Orthodox Economics and the Science of Climate Change

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We have finally reached the point where most people around the world believe that climate change is really happening. Almost a decade ago, the landmark report by Nicholas Stern sparked a fierce debate among economists, not over whether climate change was real, but over the costs of addressing it.1 In the years since, the Intergovernmental Panel on Climate Change (IPCC) has published further alarming reports on projected future global temperatures, rates of glacial melting, and sea levels.2 Most recently, last December saw an unprecedented agreement by nearly 200 countries at the Paris climate summit to take steps to address the problem. The agreement's achievements are admittedly more in spirit than in substance, but the accord nevertheless provides further evidence of a rapidly growing global awareness of the climate crisis.

My concern here is therefore not to continue making the case for the reality of climate change, but instead to show how that reality is portrayed—and distorted—in the mainstream media, with behind-the-scenes assistance from orthodox economic analysis. Faced with such irrefutable evidence of climate change, we nevertheless must be clear and forthright about what we still do not know. For instance, some climate change skeptics are correct to point out that we do not know if preventive action would be worth it, given the likely irreversible damage that has already been done. I am not advocating the "do nothing" policy implications of such a stance; I merely wish to recognize the logic in the argument that it may be more "economical" to invest in means of adapting to future changes (dikes, floating cities, and the like) than to try to prevent the unpreventable.

Such uncertainty makes orthodox economists nervous. They pride themselves on being able to study problems such as climate change and, with the proper analytical tools, calculate scenarios that might help inform or advise policymakers. The problem is that doing so requires numbers. We know that climate change is happening, but to justify serious action against it—beyond the symbolic kind—many believe that "science" must be on our side. In other words, some quantitative expression of the expected costs and benefits of policy action is needed.

There are many areas in which capitalism exploits the widespread but erroneous belief that numbers are somehow inherently more scientific or objective than qualitative information. Here I will limit my scope to how this delusion manifests itself in the case of climate change, which capitalists for the most part do not, for obvious reasons, want seriously to address. Even though many of us are rightly very worried about possible future impacts of climate change, many would also be comforted by the idea that it can be controlled or managed. Reducing complex problems to mere dollars and cents is often how capitalism "tames" the crises that it produces, with climate change as merely the latest example.

Many others have written insightfully about orthodox economics' ideological service to capitalism, and I will not add to the discussion here.3 I will instead present an example of how this happens, by trying to "unmask" the economic orthodoxy in the use of social cost-benefit analysis, based mostly on fictitious numbers, for the purpose of recommending particular climate change policies—invariably ones compatible with corporate profits. The pseudo-quantitative precision of such studies effectively rebrands the problem as merely another "challenge" to be

confronted and debated, instead of the existential risk that it is.

The Economics of Uncertainty

Despite the great strides that scientists have made in statistical modeling and computing power, climatology is still very far from a precise science. Model outcomes depending on simultaneous differential equations are frequently highly sensitive to minute changes in system parameters, which are based on assumptions that we make in the absence of direct, precise observation. Many practicing scientists marvel at the near-infinite complexity of the climate system, in which self-reinforcing and self-cancelling effects bedevil efforts to measure effects precisely. How, then, can economists justify using cost-benefit analysis for evaluating climate change policy? Quite simply, it is done through obfuscation and misrepresentation on the matter of uncertainty.

To begin with, it is customary in orthodox economics to relate the word “uncertainty” exclusively to uncertainty about the future—that is, difficulty in making predictions. Imprecision in measurements or estimates, as well as normative or moral conundrums and ambiguities, tend to be ignored or considered outside the ambit of economics. Orthodox economists assume that participants in capitalist economies, from consumers to workers to corporations, possess “perfect information,” producing in free markets a rational equilibrium whose “objectivity” transcends morality. They do so in order to simplify things sufficiently to make the required mathematical analysis tractable.

Economics handles uncertainty by assigning probabilities to predetermined outcomes, what some in the literature call “weak uncertainty,” or risk. Such methods imply that we not only possess an exhaustive list of possible scenarios, but can estimate exactly the individual probability of each scenario. Do economists believe this to be realistic in the case of climate change? Of course not. But the practice is generally justified on grounds that the analysis is not possible without probability figures, and that the figures are often close enough.4 “Close enough” figures are ones sufficiently realistic not to be dismissed out of hand. And more important, the postulated scenarios and presumed probabilities allow economists to “do the math,” thus lending a scientific aura to what they do.

