

**Summary Minutes of the
U.S. Environmental Protection Agency
Science Advisory Board
Computable General Equilibrium (CGE) Model Review Panel Teleconference
January 31, 2020**

CGE Model Review

Panel Members:

Dr. Peter Wilcoxon, Chair
Dr. W. David Montgomery
Dr. Sergey Paltsev
Dr. Ron Sands
Dr. Dominique van der Mensbrugghe
Dr. Alan Fox
Dr. Mun Ho
Dr. Tom Rutherford

Purpose: The CGE Model Review Panel discussed its draft report and final recommendations to EPA's National Center for Environmental Economics (NCEE) on its CGE model named SAGE.

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

Other EPA Staff: Ann Wolverton, Alex Marten, Andrew Schreiber, Michael Shelby, Tom Brennan, Tess Petesch, Allen Fawcett, Dana Jackman, Jim McFarland, Eliane Catilina

Public: Jared Woollacott (RTI International); Andy Bollman (North Carolina Division of Air Quality)

January 31, 2020

Dr. Holly Stallworth, Designated Federal Officer for the CGE Model Review Panel, gave her opening statement noting the compliance of the Panel with the Federal Advisory Committee Act and federal ethics laws. Dr. Wilcoxon also welcomed the Panel and emphasized the need to have consensus on the Panel's Tier 1 recommendations, i.e. those recommended tasks the Panel thought necessary before the Agency could use the model for regulatory analysis. Less urgent recommendations were categorized as Tier 2 (T2) or Tier 3 (T3) in the Panel's draft report. Dr. Wilcoxon noted that the allotted time for the teleconference distributed across the 87 recommendations in the Panel's report would mean only 2 minutes of discussion per recommendation. Dr. Ho said he had noted duplication among the recommendations and would offer those observations throughout the teleconference.

Dr. Ann Wolverton, economist at NCEE, thanked the Panel for its thoughtful suggestions on how to improve SAGE. She offered the following requests for clarification.

1. NCEE found some inconsistency with regard to the assigned tier of particular

recommendations, e.g. improving the baseline by departing from a balanced growth path. The sector-differentiated productivity growth rate recommendation is referred to as a tier 2 recommendation in question 2 but as a tier 1 recommendation in question 10.

2. NCEE noted that the discussion of the way balanced growth returns to a steady-state transition path seems to differ slightly throughout the report, possibly as a function of multiple authors. The terms might need to be defined more explicitly in their first mention.
3. NCEE needs clarification on whether some of the documentation improvements were categorized as Tier 1 because of their importance or because of their feasibility, i.e. low hanging fruit.
4. NCEE requests citations or data sources for some recommendations as potential starting points for implementation, e.g. the recommendation to distinguish between the tax rate for capital versus the tax rate for natural resources.

Dr. Wilcoxon then led the Panel sequentially through the recommendations, beginning with Charge Question 1 (model documentation).

With respect to recommendation CQ1-3, the Panel agreed to “downgrade” improving the typesetting of variable names from T1 to T2 to allow EPA the flexibility to determine when and how to incorporate this change. The Panel also agreed to “downgrade” CQ1-4 to clarify the treatment of taxes to T2, though it emphasized that this task should be completed relatively soon. Dr. Rutherford also pointed out that the two equations in the CQ1-4 define prices in an inconsistent manner, which should be corrected in the final document. Similarly, the Panel agreed to “downgrade” CQ1-14 on use of the term “clears” in the goods market, and CQ1-16 on correcting the regional balance of payments to T2. On CQ1-15, panelists discussed its recommendation to NCEE to clarify its choice of numeraire across time. Dr. van der Mensbrugge said he thought the NCEE team was going to have some problems describing the evolution of prices over time because they are deflated to the base year. Dr. Wilcoxon stressed the need to clarify what the numeraire is and how to interpret model results in light of the choice of numeraire.

On CQ1-17, panelists agreed to lower the tier level of this recommendation to discuss options for time steps and model horizons to T2. On CQ1-18, panelists agreed that NCEE only needs to add a citation from the literature on discount rates but decided to give NCEE flexibility on which citation to use. On CQ1-22, panelists agreed to lower that recommendation to expand its explanation of how the public might use the model to T2 and to rewrite the recommendation to be more flexible so that it can accommodate alternative licensing arrangements.

