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Abstract

The *Stern Review* adopts two interesting elements in its calculation of the costs and benefits of climate change mitigation. First is a 'global welfarist' approach that values the utility of the World's people (now and into the future) equally, and sets global utility maximization as the correct goal for policy. Second is an assumption of a declining marginal utility to income. Consistent application of the 'global welfarist' approach and the declining marginal utility of income together would demand an urgent process of global income redistribution. Over the long term, this might see the richest ten percent of the World's population facing an average redistributive tax rate in the region of 82 percent.

Introduction

The Stern Review on the Economics of Climate Change has created considerable interest and commentary since it was issued in October, 2006.² A few economists have been critical of parts of the report, suggesting that it may over-emphasize potential damage done by climate change or use inappropriate discounting to equate costs of climate damage felt in 2100 with costs of mitigation measures paid today. But many other eminent economists have welcomed the Review³ as have a number of politicians, commentators and businessmen.

This is clearly something to be welcomed by those people who are concerned by global climate change. But the widespread acceptance of the Report should be of considerable interest to all who are concerned by global development, whatever their views about the relative importance of climate change compared to other challenges.⁴ The Report is an interesting development far beyond the issue of climate change because of the approach that it uses, an approach that has received broad acceptance along with the Report.

¹ charleskenny@gmail.com. This is a note of no standing which may not represent the more considered views of the author, let alone his employer. Thanks to Halsey Rogers, Michael Clemens and Andrew Oswald for comments, with more than the usual disclaimer regarding errors and opinions being mine.

² Stern, N. (2006) *The Stern Review Report on the Economics of Climate Change* London: UK Treasury. A Google search for the full title in quotes revealed nearly 64,000 hits on 01/26/2007.

³ http://www.hm-treasury.gov.uk/media/9F3/38/20061028_Quotes-7.pdf

⁴ For example, those who put climate change relatively far down the list of global priorities as part of the Copenhagen Consensus should still be heartened by the Review's reception.

There are two elements of note to this approach. The first element is the adoption of what might be termed a ‘global welfarist’ standpoint. By this I mean that the Report uses utility as its measure of ‘the good we wish to see maximized’ and it values peoples’ utilities of equal worth whether they live in London in 2010 or Lagos in 2100. The second element of the approach is a reliance on the concept of the declining marginal utility of additional income. While these elements are central to driving the Review’s model results, it is worth noting that neither of them has been widely (specifically) debated. Those who oppose the Review’s analysis have focused on the choice of scientific estimates of the impact of climate change and the issue of the discount rate used for equating costs and benefits over long time horizons.⁵

What makes the positive reception of the Report, and particularly these elements, an interesting event for all concerned with global development is that, were the ‘global welfarist’ and declining utility approaches applied consistently, they would suggest a radically expanded program of redistribution to the benefit of the World’s poor. This note discusses the Report’s approach and makes a first attempt to estimate the size of the distributive effort implied.

The Stern Review, Global Welfare and Marginal Returns

The Review itself expresses concerns about the adequacy of the cost-benefit approach which it takes to calculate the impact of climate change. Nonetheless, the Review’s calculations are grounded in welfare economics. "The underlying ethics of basic welfare economics, which underpins much of the standard analysis of public policy, focuses on the consequences of policy for the consumption of goods and services by individuals in a community" notes the Review. "The perspective sees individuals as having utility, or welfare, arising from this consumption. In this approach, the objective is to work out the policies that would be set by a decision-maker acting on behalf of the community and whose role it is to improve, or maximise, overall social welfare. This social welfare depends on the welfare of each individual in the community" (Chapter Two).

In using the tools of welfare economics, the report makes a number of ethical statements that guide the calculations. Not least, the Review suggests that “if we know a future generation will be present (that is, apart from discounting for the small chance of global annihilation), we suppose that it has the same claim on our ethical attention as the current one.” Again, “the only sound ethical basis for placing less value on the utility (as

⁵ See for example Richard Tol’s response: <http://www.fcpp.org/pdf/CritiqueofSternReport.pdf> or William Nordhaus’ comments: <http://nordhaus.econ.yale.edu/SternReviewD2.pdf>. It should be noted that the Review uses declining marginal utility as the key element in determining the appropriate discount rate which Nordhaus and others have found too low, and Nordhaus provides a number of other potential bases for setting the social discount rate. However, most critiques center on the low value given to the other element of the Stern discount formula regarding the pure time rate of discount, rather than the assumption of declining marginal utility of income per se. Partha Dasgupta has gone as far to argue that the value for declining marginal utility is set too low (William Cline, in an earlier economic model of the impact of climate change, set it at 1.5). (See <http://www.econ.cam.ac.uk/faculty/dasgupta/STERN.pdf>). The results in the second half of this paper would stand with more rapid declining marginal utility of income.

opposed to consumption) of future generations was the uncertainty over whether or not the world will exist, or whether those generations will all be present." (Chapter Two Technical Annex). In other words, the value of a unit of utility (a 'util') is the same if that unit is enjoyed in 2100 as it is if it enjoyed in 2000. The only reason for 'discounting' that util is because there is a risk we will have suffered global annihilation by then, and there is no-one around to enjoy it.