Economists in the post-Keynesian tradition, among others, argue against these assumptions, but usually only go as far as insisting that the probabilities cannot be known *a priori*. Both groups imply that the possible scenarios are, or at least can be, known. Yet when it comes to a phenomenon as complex as climate change, it is not possible to know all—or, to be precise, *any*—of the possible outcomes. So if “uncertainty” means knowing the outcomes, just not the probabilities, we need a further distinction between uncertainty and ignorance. In the case of climate change, the latter dominates.

We can be ignorant about relevant system inputs, which would mean that we lack precise measurements of, for example, ocean temperatures or ice density. Ignorance about these factors impedes precise understanding of climate change effects, though one could at least argue that meaningful progress has been made in scientific measurement. But we are also likely to be systemically ignorant, meaning that we lack an adequate understanding of the global climate “parts” needed to accurately model the “whole.” This would mean insufficient understanding of the myriad ways that ecological and physical subsystems feed back on each other, either positively (reinforcing) or negatively (countervailing). Finally, we can be cognitively ignorant, meaning that even assuming we possessed all this information, the global climate may be far too complex to be able to model—even with the most powerful computers—in such a way that we could seriously expect our projections to be precise.5

What makes modeling climate change so complex? Modern computers easily model phenomena that are more or less mechanistic and deterministic. In other words, we know enough to predict what will happen if we mix chemicals

A and B in a beaker and apply x force or y electricity to it, since such relationships tend to vary little over repeated trials. Even when the systems under study are highly complex, a powerful computer can easily perform the necessary calculations.

But the global climate is infinitely more complex, with little or no evidence of such determinism. We know very little about how, for example, ocean temperatures, currents, and acidity levels collectively influence climate change—or even if they do so in any meaningful way. And even if we possessed an approximate understanding, this would be very different from being precise. It is well known, for example, that rising temperatures imperil the underground permafrost in Arctic regions. Its melting is associated with release of methane into the atmosphere, and while nobody knows precisely how much, we do know that methane is a much more potent gas than carbon dioxide. Scientists are thus naturally concerned about a “positive feedback loop,” whereby the melting permafrost releases the methane that then leads to still warmer temperatures, melting more permafrost, and further raising temperatures, and so on. A similar feedback loop, known as the ice-albedo effect, is seen with the melting of ice caps. Because of its lighter color, ice reflects many more of the Sun’s rays back into space than ocean water. As the ice melts, there remains less of it to reflect the rays, so more are absorbed and the planet heats up, increasing the melting rate of the remaining ice.

The two phenomena are easy enough to understand. But we can know very little about how sensitive each effect is to other related factors over time, as well as how the global climate as a whole will be affected by these particular changes, which are after all a mere two examples among countless likely effects.

If we cannot reasonably predict future outcomes—and less reasonably the further into the future we glance—it is impossible to reliably project future climate and planetary outcomes. This should make informed policy on climate change untenable; how are we to weigh the approximate benefits and costs of mitigating or adapting to climate change if we are so in the dark about future outcomes? There is also an elephant in the room that policymakers and economists especially are loath to discuss. If catastrophic effects—to the point of human extinction—were considered a real possibility, one would expect that climate change would be combatted with utmost urgency.

From a policy standpoint, therefore, the precise values of benefits and costs should be an afterthought: either we deem future climate change a moderate to serious crisis with serious human consequences that nevertheless poses no existential threat to humanity (and which thus might not warrant “prohibitively expensive” action), or we determine that it poses a real existential risk, in which case it becomes a singular global priority. Given the vast uncertainty, how can we justify *not* following the second of these—if nothing else, to play things safe?

The question may seem ethically unanswerable, but orthodox economists have devised such a justification. The first part of the justification involves following economists’ modeling of uncertainty as “risk”—in other words, assuming that we know much more than we do, in order to “approximate” future climate outcomes. The second part involves undertaking a social cost-benefit analysis that puts figures (i.e., dollars) on the benefits and costs of such outcomes.

Valuing Human Life?

Corporations and governments alike employ cost-benefit analysis to make decisions. But while capitalists only consider private revenues and costs, policymakers face a much greater challenge. They frequently rely on social cost-benefit analysis, which, in addition to dollar outlays, takes into account costs and benefits to broader society.

