

THE ECONOMIC SCIENCE FICTION OF CLIMATE CHANGE: A FREE-MARKET PERSPECTIVE ON THE STERN REVIEW AND THE IPCC

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The Stern Review and the IPCC believe that anthropogenic climate change is a serious global threat and demands an urgent response. Examining the IPCC's projections of future climate change and Stern's estimates of its costs from a free-market perspective shows that they are based on flawed methodological assumptions and reflect an excessively optimistic approach to knowledge of the future. The foundations of reliable knowledge for a sound policy framework have not been put in place.

Introduction

The Stern Review analyses climate change as a market failure – and indeed not just any market failure, but ‘market failure on the greatest scale the world has seen’ (Stern, 2007, p. 27). Or is it rather the greatest moral panic?

In a neoclassical context, market failure assumes welfare maximisation, in that market failure occurs when markets fail to maximise welfare; that is, they fail to locate the one level of output (of goods whose production is carbon intensive) that brings marginal benefit and marginal social cost into equilibrium. The economist more in agreement with the Austrian school of economics disagrees with this basic premise of Stern's analysis. It is not markets that have failed, but governments in failing to allocate property rights. One approach to environmental economics – based on the Austrian approach – understands environmental problems as interpersonal conflicts rather than market failures (Cordato, 2004). Climate change is an example of interpersonal conflict over the use of resources as some individuals use the atmosphere as a carbon sink, changing the climate and thereby making it impossible, for example, for other individuals to rely upon an unchanged climate as a resource for growing crops in particular locations. The purpose of climate change policy is to allocate the missing property rights (to a climate unchanged by human activity) and install legal institutions that will enable

goal-seeking individuals to defend those rights against invasion. True, this is an arduous task but less so, in the opinion of this author, than the orthodox approach to climate change policy, which Stern inadvertently reveals to be based upon guesswork and wishful thinking, and which is without serious prospect of success.

I will try to make good this claim by examining the Stern Review and the work of the UN's Intergovernmental Panel on Climate Change (IPCC), on which Stern uncritically relies, from a free-market perspective. Firstly, I will argue that the IPCC is a near-monopoly producer of climate science, much of which is politicised. Secondly, Stern's dramatic headline figures are, I will suggest in common with other commentators, in part the result of incorporating estimates of alleged costs that are immeasurable and of using an unrealistically low discount rate. Thirdly, they are also the outcome of Stern's decision to rely exclusively on just one of the IPCC's ‘families’ of emissions scenarios (the A2 family), even though the IPCC itself regards them all as equally valid. The policy framework that Stern puts forward is therefore without secure foundations in theory or evidence.

Conjectures, refutations – and negotiations

There are legitimate questions to be asked about climate science as it is presented by the

IPCC, many of which are raised in a report on the economics of climate change by the House of Lords Economics Affairs Select Committee (House of Lords, 2006). Stern does not reference this illuminating report, and dismisses doubts about the IPCC's climate predictions. This is a damaging omission because the IPCC's science is politicised. According to Popper (1965, pp. 24–25) science proceeds by the refutation of conjectures that fail and the tentative acceptance of conjectures that withstand empirical testing. The 'friendly–hostile co-operation' of scientists in testing each others' conjectures is similar to the behaviour of firms in a competitive market, hostile in the competition to make a profit by supplying the market, but friendly in that their rivalry is governed by agreed rules of the game. Firms achieve success by keeping costs down or through innovation, not by anti-competitive practices such as negotiating price-fixing arrangements. This is particularly true at the introductory stage of the industry cycle, where there are many small firms experimenting to find the product that will become the industry standard.

The science of climate change is not yet settled and is therefore still at the introductory stage of the industry cycle. Some scientists maintain that global temperature changes are caused largely by natural forces including variations in solar activity (Baliunas, 2002; Carter *et al.*, 2006; Singer, 1999; Svensmark and Calder, 2007). Others argue that even if anthropogenic climate change is occurring, it may not be on a dangerous scale.

