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Conservatives, Climate Change, and the Carbon Tax

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Global warming has for a long time been a partisan issue rather than a purely scientific one—and in important respects, conservatives have painted themselves into a corner. Based on the reasonable expectation that admitting a problem would lead to a huge government power-grab, those conservatives with access to the biggest megaphones have long used scientific uncertainty to avoid the issue. That game is up, and they suddenly find themselves walking unprepared into the middle of a sophisticated scientific and economic conversation about how to deal with the problem. While a few conservative think tanks have considered these issues seriously for some time, the public discussion has until recently been conducted largely among various liberal factions and has turned into a technical debate about differing schemes for taxing emissions of carbon dioxide.

Still, no matter how much global-warming activists feel as if they have won all the debates in think-tank meetings, editorial pages, and faculty lounges, it is going to be a tough battle to convince the voting public to make huge sacrifices based on the evidence that we have now. After all, Wharton Econometric Forecasting Associates has estimated that implementing even the limited emissions abatement envisioned for the United States under the proposed Kyoto Protocol would cost the average U.S. family about $225 per month. Ongoing polling conducted by researchers at M.I.T. suggests that the median U.S. family would be willing to pay $21 per month to "solve global warming." That's quite a bid-ask spread.

The electorate is pretty unsentimental in pursuing its own interests. This drives global-warming activists crazy, and if conservatives keep their cool, may ultimately lead activists to commit serious blunders that alienate public opinion. Some are already starting to attack the consensus science of the United Nations Intergovernmental Panel on Climate Change (IPCC)—which, along with former U.S. Vice President Al Gore, was awarded the 2007 Nobel Peace Prize—as too timid because it does not support predictions of imminent global catastrophe. But that precise fact means that global warming need not be a losing political issue for

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conservatives: The best available science and the best available economic analysis show that the proposed programs to radically reduce carbon emissions through taxes or regulation are very likely to cost much more than the benefits they provide. By getting past denial and taking a science-based approach to the issue, clever conservative candidates could take a principled stand that pays major tactical dividends.

Unfortunately, it isn't yet clear that conservatives are catching on to this reality. The Republican Party's standard-bearer in the 2008 presidential race, Senator John McCain, supports the creation of a "cap-and-trade" emissions law that would have a tremendous economic cost but almost no effect on global warming. A cap-and-trade bill sponsored by Senators Joseph Lieberman and John Warner was defeated in June 2008 on economic grounds—but it inched close enough to passage to guarantee that something similar will be proposed again. It is a good bet that another, maybe more stringent, version of emissions reduction legislation will be introduced and debated in the next two to four years. Conservatives may be able to mobilize sufficient opposition, even in the minority, to prevent its passage, but there is a real possibility that some form of carbon tax or cap-and-trade scheme will become law.

In girding for the political battles to come, conservatives should keep in mind a few central facts. First, global warming is real—but it is a problem that is expected to have only a marginal impact on the world economy. Second, while it is economically rational to reduce (slightly) this marginal impact through global carbon taxes, such a global carbon-tax regime would be very unlikely ever to be enacted—and even if it were, the theoretical benefits it might create would probably be more than offset by the economic drag it would produce. And finally, a far better course—one much less costly to implement and much more commensurate with the likeliest risks—would be to invest in new technologies that could help avert the worst potential impacts of global warming.

Modeling Earth's Climate

Understanding the politics of climate change should begin with the science. Carbon dioxide is a greenhouse gas, meaning that it absorbs and redirects longer-wavelength (infrared) radiation but not shorter-wavelength radiation. The sun constantly bombards the Earth with a significant amount of high-energy radiation with short wavelengths, such as visible light. Some portion of this is temporarily absorbed by the land and oceans, where it does work by moving electrons around. This work

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consumes energy, so that a significant portion of the radiation that is subsequently re-emitted by the Earth is lower-energy, longer-wavelength infrared radiation. As the re-emitted infrared radiation travels through the atmosphere on its way back to space, some of it is absorbed by carbon dioxide molecules and then scattered, so that some portion of this absorbed energy is then re-directed back towards the Earth. If all else is equal, the more carbon dioxide molecules in the atmosphere, the hotter it gets.

In a simplified model of the planet—one in which the complexities created by things like water vapor, convection, clouds, trees, polar ice caps, and so on are all ignored—it would be pretty straightforward to estimate the warming impact of increasing concentrations of carbon dioxide. But the Earth is nothing like that planet: any change, including pumping out more carbon dioxide, initiates an incredibly complicated set of feedback effects. Some of these will tend to magnify the greenhouse warming impact; others will tend to dampen it. Famously, as the atmosphere heats up, polar ice caps tend to melt, reducing the amount of solar radiation that is reflected and thereby causing further heating. On the other hand, more carbon dioxide should lead to faster plant-growth; this pulls carbon dioxide out of the atmosphere and therefore reduces warming. The list of such potential effects is very long; many of these feedback effects interact with one another; these interactions interact with one another; and so on *ad infinitum*.

The entire legitimate scientific debate is really about these feedback effects. Feedbacks are not merely details to be cleaned up in a picture that is fairly clear. With no feedback effects, the base impact of a doubling of carbon dioxide in the atmosphere would be on the order of 1 degree Celsius. Taking the feedback effects into account, the IPCC estimates that the impact of doubling carbon dioxide is about 3 degrees Celsius. So the feedback effects in the IPCC scenario dominate the prediction.