In the case of climate change, benefits and costs must be projected many years into the future. Approximating the

attendant costs involves estimating the economic sacrifice—either direct or indirect—required to combat climate change. Such costs can be reasonably approximated monetarily, and with relative ease, since most involve spending on existing technologies for which markets exist. Benefits, in contrast, are far more difficult to estimate. These are not the benefits of preventing damage to property and assets, which are also approximated relatively easily, but the benefits associated with averting harm to humans.

In the case of climate change, even vaguely approximating such benefits would require knowing not only likely future climate outcomes, but also their human impacts, in terms of disease incidence, likelihood of armed conflict, effects of mass migration away from flooded coastlines, and the like. More to the point, it would also require putting monetary values on human suffering, harm, and even death. It is impossible to estimate the monetary benefits of averted harm to humanity without some notion of the monetary value of individual lives.

Is this the logical consequence, then, of our compulsion to quantify—the quantitative valuation of life itself? Could anyone take such a project seriously? Not explicitly, of course, but orthodox economists are clever. Few explicitly state that a human life is "worth" any specified amount. Instead, they argue, we reveal the values that we ascribe to a human life in our actions (economists are fond of the notion of "revealed preference") based on the projects that we undertake. For example, the fact that we are willing to take on, say, a construction project with a non-zero risk in terms of "statistical lives" (the number of people expected to be harmed or killed) directly implies that we do not value human life infinitely, otherwise any non-zero risk would be infinitely costly, prohibiting any such project. Inferring the maximum value of one life then becomes a matter of dividing the expected benefit from the project by the number of lives affected.6

As objectionable as such utilitarian thinking might appear, its logic appears unassailable. Yet its reasoning is circular. As discussed above, orthodox economics assumes that people are perfectly well informed—including, presumably, about the value of human life. We are therefore assuming that we already know that which we are trying to ascertain. If we relax the assumption that people are perfectly well informed, it destroys the precept that people are able to accurately, if implicitly, judge their own value.

To argue against monetary valuations of human life is not to say that we should only undertake projects that guarantee zero risk to all people. Indeed, to do so would mandate a halt to pretty much all economic activity. But project appraisals should consider monetary values as well as other criteria, both quantitative and qualitative. Doing so, however, rules out social cost-benefit analysis as a basis for making policy decisions, and arguably pushes us into a far more subjective realm.7 Consequently, many researchers, particularly economists eager to burnish their scientific bona fides, refuse to do so.

Even if we accepted the distasteful calculus of human life valuation, how would we "price" outcomes that put all of humanity at risk? When exactly do we cross the threshold between the risk to a few "statistical lives" and humanity in its entirety? While we might tolerate a certain degree of human risk in the name of "progress," surely almost nobody would accept risking the extinction of humanity. Presuming that climate change poses such a risk, how could any cost-benefit analysis ever justify not accounting for this possibility?

Orthodox economists, especially those oriented to microeconomics, are not catastrophists. Rather than contemplating the possibility of momentous systemic shocks, they are more comfortable assuming stable systems and confining their scope to the profits, gains, and losses of marginal changes. Greater change will generally produce greater effects in their models, but the process is usually more or less linear—in other words, discontinuities or sudden "leaps" are seldom seen. Most economic analysis would expect to observe a greater

human impact from a more meaningful change in the world's climate, but none of it is ever considered to be of existential risk.

One report, for example, estimates negligible damage to global output from a 1°C increase in average global temperatures, and only slightly more than a 10 percent loss of GDP from an increase as great as 6°C.8 To make clear the significance of these magnitudes: the prevailing expert view is that an increase in global temperatures of anything more than 2°C is considered, if not catastrophic, at least very destructive. To say that the report understates the potential damage from a temperature increase of 6°C is a grave understatement.

Orthodox economics tames uncertainty by redefining it as "risk." "High damage" scenarios are permissible—though invariably with low probabilities—but catastrophic scenarios are simply ruled out.9 The analysis then requires only assigning currency values to the presumed benefits and costs, including the benefits of averting damage to human life.

