasticity could be used as a "threshold" for determining when GE analysis is needed, citing, for example, a 10% deviation. Dr. Wilcoxon said that unless the Panel could provide guidance on how a threshold should be determined the report should not recommend setting a pre-determined one. The Panel's consensus was that instead the report should emphasize the criteria stemming from the Harberger equation (the existence of significant cross-price effects and significant distortions in other markets). One reason cited to back away from the "threshold" criterion is that it requires running a GE model before a decision is made whereas the two criteria implied by the Harberger equation could be assessed ex ante. Panelists also suggested that it is important to allow analysts the flexibility to apply judgment regarding the need for a GE approach as the attributes of a particular regulation will be important to consider. Panelists accepted Dr. Wilcoxon's proposal to take out the discussion of a specific threshold but instead earmark a recommendation in the Executive Summary on when GE analysis would likely be most helpful.

National Center for Environmental Economics (NCEE) Comments on Draft Responses on Social Costs and Social Benefits

On behalf of NCEE, Dr. Ann Wolverton asked that, when making research recommendations across the timeframes (possible now, near-term, long term), the Panel consider distinguishing between research gaps more generally; research gaps with regard to how to represent that phenomenon or factor in a CGE model; and implementation challenges when attempting to apply a CGE model in a particular context. Pointing to p. 6, lines 34 – 37, Dr. Wolverton cited the recommendation for work on integrating insights from behavioral economics in CGE models as an example where more specificity in this regard would be helpful. Also in that paragraph on p. 6, Dr. Wolverton pointed out the statement about incorporating involuntary unemployment into CGE models could be misinterpreted if taken to mean that the literature has already agreed on the most appropriate approach for doing so. However, other statements (e.g., pages 26, 55, and 80) note that it is rare for CGE models to incorporate unemployment and that that literature does not agree on the best approach for doing so. Dr. Wolverton pointed out an inconsistency where the Panel on p. 16 said "transition costs are part of social costs" but then on p. 26 said "it remains an open question how much of that earnings loss represents a social cost."

Dr. Wolverton also asked whether the Panel had reviewed its draft recommendation on p. 62, lines 17-19 regarding the quantification of productivity gains for benefit-cost analysis. Dr. Wilcoxon indicated that it is still on the Panel's to-do list. In response to a request from Dr. Wilcoxon, Dr. Wolverton said she could provide a written copy of her comments.

NCEE Comments on Draft Responses on Economic Impacts

With respect to the Panel's responses on economic impacts, Dr. Wolverton pointed out that charge question 5.1 (as it is now labelled in the draft response) asked for the Panel to characterize the extent to which CGE models are appropriate "relative to other tools EPA has at its disposal." She asked the Panel to make it explicit when it thinks a CGE model has added value over the standard approaches currently used by EPA or when PE or bottom-up approaches may yield a better approximation, at least at this time. Dr. Wolverton pointed to p. 70 where the Panel suggested linkages from a GE model to a sector-specific PE model would improve estimates of plant closings, as one example. It was not clear how linking GE to PE models would improve such estimates as compared to a PE model alone. Section 5.5.2 on transition costs also provided a response in which the Panel discussed problems with relaxing instantaneous adjustments in GE models. She asked: Does this imply a PE approach would be the best option? Dr. Wolverton stressed the need to continually compare GE to PE approaches in terms of their relative merits.

With respect to Section 5.1.4 on income distribution, Dr. Wolverton noted the EPA White Paper's discussion on using CGE model outputs as inputs to PE models (a one-way link), which is common in the literature, is not referenced in this section but is referenced on p. 90 in a way that suggests it is an acceptable approach. With respect to Section 5.2 on international competitiveness, Dr. Wolverton pointed to p. 73 (lines 31-32) and asked what "near to longer-term" meant. In addition, she noted the general nature of the Panel's statement that "EPA should consider developments that move beyond the Armington assumption and perfect competition." She pointed out the paragraph above it that says "modeling firm heterogeneity is the frontier of trade modeling" sounded more like a long-term goal. The next sentence said that for non-carbon air regulation, it may not matter whether analysts are using an Armington or a Melitz structure. She requested more specificity as to when the Panel is suggesting EPA move beyond the Armington assumption and perfect competition. She noted another general statement in Section 5.2.3 on p. 75 (lines 9 – 10) with "the Panel recommends CGE modeling as a key method for assessing international competitiveness effects and leakage." Without qualification, she suggested, this sentence can be applied more generally than what the Panel appears to be suggesting in other parts of the document.