Furthermore, the Review suggests that we should not care where the util is enjoyed. Climate change is a global issue, notes the Review, and the assessment "is done from the perspective of the world as a whole" (Chapter Two Technical Annex). "We convert per-capita global GDP at each point in time into consumption, and then calculate the social utility of per-capita consumption. This is then multiplied by global population," notes the Review. The future generation that we care about, then, is the global generation, regardless of where it lives. This future generation (all of it) deserves to have its utils valued as much as we value our own. To complete the circle, this suggests that the present global generation (all of it) deserves to have its utils valued as highly as we value our own.

A third decision made by the Review concerns the declining marginal utility of changes to income. This assumes that each dollar of additional income buys us ever fewer units of utility. If the first dollar buys us one util, it will take us two dollars to buy the second util, four to buy the third and so on. The value of moving from \$2 to \$4 income is the same as moving from \$4 to \$8 or \$8 to \$16.

In the calculations in the Review, only the utility impact of global changes in income going forward are measured in this way, although this seems to be for practical rather than ethical reasons. The Stern Review does not use declining marginal returns across people at the same time (intra-temporal concerns) in its calculations of costs and benefits. "[E]quity-weighting approaches [are] supported by... ethical considerations... as well as empirical observations of the attitudes that people actually hold towards inequality in wealth" notes the Review. Nonetheless "[t]he welfare calculations fail to take into account distributional impacts, even though these impacts are potentially very important: poorer countries are likely to suffer the largest impacts" notes the technical annex to the postscript.⁶ "An approach that would better reflect the consequences of climate change on different world regions would take regional per-capita utility (e.g. for India and South-East Asia) and multiply by regional population to get 'regional utility'. Global utility would then be the sum of regional utilities. Doing so was beyond the scope of this exercise," notes the main report.

⁶ The report repeatedly emphasizes the greater damage that climate change will do to poor countries. "Up to around 2 - 3°C warming... it is clear that any benefits are temporary and confined to rich countries, with poor countries suffering significant costs.... For warming beyond 2 - 3°C, the models agree that climate change will reduce global consumption... in this range too, the models agree that poor countries will suffer the highest costs" In the baseline-climate scenario used in the Review, the mean cost to India and South-East Asia is around 6% of regional GDP by 2100, compared with a global average of 2.6%, for example (Chapters Five and Six of the main report).

Nonetheless, it is worth repeating that the Review does look at *global* impact, and it does so by adding up global damages and assumes all future global citizens should be treated with equal value. A big impact that will largely be felt in developing countries in the future should be of concern equally, globally, to us all today. The community for which we are seeking to maximize utility, and for which we are discounting utility using a declining marginal return to income, is the World.

The postscript to Review suggests that the case for treating climate change using a global cost-benefit analysis may be different from treating financial assistance (as it might be) in the same manner: "emitters do not have to compensate those who lose out because of climate change" it suggests. "In this sense, human-induced climate change is an externality, one that is not 'corrected' through any institution or market, unless policy intervenes." Does this suggest that the Review is 'merely' an example of what might be termed classical economic liberalism (a doctrine of compensating interference) or does the Review presage a full welfarist approach?

Even if one argues the first, that the Review is only interested in spillovers at the global level over time, it is worth noting the numerous activities we undertake which involve externalities both inter- and (cross-border) intra-generational and which even if one is 'only' becoming a global classical liberal, one would have to account for. Having children is one obvious case –if we didn't have them, we wouldn't have to worry about intergenerational equity. But so is allowing or preventing immigration. The illiberal act of denying entry to a migrant will very likely constrain the welfare of the migrant and their children, to say nothing of those in the recipient country.⁷ Other cases include using natural resources other than the atmospheric carbon sink, wiping out (or introducing) diseases, wiping out (or bioengineering) species, researching technologies, creating works of art or writing articles on climate change, investing in long-lived infrastructure like sewage systems or investing in education. The list should also include anything that changes the structure of institutions, which by and large change very slowly. And probably it should include growth itself –income is very sticky, and even when we try hard to destroy a country (think Germany in World War Two), once one has reached a certain level of GDP per capita it appears hard to go back below it over the long term. Growing today provides a big positive externality to ones neighbors and to one's children tomorrow. Not growing today when we could is clearly a thoughtless and irresponsible act. An approach that (merely) adopts a non-(or at least compensated) interference principle still suggests a large agenda, then.