The innovations that could flourish in this introductory stage are severely under-resourced because the IPCC is a state-sponsored monopoly attempting prematurely to impose an industry standard. The IPCC's would-be industry standard is not a science, not a collection of conjectures that have survived rigorous testing, but a politically driven selection from the full range of scientific opinion. The Summary for Policymakers of the IPCC's Fourth Assessment report of 2007 is 'the product of political bargaining among member governments' (Kasper, 2007, p. 90; McKittrick *et al.*, 2007). A publication that political representatives have negotiated line by line is not science as conjecture and refutation.

Creatively accounting for the costs of climate change

The headline numbers in the Stern Review which have been reported are sensational, most prominently the claim that by 2100 the damage wrought by climate change might reduce the value of the world economy by between 5% and 20% compared with a world without climate change. Yet this catastrophe could be prevented at a cost of only 1% of the world economy. On the face it, Stern's call for policies to be put in place urgently to reduce greenhouse gas emissions present government with what is colloquially called a 'no brainer'; a decision so obvious that no thought is needed to make it.

The Stern Review (pp. 161–162) explains that the main reason for deciding to run PAGE2002, a British integrated assessment model designed for government use in assessing the physical and economic consequences of climate change, is that it can readily be adapted to include estimates of non-market impacts or costs of climate change. Firstly, even before considering non-market and other impacts omitted from other estimates, Stern's results are higher than the 1–2% loss of world

gross national product that most previous researchers found (Cline, 1992). Stern claims that 'if we don't act, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever' (Stern, 2007, p. xv). I return to the gnomish phrase 'now and forever' below.

Secondly, Stern departs from most other models by adding 'non-market' impacts on the environment and human health, which increase the total cost from 5% to 11% of global GDP. These estimates are highly controversial, having been dismissed by some commentators as 'conjectural' (Byatt *et al.*, 2006, p. 205). In fact they are worse than that: they fail to acknowledge the degree to which both disease and casualties from natural disasters are related to income rather than environmental factors (Carter *et al.*, 2006, p. 187; Goklany, 2007; Reiter, 2007). Stern's predictions of impacts are based on the A2 'scenario family' from the IPCC's Special Report on Emission Scenarios (SRES), in which 'per capita economic growth and technological change [are] . . . slower than other storylines' (IPCC, 2007, p. 14). Stern arbitrarily prefers A2 to the A1 scenario family which assumes 'rapid economic growth' and 'a substantial reduction in regional differences in per capita income' (IPCC, 2007, p. 14).

Thirdly, Stern includes estimates of the positive feedback effects of climate change ('recent scientific evidence indicates climate . . . may be more responsive to GHGs [greenhouse gases]'), which increase the potential total cost from 11% to 14% of global GDP. Finally, Stern addresses the expectation that a disproportionate burden of climate change will fall on poor regions. Giving this burden a stronger relative weight 'could increase' total costs by a quarter, taking the total cost of global warming up to 'around 20%' of global GDP 'now and forever'. Stern arrives at such a large adjustment for poor regions 'now and forever' because he assumes that vulnerability to climate change is independent of development. However, according to Tol and Yohe (2006, p. 237), 'it is widely known that adaptive capacity and thus net sensitivity . . . to climate change is very site specific and path dependent'. All but one of the six illustrative SRES scenarios assume that developing countries are no longer poor in absolute terms when severe impacts occur.

What does Stern mean by 'now and forever'? According to Nordhaus (2007), losses expected to occur over the period 2000–2100 average only about 1% per year but are increased to about 14% 'now and forever' because the extremely high losses predicted for the distant future are averaged out over all the years from the present to the occurrence of the loss. The Stern model, as run by Nordhaus (2007), projects a mean loss of only 0.4% of world output in 2060 (including non-market and catastrophic impacts), rising to 2.9% in 2100 and 13.8% in 2200 (pp. 157–158). Nordhaus (2007) concludes that 'using the Review's methodology, more than half of the estimated damages 'now and forever' occur after the year 2800' (p. 158).