Turning to Section 5.4 on labor impacts under full employment closures, Dr. Wolverton noted the charge question asked what types of labor impacts can be credibly identified and assessed. The Panel's response discussed what impacts cannot be identified and assessed, which is quite useful. However, she also said EPA would appreciate more explicit statements of the proper metrics for employment impacts that can be reported out of CGE models. Lines 34-35 on page 78 seem to suggest this might be a change in quantity of labor or in hours worked.

With respect to Section 5.6.6, Dr. Wolverton noted that, while the discussion that preceded this section did not endorse any alternatives to CGE, the summary in Section 5.6.6 seemed to

embody a change of tone toward more positive comments about other economy-wide approaches. She asked the Panel to ensure consistency between the sections and to be explicit about whether it is advising EPA to invest in particular alternative approaches to CGE.

NCEE Comments on Draft Responses on Comparability

Turning to Section 6.1.1, Dr. Wolverton called the Panel's attention to p. 89 (lines 16 – 17) where the Panel suggested a distinction between market and non-market effects might be more helpful than distinguishing between costs and benefits. She said she wasn't sure that distinction works well when leisure is considered, but was looking for the Panel to clarify. Turning to Section 6.2.1, Dr. Wolverton noted an inconsistency where the Panel questioned the value of a CGE cost measure given the existence of non-separability in preferences and production relationships. In other parts of the report, the Panel had defended the value of CGE models when benefits are only partially represented. See, for example, p. 65 (lines 9 – 12) where the Panel said the model would still have informational value when benefit measures are incomplete. See also page 92 (lines 1-6).

With respect to Section 6.3.1, Dr. Wolverton offered a definition of a proprietary model from an EPA guidance document as follows: "models for which source code is not universally shared" (EPA/OSA, Guidance on the Development, Evaluation, and Application of Environmental Models, p. 31). Dr. Wolverton cited parts of the Panel's draft that offered different definitions of a proprietary model that are not consistent with EPA's working definition. In addition, she suggested the Panel distinguish between proprietary models and proprietary data since many non-proprietary models rely on proprietary data (e.g. confidential business information or IMPLAN data). Dr. Wolverton also pointed out that the charge notes EPA guidance recommending that EPA use models that provide the most reliable and best accepted characterization of a system – which may be proprietary - and the footnote to the charge on the type of documentation that should be made publicly available when using proprietary models (which differs from what EPA guidance asks of analysts when evaluating non-proprietary models). This information might prompt the Panel to revise its statements on p. 24 (lines 39-41).

Dr. Wilcoxon asked Dr. Wolverton if there was a public alternative to the electricity-based Integrated Planning Model (IPM) that EPA could use. Dr. Wolverton responded that, to her knowledge, there was not a current model with both the level of detail and peer review as IPM.

Panelists discussed how strongly their statements on public availability and open source models should be couched. Dr. Wilcoxon said the Panel could both strongly advocate public models while acknowledging the practical need for proprietary models in the short-run while public models are developed.

Panel Discussion of Impacts and Comparability Questions

Dr. Leamer raised the issue of reliability and suggested the Panel's report was more focused on "do-ability" rather than reliability. But Dr. Wilcoxon said there were places in the Panel's report that warned against unreliable results. Dr. Metcalf suggested Dr. Leamer's general points could fit into Section 5.1.1 on general principles. Dr. Wilcoxon said he would get in touch with

the lead authors of this section to revise this section.

After the break, Dr. Balistreri said he would address Dr. Wolverton's comments on Section 5.2 on international competitiveness. On Section 5.3.3 on CGE versus PE for comparing impacts, Dr. Williams said he thought the Panel's comments on perfect foresight models were too critical because it criticized the perfect foresight assumption. Dr. Paltsev, the lead author of this section, disagreed but, after some discussion, said he could refer back to another discussion of perfect foresight in Section 3 that provided a more balanced perspective. He said he would also change the word "counterfactually" in Section 5.3.3.