But the Stern Review goes further than that. The approach taken in the Review is not one of calculating compensation for damage but of global utility maximization. Indeed, the Review specifically states that it does not make calculations as to which parts of the world it is that would suffer the most in terms of utility loss, nor those that might gain,

⁷ Pritchett argues that the impact on global GDP of full liberalization of the global labor market is around 100 percent. http://www.brook.edu/es/commentary/journals/tradeforum/papers/ravallion_comment1.pdf

instead using a global GDP per capita figure to examine gains and losses.⁸ It does not suggest that we put aside resources to pay out to future flood victims on the basis of our individual carbon footprint. Whatever the modesty of the postscript, the Review's approach is a global welfarist one. And welfare approaches, based on a moral underpinning of utilitarianism, do not trade in moral distinctions between the done which should not have been and the undone rightly done.

In short, if we accept the moral basis of the Stern Review, we have accepted: (i) the members of the community whose utility we want maximize is everyone in this generation and following generations everywhere and (ii) within this community there is a declining marginal return to changes in income. This is a considerable development. Has there been a previous cost-benefit calculation carried out at the global level which includes a specific and strong presumption of declining marginal utility to income and has gained such widespread attention and acceptance?

Implications

The Stern review uses the global welfarist approach and the declining marginal utility of income in order to justify the case for abatement mechanisms to reduce climate change. But once one accepts that we wish to maximize global utility and that there is a declining marginal return to income, it is not only the case for avoiding climate change that becomes more compelling. Not least, these assumptions justify a massive redistribution of global income.

Figure one displays data on global incomes for a little over 5 billion people in 1993, using data from Milanovic (2002).⁹ The figure makes clear how unequally income is currently distributed. Dikhanov (2005) suggests that the bottom ten percent of the World's population shares 0.6 percent of global income (an average of \$291/year) compared to a 53 percent share for the richest decile (an average of 30,081/year) –give or take, a 100-fold difference.¹⁰ If there is a declining marginal utility to income, it is clear that we could dramatically increase global utility by flattening this income distribution. All else equal, we would maximize global utility by equalizing incomes. Figure Two, again based on the Milanovic data, suggests the size of income subsidies or taxes (expressed as a percentage of current income) needed to achieve that global goal. The bottom two million people accounted for in Milanovic's data would receive subsidies equal to over 9,000% of their current income. The top 35 million people would be taxed at about ninety percent of their current income.

⁸ Chapter eight notes the positive impact of climate change which are incorporated into the models –the model is not just an accounting for the negative effects of climate change, but a full cost-benefit of the same type carried out when we build a road or a dam.

⁹ Milanovic, B. (2002) True World Income Distribution, 1988 and 1993: First Calculation Based on Household Surveys Alone *The Economic Journal* 112 (476), 51–92. Data is as provided by Milanovic except Yemen and the bottom ten percent of urban Argentina and New Zealand are dropped from the sample (reported annual incomes were given as \$3.3 and \$195 respectively).

¹⁰ Dikhanov, Y. (2005) Trends in Global Income Distribution, 1970-200, and Scenarios for 2015 Human Development Report Office Occasional Paper.

This model is only correct, however, if we assume a declining marginal return to all income. The Stern Review in practice utilizes a declining marginal return to income *growth*, rather than income per se. Following this model to the letter, an approach that would maximize the utility of global income changes going forward would be to focus available additional income where the same absolute dollar amount has the maximum impact on income (and thus utility) change --if each doubling of income has the same impact, we will want to focus global resources where incomes can be doubled at the least cost.

What would such an approach look like? It would involve taking available resources from growth and providing enough additional income to give the poorest person the same income as the next richest, then these two the same income as the third richest, and so on. The incomes of richer global citizens would be capped at their current level until such time as poorer people had caught up with their current income level. Using data on global income deciles from Dikhanov (2005), and assuming a two percent global growth rate as does the Stern Review, we can model such an approach.

