

Comments by Merritt Hughes:

The Climate Ethics and Climate Economics conference held April 12 to April 15 provided a fascinating opportunity for academics from diametrically opposed disciplines to discuss what many people consider the most pressing policy challenge facing humanity in our generation. Though a variety of topics were discussed, the conference centered around the work of John Broome's "Efficiency and future generations", particularly the paragraph at the bottom of page one:

"First, emissions of greenhouse gases cause inefficiency, so a Pareto improvement is possible. Second, this externality can be corrected in a particular way, by imposing a carbon price equal to the external cost of greenhouse gas emissions. Third, it can be fully corrected – so it causes no remaining inefficiency – in a way that is Pareto improving. Fourth, this result can be achieved by means of a carbon price along with proper compensation. In sum, the externality can be corrected without sacrifice from anyone."

This quotation makes assumptions that set economists barreling down one path and philosophers down another. It is not clear, really, that emissions cause inefficiency in the economic sense, a point I will discuss below. The assumption that we can calculate the external cost of greenhouse gas emissions in a meaningful, or at least not misleading way, is one many economists seem to make willingly but philosophers stumble over. If we were able to define the inefficiency correctly, and fully correct the damage by economic means alone, whether by compensation or otherwise, the fourth assertion that this would be able to be achieved by carbon pricing and compensation seems quite dubious from a political perspective.

At this point in time there are already places in the world that have experienced more than 2 degree temperature rise since the beginning of the 20th century (not surprisingly, these are nations with low global power such as Mongolia)¹. There are already human settlements that are being relocated through government assistance as response to ecosystem changes, including in the US. In other words, there are already people who argue they are sacrificing now in a way no economic compensation can fully cover. And, as an article on the New York Times on April 24, 2016 pointed out, global warming actually feels quit pleasant to many people. I think it is important to keep in mind that climate mitigation discussion is between a variety of people with different value systems living now. The reality is that it is not a discussion between future generations and ourselves. We hold all of

¹ See for example, IPCC Working Group summary for policy makers (SPM 28).

the cards. It is a discussion amongst ourselves, and some of us hold better cards than others.

The motivation for providing a Broome-type argument seems to be a political one. I agree with what I think was already brought out in the conference, that the main advantage in communicating this logic is that it would be politically inefficient to suggest that there is no hope for anything other than suffering both now and in the future. The disadvantage is that there is a danger for it to be used to slide further into complacency. There are many reasons why we should not act, or act in a way that we suspect future generations will not thank us for. Thus, in terms of how energetically this argument should be promoted, I think it is ambiguous. One assertion in the above argument is that in the context of climate change, an economy can be made more efficient by internalizing externalities associated with global warming. I would argue that while there is clearly some improvement possible, there are also significant limitations.

1. Negotiated full correction

Staying within the frame

Feasible bargaining solutions for Pareto improvement assume property rights are well defined, transaction costs small, and that there is perfect information. These conditions are dramatically not fulfilled in the context of climate change. There is a great deal of uncertainty and asymmetric information, climate science relies on “expert” analysis most people don’t understand, and future generations have no real property rights in the current period. While the future generation will know what the value of today’s actions are, we cannot.

Substitution and valuation

Some ecosystem services are irreplaceable, not substitutable with market goods, and hence invaluable. Only to the extent that they are substitutable and hence valuable can Pareto improvement occur. We require not just a general sense of preference for A over B, but a specific willingness to pay. But willingness to pay implies that there is a possibility to remediate. If no remediation is possible, there is no point in paying.

We do not really know how close we are to losing the irreplaceable. The cost of ecosystem services that the future would prefer to buy from us cannot be known to us. We cannot evaluate precisely what future generation would prefer. Even more importantly, it is likely that many of the ecosystem services that will be critical in the future have no market today.

Armon Rezai also mentioned this point in his presentation “Who pays to avoid climate change and how much does it cost”: non-economic costs should be incorporated into estimation of the social cost of carbon. But there is no way to do this, nor is there much evidence of whether the non-economic component is larger or smaller than the market-identified losses. A number of the economics papers presented assumed, with no discussion, the practical possibility of a Pareto improvement. The philosopher contingent seemed less sanguine about this issue.

Keeping the bargain

In terms of the question of whether it is possible for the current generation to receive compensation from future generations that would induce it to make the full changes the future generation thinks it is paying, Broome mentioned there needs to be the coercive power of the State behind the bargain. But this puts the State in a position of moral authority, whose authority comes from the collective moral judgment of the polity. But it is not clear that a collective political consensus is possible. At any rate, the moral appeal that was being avoided by economic idea of no- sacrifice has not gone away after all.

2. More on substitution without sacrifice

My understanding is that the proposal is to shift investment from, eg, dirty industry to clean industry, perhaps reducing the overall level of physical capital stock which would have otherwise been used in the future, the idea is that this could be done with no reduction in consumption in the present, and a preferred state in the future. It is noteworthy that the 50 dirtiest power plants in the US, comprising 1% of generation units, release one-third of all power plant emissions in the US. If they were a nation unto themselves, they would be the 7th largest GHG emission country in the world. Shutting them down would seem likely to be a cost effective solution. The report listing these statistics was published 3 years ago. Little change has occurred².