On CQ1-23, Dr. Montgomery offered to revise this recommendation so that the Panel is asking NCEE to clarify the relationship between capital remuneration and savings to make it clear that all income is consolidated into a single variable.

On Charge Question 2 (model structure and assumptions), Dr. Ho said there was repetition between the Panel's comments in response to Question 10. Panelists agreed to revisit the discussion in Charge Question 10 to remove redundancy and refer back to discussion in Charge Question 2. On recommendation CQ2-3 to demonstrate the usefulness of their partial "putty-clay" capital formulation, panelists agreed to move CQ2-3 to Charge Question 10 and merge with the discussion of developing a recursive-dynamic model. Likewise, Panelists also agreed to move CQ2-4 on the treatment of labor mobility, CQ2-5 on time steps and CQ2-6 on alternatives to perfect foresight to Charge Question 10.

Panelists identified the recommendation in CQ2-8 to move to an estimated consumption parameter as redundant with CQ3-7 and CQ3-9 and thus, unnecessary; thus CQ2-8 will be deleted. CQ2-9 recommendation to use a flexible function form to model consumption, assigned as Tier 3, would be left unchanged. The CQ2-10 recommendation to refine demands for energy goods and CQ2-18 to develop a plan for sector-specific modelling were also identified as redundant with CQ6-5 and will be deleted.

Panelists agreed to move CQ2-16 to allow more flexible modeling of productivity so it appears before CQ2-2 on industry productivity. Dr. Rutherford asked the Panel to return to CQ2-13 on alternative discount rates to discuss the difference between the market interest rate which is endogenous versus the intertemporal rate of time preference which is subjective. Dr. Marten said the 4.5% interest rate used in SAGE is endogenous in the SAGE model, starting with Council of Economics Advisors estimate of returns to private capital (7%) minus the tax wedge to get 4.5%. Calibrating back to the intertemporal rate of time preference yielded a number much lower than 4.5%. Dr. Wilcoxon suggested the recommendation be rephrased to recommend the Agency do sensitivity analysis with respect to the underlying pure rate of time preference.

The Panel agreed to move and merge its T2 recommendation in CQ2-19 to include emissions coefficients in production to CQ10-2, which discusses emissions coefficients in more depth. The Panel also agreed to consolidate recommendation CQ5-6 with CQ10-2. With respect to CQ2-20, the Panel's recommendation to strengthen the modeling of resource supply, Dr. van der Mensbrugge offered suggestions for where this discussion on modeling resource supply might better fit. Dr. Wilcoxon suggested that CQ2-20 be split into two pieces: a recommendation to add an iso-elastic or S-shaped resource supply curve (T2) and a suggestion to think harder about what the supply curve would look like given the specific nature of the natural resource in question (T3). Dr. Wilcoxon said he would attempt such a revision. Other recommendations in the response to Charge Question 2 remained unchanged from the draft.

On charge question 3, the Panel agreed not to recommend the introduction of trade and transportation margins as part of CQ3-2 to refine the tax system and to "downgrade" the level of the recommendation to T3. The Panel agreed to consolidate its recommendation CQ3-4 with CQ10-2 where energy balances and emissions coefficients are discussed. The Panel also agreed to lower the recommendation level of CQ3-5 to assess the feasibility of moving from IMPLAN data to WiNDC from T1 to T3. The Panel agreed to merge recommendation CQ3-6

to move to an activity approach with CQ10-7.

With respect to recommendation CQ3-7, Dr. Wilcoxon suggested integrating the discussion and first recommendation into CQ2-7 where the Panel discusses the need for the Agency to move away from a homothetic consumption function. The second recommendation embedded in CQ3-7 would be combined with CQ2-9 on using a flexible function form to model consumption. CQ3-8 on trade elasticities would be integrated into CQ2-25 on relaxing the small open economy assumption. CQ3-9 to move toward econometric estimation is redundant with and therefore will be merged with CQ10-6.