The Ethics of Discounting

I mentioned that any cost-benefit analysis of climate change requires projections years into the future. Consequently, another challenge involves the valuation of future costs and benefits relative to present costs and benefits. The difference is of vital interest to the capitalist investor. Investors use what is known as the "discount rate" to calculate how much future receipts of income are worth today (what economists call their present value). While anyone could tell them that $1,000 in ten years' time is worth less than the same amount received today (because in that decade they could have invested the money at some rate of interest), the question remains of exactly how much its value would diminish. Dividing by the discount rate (compounded, in this case, over ten years) gives an estimate of this projected loss. Such information enables cost-benefit analysis of private projects, even many years into the future, because it permits the translation of all future benefits and costs into present values that are directly comparable to today's benefits and costs.

Social cost-benefit analysis uses a similar procedure, but in the social arena, discounting is more dubious. For discounting purposes, private investors typically use an interest rate for an investment of comparable risk to their project, since it represents what economists call the "opportunity cost" of capital. But how relevant is capital opportunity cost when we are talking of intangible social benefits and costs that have real impacts on people's lives? To say that, by dint of a compounding discount rate, benefits and costs far into the future carry far less weight in a climate change cost-benefit calculation is morally questionable. It is tantamount to saying that future people are not "worth" as much as people today.

Any thinking, feeling person will recognize the problem with any policy that forces us to choose among different people's lives as a matter of policy. But it gets worse. Orthodox economists generally justify the discounting of future human lives on the grounds that people not yet born will, on average, be better off than their predecessors. They assume this on the basis of a historical extrapolation from the sustained growth in global income per capita over the past two centuries. Marxists, among others, would of course not concede this point, but let us do so for the sake of argument. If, then, we knew that future people would be better off, one might plausibly argue that discounting makes sense on grounds that we should not be making sacrifices today for a future population that will benefit regardless. A higher discount rate effectively means we are less concerned about future climate change damages—which, to continue this line of reasoning, is acceptable because richer, healthier, more stable future generations would be better positioned to deal with or adapt to these problems.

As ecological economist Joan Martinez-Alier has noted, such thinking is perverse, since by making us less cautious toward the fates of future people, the implied higher discount rate makes it less likely that they will be better off than us.10 The high discount rate, in other words, makes capitalist investors even more rapacious than they might be otherwise, leaving a smaller resource endowment for future generations. One of orthodox economics' most basic analytical tools thus proves self-contradictory when applied to human lives.

More important, a positive discount rate requires that we assume that there is a zero percent chance of catastrophic climate effects in the future. If the probability of future human extinction caused by climate change were any number greater than zero—however small—we could not, by any metric, assume that future generations would be better off. In expected value terms, any positive probability multiplied by an infinite loss is still an infinite loss. Such a prospect would require us to use a large negative discount rate, with the inevitable policy recommendation that we must aggressively confront climate change at any cost. This is why it is so important, for orthodox analyses to "make sense," to assume tacitly that the probability of catastrophe is zero.

Arbitrarily choosing some private interest rate to stand for the social discount rate would of course be absurd, but many orthodox economists, including William Nordhaus or Nicholas Stern (of the *Stern Review*), defend the use of discount rates in social cost-benefit analysis, even if they differ over its proper value. The *Stern Review* aroused much controversy in economic circles because of the relatively low discount rate (1.4 percent) it used for its calculations, compared to Nordhaus's preferred rate (6 percent).11 Based solely on this discrepancy, there is a hundred-fold difference in the estimated benefit of aggressive climate policy today. Consequently, Stern, to the chagrin of many economists, advocates a much more active role for government in combating climate change.

While it is true that one cannot conduct social cost-benefit analysis without committing to some discount rate value, if anything this very point illustrates why the use of cost-benefit analysis should be confined to capitalists and their private investments. For ethical matters concerning society, there can be no such thing as a "correct" discount rate. Choosing a particular one merely produces an arbitrary cost-benefit conclusion. If politicians read the conclusion at face value, the chosen rate could, in theory, carry far-reaching policy implications. Yet whatever the outcome, one could never claim that it was objectively determined.

Conclusion

Climate change presents capitalism with an unprecedented problem. For the first time, the world faces a largely human-made challenge that jeopardizes the very viability of our species. But capitalism is incurably short-sighted, with the imperative for continued growth trumping everything else. Even if it were to come at the expense of future generations of capitalists, the corporate elite would not accommodate any meaningful change in policy if it meant a reduced surplus. Consequently, the message that climate change can be "managed" by balancing the benefits against the costs, effectively denying any existential risk, is indispensable, at least in allowing capitalists to buy time.