'Why should I do anything for posterity? What has posterity ever done for me?'¹

In order to evaluate impacts over the long term it is necessary to choose a discount rate, and Stern's decision to use much lower rates than other researchers has proved controversial. The discount rates used in Stern's running of PAGE2002 were eventually disclosed as 2.1% up to 2100, 1.9% for 2101–2200 and

1.4% for 2201–2300 and indeed in perpetuity (Monckton, 2006); i.e. they decline over future time. The uncertainty surrounding knowledge of events in the remote future may reasonably be thought to imply a higher discount rate over time, but Stern argues that uncertainty implies a lower rate. Such low discount rates virtually guarantee a high estimate for the costs of climate change compared with the costs of action to mitigate it, as the former are largely borne in the distant future and would therefore diminish sharply were a higher discount rate to be used, while the latter are incurred in the near future (Tol and Yohe, 2006, p. 238).

Stern explains the decision to use a low discount rate as an acknowledgement of the importance of intergenerational justice, drawing upon the theory of justice as fairness (Rawls, 1973). The idea of treating individuals fairly or impartially might be extended over time, suggesting that the well-being of each generation should be equally valued. The implication is that the discount rate applied by society to further the well-being of future generations should be zero. Mitigation is therefore inescapably altruistic, being intended to benefit people who do not yet exist.

On Stern's own assumptions, however, future generations will be much wealthier, which would argue for a higher discount rate. Moreover, there are issues of intra-generational justice to be considered. The current generation is obviously not uniformly affluent. The low discount rate implies that the current generation of poor people should transfer a greater part of its income to wealthier future generations (Byatt *et al.*, 2006, p. 214). Stern's view seems to be that the extra burden of reduced consumption entailed by mitigation should therefore fall disproportionately on rich countries. However, Stern does not seem to follow this through by increasing his estimate of the burden of mitigation on today's rich countries.

Stern has been criticised for considering only 'a narrow range of plausible ethical approaches', omitting in particular agent-relative ethics (Beckerman and Hepburn, 2007, p. 188). The essence of agent-relative ethics is captured in this quotation from Hume:

'A man naturally loves his children better than his nephews, his nephews better than his cousins, his cousins better than strangers, where every thing else is equal.'

(Hume, 1740, reprinted 1969, p. 462)

The difference between Rawls and Stern on the one hand and Hume on the other reflects a difference of attitude among the current generation towards temporally remote strangers. However, the underlying reason for scepticism towards Rawls is not one of limited sympathy but of limited knowledge. John Kay criticises Stern's approach as unworkable on epistemic grounds:

'The number of future generations is potentially so large that small but permanent benefit to them would justify great sacrifice now . . . The burden of caring for all humanity, present and future, is greater than even the best-intentioned can bear.'

(Kay, 2007)

There is more to the epistemic case against Rawls than the open-ended nature of a commitment to fairness for posterity.

What would it mean to treat a generation that will not exist until far into the future impartially, that is, with as much consideration as the current generation? Treating different people fairly entails taking account of relevant differences such as income, wealth, wants, beliefs and security. Without even the possibility of such knowledge, there is no basis on which to write blank cheques in favour of distant future generations.

'I never make predictions – especially about the future'²

The objective of climate change policy, according to Stern, is to control the risks of serious damage from climate change (p. 347). This probability-based (or expected utility) approach (p. 173) is best understood in terms of an analogy with insurance. You insure, not against routine minor mishaps, which are excluded by the excess, but against events that are unlikely to happen to you but will be catastrophic if they do. However, there is no actuarial basis for assessing the risks of climate damages because there is no population of individuals whose experience can be used to calculate an average risk. The risks estimated by Stern therefore reflect the probability of catastrophe predicted by running the PAGE2002 model. And here lies the strongest argument against the fundamental direction of Stern's approach.