With a global economy worth approximately \$33,000 billion, the first year of 2% global growth produces around \$660 billion to redistribute. Raising the incomes of the poorest ten percent of the world's population to the second poorest ten percent's level (from \$291/year to \$577) takes \$172bn. Raising the two lowest deciles to the income of the third (\$829) takes \$474 billion. There are enough additional resources from the first year's growth for redistribution to take the bottom thirty percent's annual income to \$935. Within the first year, then, we can raise the incomes of the poorest twenty percent of the world's population to the incomes of the third poorest. Because we have focused available resources on the poorest, the utility gain is far larger than it would have been had we focused resources on an equal percentage income gain. Rather than an average two percent rise in utility related to income based on a non-redistributive formula, we have achieved a (\$291 to \$935) 221% utility rise for the poorest decile, a (\$577 to \$935) 62% rise for the second decile and a (\$829 to \$935) 28% rise for the third decile. Other deciles see their utility unchanged, but utility related to income has nonetheless risen by a global average of 31 percent.

In the second year, we have more than twice the amount to redistribute, because there has been an additional two percent growth. With these resources, we can raise the incomes of the poorest 30 percent of the world's population to the level of the fourth decile. This approach can continue until the bottom nine deciles reach the income of the tenth, at which point the income of everyone in the globe would continue rising together. Figure Three displays the path of global incomes over time using this approach, with each line leaving the y-axis representing a global population decile. Figure Four displays the implied tax and subsidy rates as they develop over time. As can be seen, by the 86th year, all nine lower income deciles have caught up with the richest decile's (post-redistribution) income, and the world sees perfect post-redistribution income equality. At this point, the richest decile faces an 82 percent tax rate, while the poorest decile is receiving a 1,801 percent subsidy.

This model is over-simple. One does not need to be a rabid supply-side economist to wonder as to the effects on economic growth in wealthy countries of an 82 percent income tax rate (although Britain saw a top rate of income tax of 75 percent in the boom years following the Second World War). Without such economic growth in wealthy countries, global income equality will take longer to achieve. The model does not allow for population growth, which is faster in poorer countries. On the plus side, the model does not allow for the more rapid economic growth in poor countries that would surely follow from such massive transfers of resources –thereby reducing the need for further transfers. Having said that, the problems with large-scale redistribution include not only effects on work incentives in donor countries, but also effects on work incentives and the political economy of recipient countries –over the long term, it might well be the case that such large-scale transfers would reduce growth in a manner akin to the resource curse.

But such concerns with model accuracy, while valid, miss the larger point. Acceptance of the Stern Review implies acceptance of a moral system that suggests we should be maximizing global utility and that suggests utility is closely related to income but with a declining marginal return. Once this system is accepted, it is impossible to avoid the conclusion that considerable global redistribution of income is a moral imperative. That the Stern Review has been so widely accepted suggests that belief in such a moral imperative may be spreading.