Enter orthodox economics. A critical advantage of mathematically sophisticated models is that they mystify all but the few who "speak the language," conferring greater credibility on those using them. Mainstream economics helps capitalism "manage" climate change by (1) redefining uncertainty as "near-certainty," where we know all the possible outcomes and their probabilities, (2) disregarding the possibility of existential risk to humanity without explicitly denying it, and (3) reducing to a single number critical moral questions that should inform future policy. The result, effectively, is that climate change is transformed from a complex mystery into a precise science.

For a challenge as complex as climate change, social cost-benefit is worse than worthless. The beguiling precision

of quantitative models gives the impression that they are useful for policy, when it is in reality highly misleading with possibly disastrous consequences. Despite their allure, numbers are frequently not based on objective science or study. In the case of climate change, to say that they are fabricated is not much of an exaggeration.

Vast uncertainty should be cause for aggressive action, not complacency. Instead, averse to meaningful change that might reduce capitalist surplus, the corporate media, with the sometimes unwitting assistance of the economics mainstream, will resist efforts to inform the public about the urgency of action, to say nothing of the incessant economic growth most culpable for climate change in the first place. Absent a shift to a system that places priority on human needs over private profits, it is difficult to imagine that quantitative methods will loosen their grip on the political imagination of economists, governments, and corporations.

Notes

1. ↩Nicholas Stern,*The Economics of Climate Change: The Stern Review*(Cambridge: Cambridge University Press, 2007).
2. ↩See for example Rajendra K. Pachauri and Andy Reisinger, eds.,*Climate Change 2013: Synthesis Report* (Geneva: IPCC, 2013), and Rajendra K. Pachauri and Andy Reisinger, eds.,*Climate Change 2007: Synthesis Report* (Geneva: IPCC, 2007).
3. ↩See Rahul Varman, "The Neoclassical Apology for Monopoly Capital,"*Monthly Review* 64, no. 6 (November 2012): 29–47. Many others, Marxists and non-Marxists alike, make similar arguments. Examples include Leo Huberman,*Man's Worldly Goods* (New York: Monthly Review Press, 1963), and Margaret Schabas, "What's So Wrong with Physics Envy?" in*Non-Natural Social Science*, ed. Neil de Marchi (Durham, NC: Duke University Press, 1993), 45–53.
4. ↩The notion of "weak uncertainty" is an example of what philosopher and Wall Street investor Nick Taleb has called the "ludic fallacy." It is characterized by the confusion of games or mathetmatical models with real life, despite the fact that only probabilities in games can be known*a priori*.
5. ↩My ideas for these classifications are taken from an article by Stephen Dover and John Handmer, "Ignorance, the Precautionary Principle, and Sustainability,"*Ambio* 24, no. 2 (1995): 92–97.
6. ↩Among the most common methods of "observing" revealed preference is to compare the risk differential (in terms of probability of accidental death) and compensation differential among a variety of occupations, and from these "infer" what value people ascribe to their own lives by how much they are being paid to take on more risk. To the extent that such reasoning makes any sense, it depends on the assumption that the subjects of such studies are perfectly informed.
7. ↩Of course, the methods used to obtain the dollar figures used for cost-benefit analysis are themselves often highly subjective and biased. But in the interest of brevity, I set these objections aside.
8. ↩William Nordhaus and Joseph Boyer,*Warming the World: Economic Models of Global Warming* (Cambridge, MA: MIT Press, 2000).
9. ↩One study found that models such as those used by the International Panel on Climate Change (IPCC) require positive proof that a particular climate scenario (e.g., multiple catastrophic feedback effects) is possible in order for it to be assigned a probability.*Absent* such proof—in other words,*always*—extreme events are considered impossible. For more on this issue, see Gregor Betz, "Underdetermination, model-ensembles, and surprises: On the epistemology of scenario analysis in climatology,"*Journal of the General*

Philosophy of Science 40 (2009): 3–21.

10. ↩Joan Martinez-Alier,*Ecological Economics* (Oxford: Blackwell, 1987).
11. ↩For a clear and concise discussion of this controversy, see John Broome, “The Ethics of Climate Change,”*Scientific American* (June 2008): 97–102. See also Richard York, Brett Clark, and John Bellamy Foster, “Capitalism in Wonderland,”*Monthly Review* 61, no. 1 (May 2009): 1–18.