The purpose of running PAGE2002 is to estimate the cost of 'business as usual' climate (Stern, 2007, p. 161). The PAGE2002 derives its baseline climate from the A2 emissions scenario family, one of six scenario families summarised in the IPCC Special Report on Emissions Scenarios (IPCC, 2007, p. 14). The A1 scenario family describes a future world of rapid economic growth, rapid technological growth and regional convergence; there are three variants of A1 distinguished by different levels of reliance on fossil fuels. The world described in the A2 storyline is characterised by slower economic growth and technological change, with a greater role for self-reliance and the preservation of local identities. In the B1 storyline the world converges on a services and information economy using clean and resource-efficient technologies. The B2 scenario family describes a world characterised by local solutions to economic, social and environmental sustainability.

The first problem raised by Stern's general procedure is that the objective of estimating the costs of business as usual climate change is incoherent. The point about human activity is that it rarely proceeds as usual. This is particularly true of the economy. Shackle (1983) was sceptical of the idea that entrepreneurial activity could be understood in terms of incremental change: '[T]here will always be shocks and things that really upset all calculations. I can't really quite believe in the idea of steady improvement, you know'.

Kirzner was equally clear that 'the dynamic of entrepreneurial discovery operates by continual disruption of the quiet life that would, in its absence, be enjoyed by those pursuing established (and partially 'erroneous') patterns of market behaviour' (Kirzner, 1982, p. 4).

One way of expanding on these insights is that economic activity in capitalist economies gives rise to endogenous shocks, surprise events that arise out of the process of innovation itself. Entrepreneurial activity proceeds by shocks or surprises and sometimes these innovations give rise to other

innovatory shocks, so that estimating the rate of technological change is subject to huge uncertainty. In failing to acknowledge the inherently unpredictable nature of entrepreneurial activity and hence economic growth, Stern risks repeating the error, attributed to the Commissioner of the US Patents Office, of claiming in 1899 that 'everything that can be invented has been invented'. Looking back at the world economy in 1976 and the enormous changes that policy and technology have wrought in just 30 years might have persuaded Stern to be wary of founding climate change scenarios on 'business as usual' for the next century and beyond.

The final and perhaps most damaging difficulty with Stern's reliance on the IPCC's emissions scenarios is that his use of PAGE2002 is undermined by the IPCC itself. In 2007 the IPCC reported the '[b]est estimates and likely ranges for global average surface air warming for six SRES emissions marker scenarios' (IPCC, 2007, p. 10). The best estimate for 'the low scenario (B1) is 1.8°C (likely range is 1.1°C to 2.9°C) and the best estimate for the high scenario (A1F1) is 4.0°C (likely range is 2.4°C to 6.4°C)' (ibid). It seems astonishing that the IPCC goes on to state, of the six scenarios chosen to illustrate each of the six scenario families, that 'All should be considered equally sound' (IPCC, 2007, p. 14). One implication is that Stern's decision to use A2 as the baseline climate for PAGE2002 is, on this basis, arbitrary, for using any one of the other scenarios would have been 'equally sound'.

The further implication of the 'equal soundness' of each of the IPCC's emissions scenarios is more damaging to the alarmist claims made by Stern and the IPCC about the impacts of climate change. It is widely believed that the impacts of an increase in global temperature below 2°C will be mild and that cereal yields will actually increase in temperate regions. At a global temperature increase of 4°C the impacts are believed to be catastrophic, with up to 80 million people exposed to malaria, up to 300 million more people affected by coastal flooding each year, and rising risks of extreme weather events (Stern, 2007, Table 3.1, and Ch. 3, pp. 65–103). The important point here is that scenarios are descriptions of possible outcomes to which no probability can be attached; the IPCC does not rate each scenario as more or less likely to occur. It is therefore impossible to assess the risk of any of the associated impacts; where there is no possibility of estimating probability, there is not risk, but uncertainty.

'The sense in which I am using the term [uncertainty] is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention . . . About these matters there is no scientific basis on which to form any calculable probability whatever. We simply do not know!'

(Keynes, 1937 [1973])

Will the impacts of climate change be mild or catastrophic? For all their climate and economic modelling, there is only one answer that Stern and the IPCC are entitled to make: 'We simply do not know!'