Figure One: Global Incomes

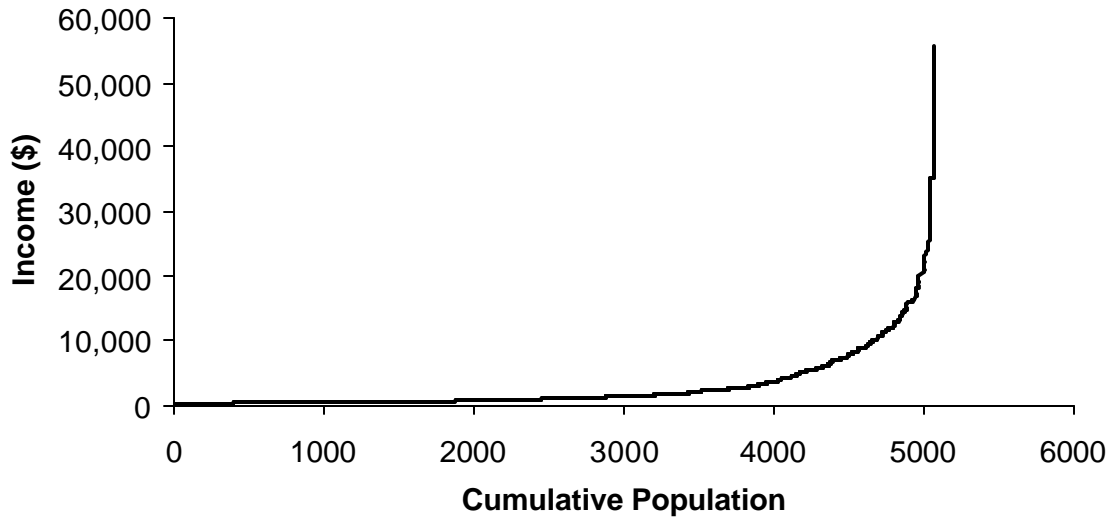


Figure Two: Subsidies (+) and Taxes (-) Required to Equalize Incomes

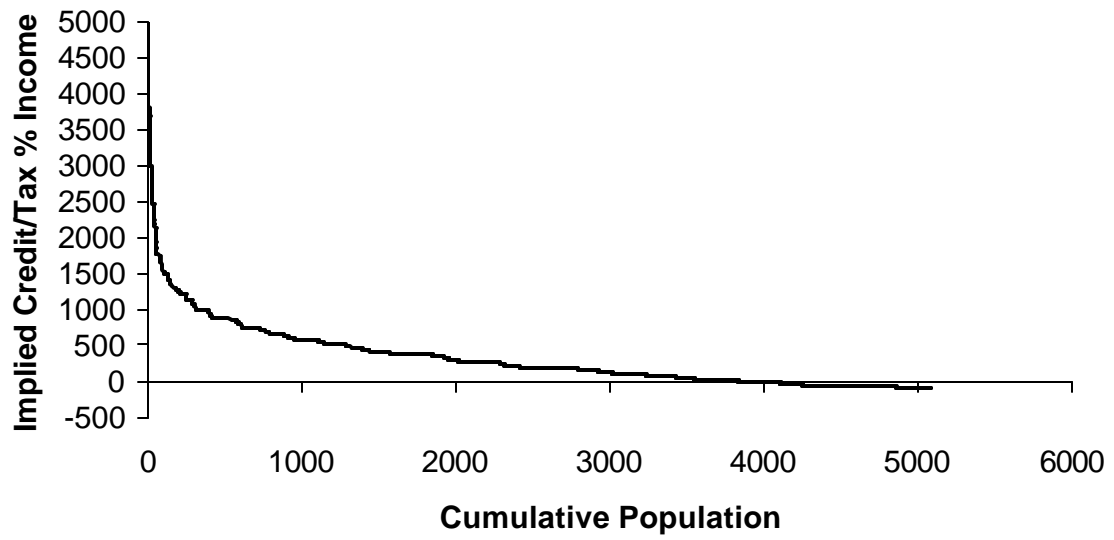


Figure Three: Post Redistribution Incomes Maximizing the Impact of Growth on Utility

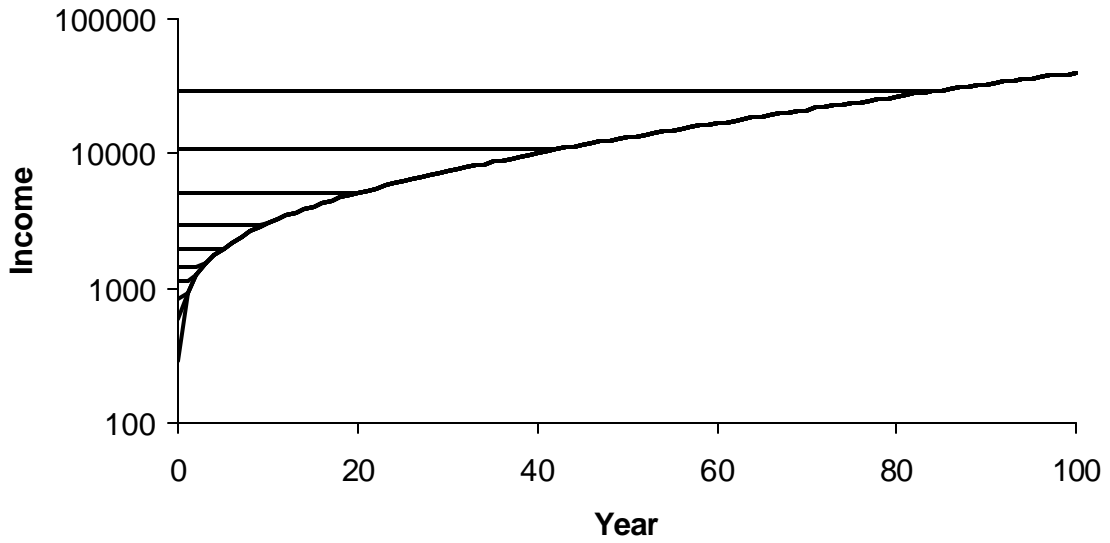


Figure Four: Subsidies and Taxes Involved in Maximizing the Impact of Growth on Utility