With respect to Section 5.5.1, Dr. Leamer said he thought the Panel should distinguish between cyclical unemployment or search unemployment. Dr. Leamer said he did not think CGE models could capture the business cycle but should try to capture search unemployment to the extent possible. Dr. Williams said of the four approaches discussed in Section 5.5.1, he would not recommend any of the first three approaches, but the fourth approach has promise, which is to build job-search frictions into the CGE model. He wanted to make sure the Panel was comfortable with that conclusion.

Dr. Wilcoxon asked for a volunteer to draft Section 5.6.5 on dynamic stochastic general equilibrium models and Dr. Montgomery volunteered. Dr. Rose promised to revise Section 5.6.6 in accordance with Dr. Wolverton's comments that the summary appeared out of sync with the preceding sections by endorsing modeling alternatives. Dr. Leamer promised to provide a revised paragraph on macroeconometric models for this section.

On Section 6.1.1, Dr. Montgomery suggested moving the paragraph on p. 89, beginning at line 16 to Section 6.1.3. On Section 6.1.2, Dr. Montgomery asked that the paragraph be expanded and explained further because they currently use very technical terms, and Dr. Wilcoxon said he would make that request of Dr. Hertel. On Section 6.2, Dr. Rose said he'd like to retitile the section to something like "partial equilibrium versus general equilibrium" and Dr. Wilcoxon promised to consider that suggestion. Panelists suggested a title along the lines of "partial analysis as distinct from partial equilibrium."

Dr. Wolverton wondered whether the paragraph on p. 84 in which the Panel discusses the possibility of a model comparison exercise like the Stanford Energy Modeling Forum might be better placed in Section 6.4. Dr. Wilcoxon agreed and raised the possibility that model comparison might also need to be elevated to the Executive Summary. Dr. Montgomery noted that model comparison is important. Dr. Leamer noted that the draft discussion of model uncertainty – that different assumptions can have important effects on results – could be enriched substantially. Dr. Leamer offered to draft revised language.

Dr. Montgomery asked for revisions to the text beginning on p. 93 at lines 39 because it did not make sense to him as written.

Discussion of Major Themes for Executive Summary and Letter to the Administrator

Dr. Wilcoxon turned the Panel's attention to a discussion of major themes for the Executive Summary. He promised to pull out all the recommendations in each section but asked the Panel

to brainstorm on its overall recommendations. He noted several important top-level themes that they would want to capture in the Executive Summary: guidance on when to use CGE models in addition to partial equilibrium and engineering modeling, what EPA can do to expand its longer-term capabilities to model involuntary unemployment and non-market benefits.

On the subject of research priorities, Dr. Wilcoxon noted that the Panel probably wants to limit itself to no more than 9 or 10 top-level recommendations. The recommendations that had been previously discussed at the Panel's face-to-face meeting were:

- improved modeling of labor markets;
- improved modeling of non-market benefits;
- improved modeling of industries (e.g. emissions intensities across firms);
- better linking of GE to PE models to capture regulations within industries;
- spatial resolution;
- greater disaggregation of households by income
- model comparisons comparing open economy and global models;
- a model comparison of closures rules (fiscal or trade deficit closures rules);
- model infrastructure development (open source database for CGE development);
- impacts of disasters and disaster preparedness.

Dr. Montgomery suggested the PE versus GE discussion really should be framed as a continuum and Dr. Wilcoxon added that the Panel was not trying to replace one methodology with another.

Timeline and SAB Process

Dr. Wilcoxon promised that he and Dr. Stallworth will have a skeletal list of research priorities and a skeletal Executive Summary with key recommendations to circulate to the Panel. He also reminded the Panel that he's like to do a "Red team" evaluation for different questions with panelists being assigned to critique each other's responses. The focus of the next face-to-face meeting would be to finalize the language of the report, most especially the Executive Summary and letter to the Administrator.

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

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