Policy

Without such knowledge the attempt to make policy recommendations is futile. Stern's review of the climate change

policy literature has caused less controversy than the modelling results, and I will simply make five brief comments on the Stern policy framework. My first comment is that the uncontroversial nature of the policy analysis is in itself grounds for disquiet. The much higher potential costs of climate change might reasonably have been expected to have prompted new thoughts about policy. However, Stern has nothing innovative to contribute to the policy debate. As Tol and Yohe (2006) observe, 'the Stern Review does not even deviate from earlier UK policy' (p. 240), even though its estimate of the potential cost of climate change damage is far higher than any previous estimates available to UK policy-makers. This is not the only inconsistency in Stern's policy review.

Secondly, there is an inconsistency between Stern's call for urgent action and the analysis of taxes and tradable allowances in the short term. The opening sentence of 'Key Messages' in Chapter 1 states that 'an overwhelming body of scientific evidence now clearly indicates that **climate change is a serious and urgent issue**' (Stern, 2007, p. 3; emphasis in original). The first four lines of 'Summary of Conclusions' contain the phrases 'if we take strong action now' and 'it [climate change] demands an urgent global response' (Stern, 2007, p. xv). However, it is a familiar argument in the economics of climate change literature that action can be postponed while new information is acquired that will enable the formulation of more efficient policy measures. CO₂ is a stock pollutant in that it is the concentration of CO₂ in the atmosphere that is believed to contribute most to global warming, not the emissions during any one year. Paradoxically (in view of his calls for urgency) Stern seems to accept this familiar argument. Stern's conclusion that taxes are preferable to quantity controls in the short run is predicated on this generally accepted view that the short-run costs of carbon are not high. In Figure 14.1A (Stern, 2007, p. 356) the marginal benefit of abatement curve is relatively flat or gently decreasing, reflecting 'the fact that variations in emissions in any single year are unlikely to have a significant effect on the ultimate stock of greenhouse gases' (Stern, 2007, p. 355).

Thirdly, a further inconsistency (or at least a tension) exists between Stern's conclusions on national policy frameworks and international policy harmonisation. In discussing climate change policy at the national or regional level, Stern argues that 'governments will want to choose a policy framework that is suited to their specific circumstances' (p. 351). This is a reasonable point in itself but Stern goes on to emphasise the importance of international harmonisation of policies; for example, in moving towards a single global carbon price. There is a clear tension between these policy perspectives, and Stern recognises it by making inconsistent claims within the same sentence: 'International coordination and harmonisation are essential yet each nation should be able to design its own mix of policy instruments to suit its own circumstances' (p. 366).

One way out of this impasse would be to set definite boundaries to national discretion, but it is difficult to see how international policy harmonisation can be achieved without circumscribing national policy discretion. For example, there is no hope of reaching a single global carbon price while many countries continue to subsidise fossil-fuel extraction. International policy harmonisation must therefore include

removing subsidies, which would in any case be a 'no regrets' policy, as Bradley (2003, pp. 119–120) points out. Yet European Union member states, officially committed to leading global efforts to reduce carbon emissions, also subsidise fossil fuels, particularly coal. The EU total fossil-fuel subsidy in 2001 amounted to €21.7 billion (EEA, 2004, p. 14). Moving towards a single global carbon price requires that such subsidies be removed, and that calls to accommodate the specific circumstances of nations and regions, mainly concerning employment, be overridden. International harmonisation in any meaningful sense is incompatible with national and regional discretion.

Fourthly, Stern seems to be guilty of failing to grasp the full significance of the distribution of the costs of mitigation. The Bali negotiations showed that most governments had no interest in Stern's 'no brainer'. Who could refuse the offer of saving the world at so little cost? The answer is that mitigation hits some countries much harder than others. Stern seems to be guilty of a bias towards excessive aggregation, failing to grasp the full significance of the fact that 1% of world GDP is not going to be evenly distributed. Stern examines the likely incidence of the costs of mitigation but mainly at the industrial sector level for the UK (pp. 278–279). Stern also acknowledges that countries producing energy-intensive goods 'may be hardest hit' (p. 289). But there is no awareness of the scale and the significance of these effects on those countries whose comparative advantage depends on their abundant endowment of fossil fuels. Reducing carbon emissions on the scale demanded involves calling for much more than a 1% loss of some national GDPs.

