Stockholm University

Department of Physical Geography
and Quaternary Geology

Global Climate and Environmental Change

Winter Term 2007
Main instructor: Karin Holmgren
Course assistant: Hanna Sundqvist

The Stern Report

- A Critical Analysis -

Maximilian Müngersdorff

Torphagsvägen 18
10405 Stockholm
muengerdorff@web.de

1 Introduction

The "Stern Review of the Economics of Climate Change"[1] discusses the effects of climate change and global warming on the world economy and is the most widely known report of its kind. The Report of approximately 700 pages was composed in 2006 by a team of 23 scientists led by Sir Nicholas Stern, head of the Government Economic Service in the UK and advisor to the British Government.[2] It was delivered to the Chancellor of the Exchequer and the Prime Minister of the United Kingdom at the end of October 2006.[3]

The Review's main finding states that the scientists "(…) estimate the total cost over the next two centuries of climate change (…) to an average reduction in global per-capita consumption of at least 5%, now and forever."[4] Stern furthermore emphasizes that continuing the business as usual path of relying highly on burning fossil fuels "(…) could create risks of major disruption to economic and social activity, later in this century and in the next, on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century."[5] Against the background of these alarming figures and projections he concludes that tackling the reasons for anthropogenic induced climate change now would definitely outweigh possible future costs.[6] Numerically this essentially means that humankind would have to invest around 1% of global GDP in the stabilization of greenhouse gases in the atmosphere at 500-550 parts per million of carbon dioxide equivalents.[7]

After its publication, the Stern Report received much feedback, especially from scientific circles which expressed criticism mainly over his methods and assumptions. This paper will discuss the most important critique both concerning the scientific background and the economic analysis of the Review. Since the focus of the Stern Report clearly lies on economic aspects, the same focus will be applied to the following examination. In this regard, it shall be emphasized that the aim of this paper is to provide the reader with a general overview of the main criticism that arose after the publication of the Stern Report. A deep analysis of the achievements of the Review as well as of the points of criticism is beyond the scope of this paper; those seeking greater depth will therefore be referred to the cited literature.

2 Climate Science – Main Points of Criticism

The scientific basis of the Stern Report's assumptions concerning the costs of climate change is of course climate science itself. Hence, a critical analysis of the data set Stern uses to predict future economic damage through global climate change is of crucial importance in order to identify possible weaknesses in his argument. In the following section, the Review's weak spots regarding the data used will be briefly analyzed.

The Stern Report's most obvious shortcoming is the utilization of only the worst case scenarios for future climate impacts presented in the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) – the Review is only based on the four worst IPCC projections out of 40.[8] Altogether, Stern and his colleagues assume even larger feedbacks, impacts and damages through climate change than any prediction of the IPCC.[9] This one-sided and quite pessimistic view of future developments also holds true for Stern's economic outlook, as will be discussed in more depth in the next chapter.

[1] In the following "Report", "Stern Report" or "Review".
[2] Tol (2006).
[3] Byatt, Sir Ian et al. (2006: 165).
[4] Stern (2006: 10).
[5] Stern (2006: 2).
[6] Stern (2006: 2).
[7] Stern (2006: 12).
[8] Byatt, Sir Ian et al. (2006: 180).
[9] Byatt, Sir Ian et al. (2006: 170).

Another vital weakness of the Review's climate science section is its reduced and selective usage of the available literature. For instance, when the Review comes to the assessment of the dangers for ecosystems and extinction risks, Stern uses a worse-than-worst-case scenario claiming that around 15 to 40 per cent of species could potentially face extinction after a temperature increase of two degrees Celsius. This statement is based on just one study which is known to be one of the most pessimistic in its research area and which deals with a large number of unknown variables.[10]
Apart from the main shortcomings presented above, there are even more weak spots in the first part of the Report about the science of climate change.[11] These mainly involve Stern's downplaying of the scope and scale of knowledge gaps and uncertainties in climate science in general and are especially prominent when it comes to natural climate variability in climate models.[12]
Based on his findings in the climate science part of the Report, Stern makes an economic analysis of the future costs and risks of climate change. Evidently, the shortcomings presented above continue in the second part of the Review, which also has several additional weaknesses. These shall be presented and analyzed in the following passage.

