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Global Warming R. Prince Models

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Comparison Eval of models

Meetings with Ray Printz

10/8/96

E X E C U T I V E O F F I C E O F T H E P R E S I D E N T

09-Oct-1996 05:13pm

TO: Jeffrey A. Frankel

FROM: Raymond Prince
Council of Economic Advisers

SUBJECT: RE: global warming models

Ev Ehrlich's group is trying to choose between two models. People from DOE prefer the Oxford model which is an intl macro model they developed in-house. EPA prefers G-Cubed which is an intl CGE model they developed in-house with help from McKibben and Wilcoxen. Both agencies prefer not to use the more elaborate DRI and DGEM (Jorgensen) models because of cost considerations. I assume Brimmer and Jorgensen are lobbying to get a cut of the action. The best argument they have is that with the simplier models you get sector specific not industry specific results.

CEA should be concerned about this decision because if you feed the results from G-Cubed or Oxford into an industry specific model (essentially an IO model) you do not necessarily get results consistent with those of integrated models like DRI and DGEM and this may be used against the administration by industry. It would be interesting to get Brinner and Jorgensen's views on this.

The Bovenberg-Goulder hypothesis is being used by some people at EPA and DOE to argue that taxes and auctioned permits are preferable to other instruments on efficiency grounds. The argument is also made, based on a simple supply and demand model for electricity, that revenues should be recycled to consumer because of the loss of consumer surplus that results from a tax. I believe this argument ignores the efficiency gains from internalizing an externality that should result in an increase in non-market environmental services (a cleaner environment). I do not think either DRI or DGEM is capable of accounting for the effects of improving the environment in their results. It might be interesting to raise that issue with Brinner and Jorgensen.

I have left a copy of a comparison of the G-Cubed and Oxford models in your box.

DOE

EPA

DOE + EPA joint

EPRI industry

Model Attribute Comparison

Key Model Attributes	Oxford	Second Generation	G-Cubed	EPPA	MERGE
Type of Model	disequilibrium	CGE	CGE	CGE	CGE
Who holds model?	Consulting firm/DOE in-house	PNL (DOE, EPA)	EPA in-house	MIT (EPA, DOE)	EPRI (DOE in-house)
Geographic disaggregation		12 World regions	8 Regions	12 Regions	4 Regions
~EU broken down?	Germany, UK, Italy, France, Other	No	No	No	No
~Key Developing countries?	China, Mexico	China, India, Mexico	China	China, India, Brazil, Dynamic Asian Countries	No
~FSU,EITs broken down?	No	No	No	FSU, Central and Eastern Europe	No
~Australia, Japan	Yes	Yes	Yes	Japan, Other OECD	No
Sectoral Detail					
~number of sectors	4 Incl. Manufacturing Industries	12 Sectors	12 Industries	10 Production, 4 Consumer Sectors	Energy Only
~forestry and land use?	No	Yes	No	No	No
~capital flows?	Yes	No	Yes		No
Estimate cumulative emissions?	Iterates	Automatic	Yes	Yes	Yes
Policy levers					
~price/taxes?	Yes	Yes	Yes	Yes	Yes
~carbon cap?	No	Yes	No	Yes	Yes
Gases covered					
~CO2 from energy	Y	Y	Y	Y	Y
~Other Gases	N	Y	N	Y	N
Handling of technology		Varies by region, dynamic	Dynamic	Two technology sectors	Endogenious
~Vintaging (each sector?)		Yes	No	Yes	
~Technological detail (source?)	No			Carbon intensive and Carbon Free Backstops	Some
~Diffusion	Possible	Possible			Yes
~Policy Induced	No	No	No	No	Yes
Overlapping Generations	No	No	No	No	
Timesteps	Quarterly	5-year	1-year	5-year	10-20 year
Foresight and modifiability	Myopic and perfect foresight/adaptive expectations	Myopic, adaptive expectations and perfect foresight	Adaptive expectations and perfect foresight		Perfect foresight
...ling of Intl. Trade	Energy and Manufactured Products			All goods	Energy Goods Only