With respect to recommendation CQ3-10 to clarify dynamic adjustments in the calibration, Dr. Montgomery suggested deleting the sentence suggesting the reproduction of baselines such as the Shared Socio-Economic Pathways. Dr. Wilcoxon also suggested that the rhetorical questions in this recommendation might also be purged. Dr. Wilcoxon further suggested a revision stating that the Panel recommends sensitivity analysis regarding the factors that drive the baseline ranging from exogenous variables to different parameter choices. Dr. Wilcoxon said he would consolidate CQ3-10 and CQ3-11 which recommend improvement to the baseline using more heterogeneous assumptions across regions, activities and households. Other recommendations for Charge Question 3 remain unchanged.

With regard to Charge Question 4, the Panel agreed to Dr. Montgomery's request to "upgrade" CQ4-2 to provide a user-friendly reporting tool from T2 to T1, but it was agreed that the language would be tweaked to be less prescriptive.

With regard to Charge Question 5, Dr. Montgomery thought that it was too much to ask the SAGE team to reproduce historical price shocks in CQ5-3, so Dr. Wilcoxon said he would trim the recommendation and combine with CQ3-10 which asks the Agency to explore alternative dynamic adjustments. The Panel also agreed that CQ5-5 would be consolidated with CQ3-10. The recommendation in CQ5-6 to track energy balances will be consolidated with CQ10-2, which addresses this same topic. With regard to Charge Question 6, recommendation CQ6-5 to increase detail in electricity and transportation was elevated to T2. All other recommendations under Charge Questions 5 and 6 remain unchanged. No changes to Charge Questions 7 and 8 were discussed.

Dr. Wilcoxon walked the Panel through Charge Question 9, which responds to EPA's own plans for near-term work on the model in three areas: (1) improving the modeling of consumption decisions by households; (2) revising the model to eliminate the assumption that the United States is a small economy in world markets; and (3) refining the treatment of production, sales, and excise taxes. Dr. Wilcoxon noted the Panel's current report concurs with (1) and (2) but regards (3) as lower priority (T3) and recommends that the agency work on improving the baseline (T1) and adding emissions coefficients (T2) instead. There was some discussion regarding whether the discussion of (3) earlier in the document was consistent with this summary conclusion, but with the discussed changes to Charge Question 3, they now should be.

With respect to recommendation CQ10-1, Dr. Wilcoxon reminded the Panel it would be deleted because it is better covered elsewhere. CQ10-2 (energy and emissions accounting) would remain and is now a repository for several other pieces, summarized above. Dr. Ho noted that recommendation CQ10-3 was somewhat duplicative of CQ2-14 so Dr. Wilcoxon agreed to merge CQ10-3 into CQ2-14. The Panel agreed that CQ10-4 and CQ10-5 are already addressed in earlier sections and are therefore redundant. Dr. Wilcoxon specified that CQ10-6 (strengthen the empirical basis of parameters) and CQ10-7 (moving to activity basis) will remain as they are now a repository for other pieces that were originally discussed under earlier Charge Questions, summarized above. Likewise, CQ10-8 (add alternative mechanisms for specifying expectations), CQ10-9 (develop a tool for expanding or collapsing industry detail), CQ10-10 (expand the treatment of agriculture, forestry and land use), and CQ10-11 (allow imperfect competition) will remain under Charge Question 10.

Dr. Wilcoxon walked the Panel through the draft letter to the Administrator where the Panel's top three priorities were listed as follows:

- Move away from the current use of a balanced growth baseline by incorporating projected changes in key variables that are exogenous to the model, such as the government's fiscal deficit;
- Improve modeling of consumer demand to avoid the current assumption that shares of different goods in overall spending are unaffected by changes in income;
- Relax the current assumption that the United States is a small open economy having no impact on world prices or financial flows.

Minor edits were offered to the first recommendation so that it is changed to "move away from the current EXCLUSIVE use of a balanced growth baseline by ALLOWING FOR projected changes in key variables ..." (emphasis added). In addition, it was suggested that "or financial flows" be struck from the third recommendation.

Dr. Wilcoxon said he would incorporate all of the changes suggested on the teleconference, with the single addition from Dr. Montgomery, and circulate a revised version for the Panel's concurrence. Dr. Stallworth clarified that a link to a Word file would be shared for any last-minute edits. Dr. Wilcoxon thanked the Panel for their participation and 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.