3 Economic Analysis - Main Points of Criticism

One of the key messages of the Stern Report is its estimation that if we do not start to combat climate change now, the overall future costs caused by these changes will be at least 5% of global GDP each year. If a wider range of risks is taken into account, the estimates of damage could even rise up to 20% of world GDP and more. The central problem concerning the practical significance of these figures has already been pointed out above: In using only the worst case scenarios and very specific one-sided literature, Stern develops a highly pessimistic outlook for future climate changes and thus builds the Review on a very weak scientific basis. In addition, the predictions of the Report cover two centuries which implies a huge amount of scientific uncertainty in both climate and economic developments.[13]

In the course of the Review, Stern focuses only on carbon-emission cuts as the solution to the problem of climate change and presents no other possible (co-)answers to the problem.[14] He especially minimizes the role of possible adaptation measures and is very pessimistic concerning the future ability of humankind to find appropriate responses to the challenges of global warming. In this regard, Stern mainly relies on studies that take inadequate or even no account of the fact that people, enterprises and institutions can generally be expected to adapt their behavior, e.g. by changes in their investment patterns or through technological progress.[15] The author even presumes that humans will emit more and more carbon dioxide into the atmosphere far into the 22nd century. This projection might be challenged if we consider the decisive moves of several economies in the direction of greater energy efficiency as well as the improvement of old and the development of new technologies to use alternative energy sources.[16]
When we take a closer look at recent history, the 'oil shocks' of the 1970's and the early 1980's demonstrated the responsiveness of energy consumption to energy price increases. The high probability that energy prices will remain high in the upcoming decades underpins the above argument.[17] In this respect, the German Institute of Economic Research (DIW) predicted a

[10] Byatt, Sir Ian et al. (2006: 183).
[11] See e.g. Byatt, Sir Ian et al. (2006).
[12] Byatt, Sir Ian et al. (2006: 193).
[13] Byatt, Sir Ian et al. (2006: 201).
[14] Lomborg (2006).
[15] Byatt, Sir Ian et al. (2006: 202).
[16] Lomborg (2006).
[17] Byatt, Sir Ian et al. (2006: 205).

doubling of the oil price to about US$200 until 2018.[18] Already today at an oil price close to US$100 per barrel, the use of fossil fuels becomes economically increasingly inefficient. It seems to be very unlikely that the world economy will not respond rigorously to such price developments, e.g. by moving towards the usage of alternative energy sources, leading to the emission of less carbon dioxide than with fossil fuel energy sources. By not mentioning, or harshly downplaying, possible adaptations of mankind to climate change and new economic challenges, Stern builds up an unrealistic picture of the future which by no means can be described as responsible policy making.[19] Furthermore, his estimations concerning the future economic damages through climate change fail to take adaptation measures into account. Hence, the future costs of climate change in the Report are set too high.[20]

Regarding the economic section, Stern is also accused of building his results on a weak scientific basis as well as cherry-picking his literature sources and predictive models. For instance, all the estimations of the economic impact of climate change are based just on one integrated assessment model, the so-called PAGE2002 model. The adoption of just a single model is on the one hand quite comprehensible, since the outcome happens to present a very clear picture without major discrepancies or a huge range of uncertainties. On the other hand of course, such an approach creates a considerable lack of both scientific firmness and reliability.[21] This impression becomes even more obvious when closely examining the basis of Stern's economic analysis. Stern only uses the A2 storyline from the IPCC's Third Assessment Report which is very pessimistic and supposes relatively slow economic growth (1.3% per year), global economic autarky, continued population growth, and retarded technological progress.[22] This results in the prediction of a global GDP of just US$243 trillion by 2100, which implies a world per capita GDP of US$16,000 while the world population lies at 15 billion. Other IPCC scenarios, for example the A1 storyline which predicts a global GDP of US$550 trillion and a per capita income of nearly US$80,000 by 2100, are not taken into account.[23]