COMPARISON OF BIASES IN MACRO AND CGE MODELS

MACRO	CGE
Treatment of shocks	
Generally not forward looking, do not optimize, markets do not necessarily clear - tendency is to overstate costs although do allow for adjustment lags	Optimizing in short run only unless assume rational expectations - tendency is to understate costs because assume perfect information and lack of adjustment lags
Treatment of technological change	
Overall rate of growth is neutral and exogenously determined, do not allow for the possibility that technology may be factor saving or enhancing - tendency is to overstate costs	Same although some allow for bias technological to reflect changes in the relative price of inputs in which case direction of bias cannot be determined a priori
Elasticity of factor substitution	
Usually assume unitary elasticity - tendency is to understate costs	Same although some have non-unitary elasticities in which case direction of bias cannot be determined a priori
Price and income elasticities	
Use both short and long run elasticities - no inherent bias	Most use short-run elasticities - tendency is to overstate costs

FACTORS AFFECTING EVENTUAL COSTS

Certain factors are generally thought to effect the costs of policies but are difficult to fully incorporate into models. The effects of positive, cost-reducing, factors generated by, or part of, a policy to reduce greenhouse gas emissions which may not be fully accounted for within a model include

- **The effects of an increase in the rates of development and adoption of emission reducing technology.** Some models do have endogenously determined rates of technological change at the sectorial level which are driven by changes in relative factor prices. As a general rule, however, the overall rate of technological changes is determined exogenously. The rate of diffusion is also generally assumed to be invariant to changes in economic conditions even though the rate of diffusion of embodied technology can be affected by the capital turnover rate which is often determined endogenously.

- **The effects of a mechanism by which countries with lower abatement costs assume some of the U.S. responsibilities in return for appropriate compensation.** Such a mechanism might be created through the adoption of an international emissions trading program or through supporting programs such as the joint implementation program under the Climate Change Action Plan.

- **The effects of an increase in trade opportunities for the United States as a result of developing more environmentally benign technology.**

- **The ancillary benefits in the form of adaptation costs avoided and reductions in the anticipated future costs of other environmental programs such as those to control the emissions of mercury and ozone precursors.**

Negative, or cost-increasing, effects that may not be fully accounted for within a model include

- **The effects of adopting policies that are not incentive-based and cost minimizing such as command and control and performance based standards.**

- **The effects of compliance and enforcement costs.** Compliance is never perfect and enforcement costs never zero for any policy but most models assume perfect compliance and zero enforcement costs. Compliance rates may be unusually low and/or enforcement costs especially high for reducing greenhouse gases given the international nature of the problem and the fact that there are a large number of small polluters.

- **The effects of rent seeking behavior such as polluters delaying actions to reduce pollution in order to qualify for more emissions permits.**

- **The effects of environmental damages associated with a greater reliance on non-fossil fuels such as bio-fuels or nuclear power.**

- **The effects of leakages as firms move abroad to countries with less stringent environmental policies.**

- **The effects of an increase in abatement costs associated with a new program.**

Most models contain implicit assumptions about all these factors which may or may not be valid for the policy under consideration. We must, however, resist the temptation of make unrealistic assumptions to suit a particular agenda. Assumptions which are at variance with our historical experience, while not inherently invalid, must be given special scrutiny.

Bovenberg-Goulder Hypothesis (AER, Sept 1996): The positive welfare effect of internalizing pollution externalities is largely neutralized by the negative welfare impact by increasing the difference in the implicit rate of taxation on labor versus leisure. Therefore, potential efficiency gains are greater with Pigouvian taxes (and auctioned permits) than other instruments because of the opportunity to use revenues to reduce distortionary taxes. In addition, the welfare maximizing tax on pollution is significantly less than the Pigouvian tax if other distortions are left untouched.

COMMENTS

This hypothesis suggests that taxes, or auctioned permits, are to be preferred over other pollution control instruments unless other costs, such as for monitoring and enforcement, are significant. This hypothesis has been cited by numerous individuals in the climate change debate as a reason for supporting the use of taxes.

1. This result is essentially a partial equilibrium analysis since it assumes that other distortions remain constant. The optimum pollution tax equals the Pigouvian tax if other distortionary influences are eliminated.

2. Result ignores the fact that taxes and permits may be set at a level inconsistent with a long run-equilibrium. With permits, however, it is possible to capture some of the foregone intra and inter-temporal efficiency if trading with banking and borrowing is permitted. No analogous correction mechanisms exists for taxes set at sub-optimal levels.

3. Auctioned permits may introduce new distortions if the market for permits is not competitive.