Concretely, we might invest less in road maintenance and more in solar panel manufacturing. But in order to produce more solar panels for the future we need the roads. We need current period manufacturing technology and infrastructure to produce current period goods. We also need it in order to combine it with research and development for the production of future manufacturing technology.

² WRI, 2013. “America’s Dirtiest Power Plants”

Maybe a better analogy is solar panels and electricity transmission grid services. Can we re-design the electricity grid to incorporate more intermittent generation without the sacrifice of raising current prices?

A. Fossil fuel use is deeply embedded in virtually all of our activities. The infrastructure supporting its use is a complicated set of institutional and technical inter-relationships that are slow and cumbersome to change. Deep infrastructure changes are needed for significantly different goods and services.

Today's large infrastructure investment with today's technology has been financed assuming a long pay-back period. Accelerated depreciation reduces the return to current investment and uncertainty over the change in the service period of the infrastructure increases financing costs. At the same time, the possible rate of infrastructure change is limited by technical knowhow and a limited rate of physical implementation. Bringing new, innovative infrastructure on-line carries the potential to be highly disruptive.

B. The impact of global warming on our ecosystem has momentum – it increases at an increasing rate. The destruction of our supporting natural ecosystem will make production processes more costly (eg disruption by severe storms). The ecosystem change we have already set in motion implies, *ceteris paribus*, future generations will find physical capital stock more difficult to replace and maintain. This implies future generations are likely to be less well off than the current generation in terms of economic production. As mentioned above, the ecosystem services that have no current economic valuation are also expected to diminish as well - at a currently un-calculable cost.

The cost of non-action therefore could be expected to escalate through time. To make future generations as well off, our rate of technological change, specifically with respect to emissions, needs to increase non-linearly as well. The longer we delay in keeping up with ecological change, the difficult it would be to do so without sacrifice. G. Pellegrino made a number of points related to this in his presentation "Pareto-Efficient Emission Cuts. Are they really possible and plausible".

3. Uncertainty and innovation

The assessed cost of inaction in the current period will be different 10 years from now, 20 years from now, 100 years from now, etc. as understanding of the potential opportunities, costs and benefits changes. There is both the *ex ante* cost of uncertainty and the *ex post* cost of mistaken investments. Future generations will have a different idea than

we do about the least costly investment path. There are many long-term actions we could take now with far reaching consequences, resulting in costs we cannot anticipate.

The future would be interested (ex post) in buying X value of specific services that we cannot know at present, but we need to plan to provide them. By trial and error, each step in time, we reevaluate long-range plans and reassess the valuation we are placing on the uncertainty associate with achieving the ecosystem state we are steering toward. It's not just about changing preferences. It's also about limits to knowledge, capacity to innovate and inertia in physical capital turnover, as well as social and regulatory institutions.

Dominic Roser, in his presentation "Against the Risk-Uncertainty Distinction" argued that because we inescapably hold subjective probabilities and when they are the best available option we will inevitably use them for decision making as if we knew better. There is an aspect to this argument that I don not entirely agree with. In my opinion, we assert subjective probabilities when we want to assert that we "know" something about the situation (generally in order to assert master on some level or decide on a course of action). We see ambiguity and ignorance when we want to assert a lack of knowing. From this perspective, policy makers hold probabilities because their context requires an assertion of knowledge rather than a lack of it. We know from psychology experiments that humans generally tend to under-estimate the risk that something bad will happen. It could well be that if one were more comfortable with ambiguity and ignorance of the type climate change legitimately confronts us with, one might reason toward a different conclusion than that which is generally achieved at this point.

4. Back to negotiated full correction

In defense of discounting, one could interpret a lower weight in our own utility functions for future generations not as an indication that they are less meaningful to us than we are to ourselves, but that they have more degrees of freedom and more unknown options (from our perspective) than we do in the current period (from our perspective).

In defense of J. Broome's suggestion to decrease long-term conventional investment in order to redirect funds to alternative capital investment; there is a double dividend in as much as we need the rate of technological change to increase as much as we need legacy emission rates to stop. From this perspective, it is important that consumption be

maintained in order that one type of investment *substitute* for another, rather than substituting for consumption.

Given the ambiguities and unknowns, the best guide of what we should do may well be to consider how much we, ourselves, would like to be living 100 years from now if business as usual continues. While the theoretical amongst us may evaluate the cost of collapse equal to the sum of the then-current lives lost, those people themselves are likely to be focusing on the destruction of the future, not on what a great time we had in the past. We don't currently know how to "solve" the climate change problem, so to say we can solve it without sacrifice may be evaluating the situation using an optimistic perspective that underestimates the ultimate cost. Underestimating the cost suggests that future generations will not be asked to pay as much as they would theoretically like to pay. This is particularly poignant for the potentially last generation before total collapse.