Furthermore, there is evidence that Stern was not only very selective with the literature he used, but to some extend also took facts out of context in order to support his own line of argument. For instance, the Report states that the increase in damages related to hurricanes is a clear sign of the rising costs of climate change. He did not mention that in the past few decades the number of people settling in more vulnerable areas close to the coast and the amount of goods situated there also increased sharply.[24] Turning our attention to another kind of natural disaster, Stern assumes that the costs of flooding within the United Kingdom will quadruple in the next years from 0.1% to 0.4% of GDP as are result of climate change. What he does not point out is that these alarming figures only hold true if the government does not take any additional measures to fight the negative effects of flooding. In contrast, the government's own assumptions, which take into account a modest increase in flood prevention, assess that the costs will actually decline to 0.04% of GDP.[25] In order to demonstrate the consequences of sea level rise, Stern chose a paper by Nicholls and Tol[26] from which he only quotes the "millions at risk" ignoring the whole second half of the Report that deals with adaptation to sea level rise and lower risk assumptions. Stern tends to predominantly handle facts and figures that indicate little or no adaptation.[27]

[18] Tagesschau.de (2008).
[19] Bailey, Ronald (2006).
[20] Mendelsohn (2006: 44).
[21] Tol (2006).
[22] Mendelsohn (2006: 42).
[23] Bailey, Ronald (2006).
[24] Lomborg (2006).
[25] Lomborg (2006).
[26] Nicholls, Tol (2006).
[27] Tol (2006).

One of the most cited weaknesses of the Stern Report is the very low discount rate he applies during the Review. Stern uses this rate to estimate the present value of future disasters. In determining the discount rate as nearly zero, the author implies that the financial burden of present and future damages through climate change will be equally distributed among generations.[28] Giving an equal discount rate and therefore an equal value to all generations seems ethically indefensible from the start. But there are serious shortcomings in Stern's assumptions as will be pointed out. Stern assumes that the distribution of wealth should not be a matter of great concern and that we should spend large amounts of money now on future generations even if they are expected to be better off than we are today. This implies a very low sensitivity to risk and inequality in consumption now and in the future.[29] With the low discount rate the author implies that the present generation of rich and poor people ought to transfer, via a far higher savings rate than exists today, a substantially greater part of their income to future generations.[30] But according to Stern's own assumption these future generations will be much richer than we are today. He assumes that the per capita yearly consumption in 2200 will be US$94,000 as compared to US$7,000 today.[31]
The essential problem here is that Stern gives too little weight to the interest of the world's poor today and in the near to medium term future.[32] This becomes obvious when we take a closer look at the author's proposal to invest 1% of global GDP annually, which is equal to about US$450 billion or seven times the amount of current development aid, only to combat climate change. With just a fraction of this amount – the United Nations (UN) estimates US$75 billion in addition to current development aid – the salvation of all the world's major basic problems (e.g. clean drinking water, sanitation, basic health care, education) would be possible right now. Furthermore, a number of economic models show that the elimination of malaria alone could provide an economic boost to the order of 1% extra GDP growth per capita per year. Solving all the major development issues pointed out above would mean, according to a very conservative estimation, an increase of 2% of global GDP annually.[33] Of course, Stern does not propose to invest in climate change mitigation only and stop, or at least not further increase, classical development aid, nor is it very probable that the developed world will increase their aid payments in an order of 700%. But on the other hand, these assumptions show that by investing more financial resources in sound development strategies the outcome in the short to medium term could be enormous – what does not mean that combating climate change should not be an essential part of such a strategy.

Another statement of Stern that should be critically revised is his worse-than-worst-case scenario of economic losses in an order of 10-13% in Sub Saharan Africa and South Asia with a synchronous increase of 145 million people living in poverty because of climate change in the coming decades.[34] Of course, it is not to dismiss that climate change would most probably affect some economic sectors, particularly the agricultural production, in these and other exceedingly vulnerable regions. But in this regard it seems to be very important to consider that even the economic scenarios used in the Stern Report project rapidly growing economies in these countries. Furthermore, the most sensitive sectors to climate change, e.g. agriculture and forestry, are expected to loose their relative importance in the long term as these regions get richer.[35] It appears very logical that middle-income countries with a declining primary sector would tend to import food from outside rather than maneuver themselves into a situation where

[28] Lomborg (2006).
[29] Dasgupta (2006).
[30] Byatt, Sir Ian et al. (2006: 214).
[31] Varian (2006).
[32] Byatt, Sir Ian et al. (2006: 214).
[33] Lomborg (2006).
[34] Lomborg (2006).
[35] Byatt, Sir Ian et al. (2006: 203).

an unproblematic supply of food for the population is not feasible anymore. Referring to this, economic growth always leads to improvements of the agrarian sector's efficiency as well, e.g. by increased plant resilience through biotechnology.[36]
Stern therefore has little trust in the capability of today's so-called third world countries to develop positively and to adapt to altered climate conditions.

