

## **Nominated Discussion**

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## **Comments on Country-Specific Market Impacts of Climate Change**

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The Environmental Change Unit also has developed a damage model similar to GIM. Called the Open Framework for Climate Change Impact Assessment (OF), the model includes transient scenarios and biophysical spatial impact indices of the reference projection (IS92a and IS92d) and climate change. Lower, medium and high estimates are made for market damages at the country level and non - market damages at the global level. Equity issues are being added in research sponsored by the European Union extend project, in collaboration with Richard Tol.

Against this background of our own work, I would like to discuss some of the implications of this paper. This paper raises a key question - to what extent does climate change imply differential impacts in different countries? The paper is a beginning of what I am sure will be a long and contentious discussion. It is an important paper in this regard.

I would like to focus my comments on four questions, that emphasize the positive contributions of this paper and its role in stimulating debate.

### **1) What should we remember from this paper?**

The overall conclusion is that the impact of climate change may well be beneficial for market - traded commodities, at least in some types of economies (e.g. where adjustment costs are small) and in some regions (particularly those that benefit from warmer conditions).

### **2) What should we not forget?**

Three influences of climate change impacts are not dealt with in the paper, and these could be important:

- a) The spatial pattern of impacts depends on the reference scenario and climate scenario. A cooler richer scenario (e.g. the IS92d) should reduce adverse impacts while a hotter, poorer scenario (e.g. the IS92a) could spell catastrophe in some regions. To some extent regional variations even out at the global level, although regional variations are important for policy makers.
- b) Sectoral estimates of climate change impacts are still highly uncertain even for market effects. Even the sign of the change has not been resolved in many cases.
- c) Non-market and equity effects dominate aggregate estimates of climate change impacts. Thus, this paper does not suggest that climate change will be beneficial, only that some effects will be beneficial.

### **3) What should we forget?**

I appreciate the authors' comparison of two methods of valuation - more such appraisals are essential. However, the Ricardian cross - sectional or spatial analogue approach is questioned when dealing with large-scale environmental changes. I am not an economist, but it seems that process-based impact models need to be matched with economic valuations that allow more dynamic assessments of the structure of economies and their service to societies.

#### 4) What should we do?

I believe we should take seriously the authors' injunction to develop country-specific estimates of climate change damages. The goal, however, is to develop better global estimates. I doubt that we are very near to achieving robust country or regional estimates for very many sectors. And I seriously doubt that knowing the winners and losers with any confidence will make international negotiations any easier, at least at this stage.

I would like to conclude with a specific comment and a general observation.

1) The GIM assessment underestimates the difference between winners and losers, at least with the reduced form model. The sum of all of the benefits (by region) in Table 3 is \$260b, while the sum of all of the costs is \$540b. Thus, the implied transfer of welfare from winners to losers (\$260b) is equivalent to the net impact at the global level (\$280b). Equity weighting implies that at the global level we are willing to count impacts in poor countries at a higher level than impacts in wealthy countries. This will offset some of the distortions induced by adding benefits and costs to a global sum.

2) Over the past year or so researchers in Europe have developed an approach to uncertainty that distinguishes between levels of confidence in the elements of climate scenarios. This cascade of confidence can be matched against reliability in economic valuation (see Table 1.) The highest confidence occurs in market valuation of convergent scenarios such as sea level rise, CO<sub>2</sub> and temperature-dependent effects (such as energy demand). The largest uncertainties remain in nonmarket (subjective or contingent valuation) and equity valuation for aspects of climate change that involve significant changes in risk (e.g. windstorms) and surprises where even risk distributions are difficult to estimate. This ordering of climate impacts and economic valuation suggests that much remains to be accomplished in answering our initial question.

Table 1: Cascade of Confidence in Climate Change and Economic Valuation.

Climate change	Climate element	Example of Impacts	Damages, % of GWP		
			Market	Non-Market	Equity
Convergent	CO <sub>2</sub> , Temperature, Sea level rise	Coastal energy, Temperate forest (?)	-0.2 - 0.5	0 - 1 <sup>+</sup>	?
Bounded Divergence	Precipitation	Agriculture Water Tropical forests (?)	-0.2 - 0.5	0 - 1 <sup>+</sup>	??
Shift in risk	Windstorms, Drought	Natural Disasters	1 - 10	0 - 10	???
Surprise	ENSO, Ice sheets, Ocean circulation	Regional collapse of ecosystems and economies	1 - 10 <sup>+</sup>	0 - 10 <sup>+</sup>	???

Notes: Economic valuation is illustrative rather than based on a specific model or review of models.