Fifthly, a more fundamental criticism of Stern's policy framework is that the basic distinction between prices and quantity controls is incoherent. The carbon price 'should be equalised across sectors' (Stern, 2007, p. 384) and the urgent task is to create a 'comparable carbon price signal around the world' (p. 530). Either a price instrument (tax) or quantity control (tradable permits) 'could establish the common price signal across countries and sectors' (p. 351). Writing from a neoclassical perspective, Stern does not explain the process by which the price signal is going to be transmitted. Hayek (1945) argued that neoclassical economics, by assuming agents are perfectly informed, placed insufficient emphasis on the discovery of knowledge and the effect this has on people's behaviour in markets. In signalling shortages or gluts to producers and consumers, price movements disseminate local knowledge (p. 523). The Austrian approach models markets on the assumption that the background knowledge, such as the location of competitively priced goods and supplies of raw materials or skilled workers, possessed by economic agents such as buyers and sellers is incomplete. The great advantage of competitive markets is how little information is needed for them to allocate resources in a way that reflects consumers' wishes and the production possibilities of the economy. In particular agents do not need to know the aggregate quantity traded. Moreover, the price and, above all, the quantity traded are not intended by any economic agent and are independent of the preferences and intentions of any individual.

The single clear worldwide carbon price signal envisaged by Stern would be an administered price signal, and the quantity

of carbon emissions produced, far from being independent of the preferences of any agent, would be set in advance of market transactions. In order to set the carbon price through tax 'across countries and sectors' governments must know the value of the negative externality and the socially optimum level of fossil-fuel consumption and greenhouse gas atmospheric concentrations. They must know the safe quantity of carbon emissions and therefore the quantity of goods that should be produced using fossil fuels throughout the global economy. What drives the price signal is therefore a quota. The price signal is merely an instrument used to control the quantity. Ultimately there is no real difference between price and quantity control.

This is why tax is not best understood as a market-based instrument, as though the government imposing the tax is a particularly knowledgeable and helpful additional agent; taxes are distortions of and interventions in the market just as much as regulation. Instead of disseminating equal bits of scattered knowledge through price signals, taxes impose an administered price derived from a judgment about quantity. The problem remains the same in both cases: how do we know what the safe or optimal quantity (of goods produced using fossil fuels) actually is? Stern can answer this question on the basis of his arbitrary choices for the climate baseline but in view of the IPCC's utterance about the equal validity of all the emissions scenarios, a reasonable person cannot do otherwise than conclude that the correct quantity is unknown.

Conclusion

My purpose in this paper has been to challenge, from a free-market perspective, the claims made by the Stern Review and the IPCC that anthropogenic climate change is a serious global threat and demands an urgent policy response. Stern's estimates of the costs of climate change are the product of an unstable mixture of sound economic modelling and guesswork. I have argued that the IPCC is not the competitive arena of scientific debate but a monopoly producer of a highly politicised science and its conclusions do not merit Stern's unquestioning adherence. The most important reason for the very high estimate that Stern places on the costs of climate change is the unreasonably low discount rate employed. A free-market perspective that sees competition as a process that uses knowledge scattered through the economy highlights the extraordinary optimism of Stern's assumption of the possibility of reliable knowledge about the indefinite future. Ironically, one of the most damaging blows to Stern's calculation of the costs of climate change impacts is dealt by the IPCC itself, in an inconspicuous comment that all of its emissions scenarios are equally valid. Since the different scenarios range from benign to catastrophic in their possibilities, Stern's reliance on only one is unwarranted. For these reasons there is no foundation for the policy framework that Stern advocates.

It is a task for another paper to undertake a critical assessment of current thinking on climate change policy instruments and to offer a free-market alternative that not only addresses the radical uncertainty of emissions scenarios but also promotes a competitive market in scientific understanding of climate change.

1. Attributed to Groucho Marx.
2. Attributed to Sam Goldwyn, the Hollywood producer.

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