4 Conclusion

Based on the presented overview on the critical literature of the Stern Report it can be clearly stated that the Review has some serious and fundamental shortcomings.

Stern combines the worst case scenarios of possible future climate change with the worst case projections both for the economic impact of such changes as well as future economic development in general. He also tends to downplay the huge scientific uncertainties of climate change scenarios in the past and especially in the future, as well as the reliability of outlooks on economic growth. Beyond this, Stern cites the most pessimistic studies and partly took the facts out of context to underpin his arguments. When it comes to presenting possible solutions to the economic costs of climate change, Stern almost totally ignores possible adaptations of humankind to climate change and new economic challenges. In regard to this, Stern particularly underestimates the potential of today's so-called third world countries to develop positively in spite of more severe climatic conditions. The only solution mentioned in the Review is the reduction of carbon dioxide emissions, which is of course an important factor but by no means the only answer to the problem. Furthermore, in setting the discount rate as nearly zero, Stern gives too little weight to the interest of the world's poor today and in the short to mid term future. In this way, he strongly underestimates the responsibility of the world's current rich countries to improve the lives of people in poor countries both economically and socially. Acting in this way today would also provide a more stable, coherent and probably even more efficient basis for the fight against climate change.

The basic criticism that can be applied to the Stern Report is that it does not present sound and responsible policies because of its weak scientific basis. Of course, this analysis does not intend to say that climate change is not one of the most urgent issues to deal with nowadays and that the concentration of greenhouse gases in the atmosphere should not be diminished substantially. But unreliable studies like the Stern Report tend to supply the groups of people who are already skeptical towards the negative consequences of a changed climatic pattern with even more ammunition. Such an approach polarizes the societal dispute instead of rationalizing it in a scientific manner.

[36] Tol (2006).

5 Bibliography

Bailey, Ronald (2006); Stern measures; *reasononline*; 03.11.2006, http://www.reason.com/news/show/116401.html, 05.12.2007.

Byatt, Sir Ian et al. (2006); The Stern Review: A Dual Critique; *World Economics*, October-December 2006, Vol. 7, No. 4, p 165-232.

Dasgupta, Sir Partha (2006); Comments on the Stern Review's Economics of Climate Change, 11.11.2006; http://www.econ.cam.ac.uk/faculty/dasgupta/STERN.pdf; 06.12.2007.

Lomborg, Bjorn (2006); Stern Review; *Perspectives*, November 2006, No. 82.

Mendelsohn, Robert O. (2006); A Critique of the Stern Report; *Regulation*; Winter 2006-2007, p 42-46.

Nicholls, R.J.; Tol, R.J. (2006); Impacts and responses to sea-level rise: A global analysis of the SRES scenarios over the 21st Century; *Philosophical Transaction of the Royal Society A – Mathematical, Physical and Engineering Sciences*, Volume 361, p 1073-1095.

Stern, Sir Nicolas et al. (2006); Stern Review: The Economics on Climate Change – Executive Summary, http://www.hm-treasury.gov.uk/media/4/3/Executive_Summary.pdf, 01.02.2008.

Tagesschau.de (2006); DIW rechnet mit Ölpreis-Verdopplung bis 2018, 03.01.2008; http://www.tagesschau.de/wirtschaft/oelpreis34.html, 04.01.2008.

Tol, Richard S.J. (2006); The Stern Review of the Economics of Climate Change: A Comment, 02.11.2006; http://www.fnu.zmaw.de/fileadmin/fnu-files/reports/sternreview.pdf; 05.12.2007.

Varian, Hal R. (2006); Recalculating the Costs of Global Climate Change; *The New York Times*, 14.12.2006; http://www.nytimes.com/2006/12/14/business/14scene.html; 05.12.2007.