

COMMENTS ON

'An Empirical Study of the Economic Effects of Climate Change on World Agriculture', by S. Kane, J. Reilly and J. Tobey (*Climatic Change* **21**, 17–35).

A recent paper by Kane *et al.* (1992) concludes that climatic changes producing substantial reductions in agricultural yield would have only modest effects on total global agricultural production and economic welfare. This conclusion could very well lead to an unjustified complacency concerning the potential effects on agriculture of climatic change induced by greenhouse gas increases. The methodology employed by Kane *et al.* (1992) is particularly suspect and not one that should be replicated in subsequent studies. Although published in what is supposed to be an interdisciplinary journal, this paper fails to draw obvious and important cross-disciplinary linkages, further undermining its conclusions. Finally, the paper concludes with a reference to policy considerations which is objectionable on both moral and legal grounds. These points are elaborated below:

(1) This paper is written from the perspective of affluent members of affluent societies. Consumer surplus, defined as 'the willingness to pay [for food, in this case] beyond what is actually paid', is used as a proxy for consumer welfare; this definition is inappropriate to the very people who will be most affected by adverse climatic change, namely, the poor. In many cases these consumers are already paying all that they can to acquire food and still suffer from sub-standard nutrition. Further price increases for them will result in increased incidence of disease and death. In the analysis of Kane *et al.*, an increase in producer surplus (due to higher prices, and allowing greater discretionary spending for this group) can offset decreased consumer surplus (implying less survival spending for some members of the group and greater mortality rates) to give no net change in human welfare. Has it ever occurred to economists to talk to sociologists about the implications of their analysis?

(2) The analysis of Kane *et al.* assumes that availability of land and other physical inputs will change so that global food supply will equal global food demand even under dramatically altered conditions. Given that the world's population may very well have reached 10–12 billion by the time the doubled-CO₂ climate is realized, this is a remarkable assumption even in the absence of climatic change. When will economists abandon the peculiar assumption that the world and its resources are infinite? Clearly there is room for interdisciplinary communication with, for example, geographers!

(3) The authors argue that the lack of interaction between agriculture and other sectors in their analysis is not important because 'agricultural production is only a small part of total output and therefore has relatively little effect on resource allocations in other sectors'. This assumption is inconsistent with the previous assumption that the amount of land allocated to agriculture will be adjusted to

meet global food demand at all times. If, as assumed in their scenario B, agricultural yields decrease by 10–20% over major food producing regions at a time when world population has reached 10 billion, this would imply unprecedented pressures on the world's remaining forests. The economic impact on the forestry sector would certainly not be negligible. Chock up another missed opportunity for interdisciplinary collaboration.

(4) Related to the above assumption is the implication in Kane *et al.*'s discussion of their results that agriculture is unimportant to industrialized economies because it constitutes only 3% of GNP on average. However, I would venture that if global agricultural production were to cease, global GNP would fall by 100%, not 3%! Agriculture is unimportant to national economies only if it is assumed that food scarcity does not arise. The purpose of analyses of climatic effects on agriculture should be to determine under what conditions absolute scarcities can be avoided, rather than starting from the premise that aggregate scarcities will not arise in the first place, as in Kane *et al.* (1992).

(5) This analysis, like the majority of climate impact analyses, does not adequately emphasize that the analysis concerns only one point in a continuum of open-ended change (barring emission restraints), namely, that pertaining to a doubled CO₂ climate. Human societies are probably already committed to a doubled CO₂ climate, irrespective of near-term energy policy decisions, so the more relevant policy information is the possible impact of larger greenhouse gas increases than an effective CO₂ doubling. Although the uncertainties are large, there are a number of reasons for expecting the risk of significant negative impacts to grow with increasing greenhouse gas concentrations: (a) net production impacts in countries such as Canada depend on the difference between losses along southern margins and gains along northern margins; as climate continues to warm less land with suitable soils will be available along northern margins to offset losses along southern margins; and (b) net impacts also depend on the balance between oftentimes large increases in both precipitation and evaporation; as climate warms, one can expect on the basis of simple principles that evaporation increases over land will increasingly dominate land precipitation increases (Rind *et al.*, 1990; Harvey, 1992). Even if one believed the net effect on global agriculture and genuine human well-being of a doubled CO₂ climate to be zero, this would provide no reason for complacency.

(6) Kane *et al.* (1992) conclude with the statement, 'policymakers' perception of the structure of *incentives to reduce greenhouse gas emissions* should not be based solely on predicted national agricultural changes, but rather on how these yield effects alter global agricultural markets, and consequently, *domestic producer* and *consumer welfare*' (emphasis added). The implication seems to be that if, for example, it can be shown that American welfare is not diminished then American policymakers need not contemplate reductions in American greenhouse gas emissions. I find this position to be morally objectionable. Furthermore, it is indefensible under emerging norms of international law (another missed opportunity for

interdisciplinary collaboration). Several recent rulings involving international litigation hold a nation liable for environmental damage occurring outside its borders as a result of actions by that nation, even if the action was not known at the time to be harmful (see Zaelke and Cameron, 1990). If one is to be guided by widely accepted legal principles, then policy decisions regarding greenhouse gas emission reductions will be based on anticipated global and not merely domestic impacts. Further complicating the assessment of domestic costs is the likelihood that strong pressures will be applied on the principal greenhouse gas emitting nations to compensate poor nations adversely affected by global warming. The analysis and conclusions of Kane *et al.* (1992) appear to rule out the possibility of compensation.

In closing, I am optimistic that the global food system can handle the impact of modest climatic warming. This is due in part to the considerable opportunities for adaptation in response to changing climate. However, 'adaption' risks becoming an Orwellian term which masks hard and brutal realities. A colleague of mine is agonizing over the decision of whether or not to change jobs within the same city; some agricultural 'adaptations' will involve decisions of 100 000's of people to make moves of hundreds of kilometres, uprooting entire families and risking livelihoods. In some jurisdictions these human-scale consequences of climate change are likely to be as important a policy consideration as the supposed macro-economic impacts.

References

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*Department of Geography
University of Toronto
100 St. George Street
Toronto, Canada M5S 1A1*

L. D. DANNY HARVEY