While it is a theoretical possibility that all the feedback effects together could lead to actual cooling, it is highly unlikely. Feedback effects could, however, easily dampen the net impact so that it ends up being less than or equal to 1 degree Celsius. The IPCC estimate is based on a set of feedback effects that are believed to massively amplify the base effect. Uncertainty about feedback effects isn't a marginal issue, but goes to the heart of how much, if at all, we should be worried about global warming.

Over the past several decades, in order to account for feedback effects, teams in multiple countries have launched ongoing projects to develop large computer models that simulate the behavior of the global climate. Roughly speaking, these models divide the surface of the Earth plus its

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atmosphere into a set of slices, usually about 200 kilometers on a side and about a kilometer thick. A set of rules for how the slice-shaped elements in the model interact with one another is established based on our understanding of atmospheric physics—so, by illustrative example, if an element heats up by X degrees Celsius, then within the next hour the adjacent elements will heat up by Y degrees Celsius. A set of initial conditions is estimated for things like the current temperature of each element. The model then advances to the next hour based on the set of rules. Each element then has a new value. Then the model advances through the following hour of changes, and so on for a simulation of many years of climate evolution.

These models are the basis for the oft-cited predictions of how much global temperatures will rise based on carbon dioxide emissions. As with all models, they are approximations of reality. Scientists in any specialty normally evaluate the reliability of such simulations by asking two questions: First, are the quantitative relationships within it based on a reasonably complete set of proven physical laws? And second, how accurately does it predict future outcomes given complete input data? For climate models, the answers are "partially" and "unknown."

Climate modelers tend to be smart and dedicated. They use known laws of atmospheric physics to establish the rules in these models whenever possible—but big gaps remain. Most obviously, the bulk of the real physics of convection, cloud formation, and so forth happens at scales much smaller than the elemental units—on the order of 10,000 square miles in area—of today's climate models. This physics must therefore be represented at a combined and gross level by parameters for each element that are determined by the modelers. Competent modelers attempt to ground these parameters in physical laws as best as possible, but they represent estimates of a compilation of many smaller-scale processes. Even if the physics of each of the smaller-scale processes were perfectly understood, the parameters would still be a patchwork with large inherent uncertainties. Even more fundamentally, the physics for some of the feedback effects believed to be most important is not well understood. And finally, some feedback effects, such as cloud formation, that could massively influence temperature are poorly understood and badly represented in today's models. These models are complicated as compared to simulation models used in some other fields, but they are extremely simplistic as compared to the actual global climate.

When evaluating model reliability, the second test—can it predict accurately?—is the one that counts. We can debate all day about whether a model is complete enough, but if it has correctly predicted major climate

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changes over and over again, that is pretty good evidence that its predictions should be taken seriously. There are plenty of studies that show what is called "hindcasting," in which a model is built on the data for, say, 1900-1950, and is then used to "predict" the climate for 1950-1980. Unfortunately, it is notoriously common for simulation models in many fields to fit such holdout samples in historical data well, but then fail to predict the future accurately. So the crucial test is *actual prediction*, in which a model is run today to forecast the climate for some future time-period, and then is subsequently validated or falsified. No global climate model has ever demonstrated that it can reliably predict the climate over multiple years or decades—never.

The available evidence from today's climate models indicates that it is likely that human activities have increased global temperatures to date and will likely continue to do so. But in spite of all the table-pounding, the total impact of global temperatures over the next century could plausibly range from negligible to severe. Long-term climate prediction is in its infancy, and improved forecast reliability is crucial to enable useful guidance for policymakers. Better science could give us what is most needed in this debate: more light and less heat.

The Economics of Risk

If you believe that human emissions of carbon dioxide create a significant risk of harmful climate change, the solution seems obvious: reduce emissions today to prevent potential problems tomorrow. The IPCC projects that, under fairly reasonable assumptions for world population and economic growth, global temperatures will rise by 2.8 degrees Celsius by the year 2100, and that this will begin to create costs equal to 1 to 5 percent of global gross domestic product (GDP) sometime in the twenty-second century. So, it is argued, we should begin right now to reduce emissions of carbon dioxide in order to prevent some or all of these costs. The most frequently discussed methods for doing this are a straightforward tax on carbon and a cap-and-trade system (like the Lieberman-Warner legislation)—which is essentially just an inefficient, back-door tax on carbon.

Now, 1 to 5 percent of global GDP is nothing to sneeze at; it is a huge amount of money, and an ounce of prevention can be worth a pound of cure. But in the case of global warming, the values may be exactly reversed: Getting most of the carbon out of the energy cycle today would be a very expensive undertaking, and a century is a long time to wait for the payoff from this investment.

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Think of it this way: In everyday life, normally I would rather have a dollar today than the promise of a dollar a year from now. I "discount" the promise: The amount of cash I would be willing to take today in lieu of that promised dollar is termed its "present value," and the percentage lower I am willing to accept today is called the "discount rate." When decisions are made on the timescale of centuries, however, discounting can have counterintuitively large effects: Consider that if the legendary sellers of Manhattan Island had put $28 in an account with a 4 percent real interest rate in 1626, they would have enough money in the bank today to buy back all the land in Manhattan. Albert Einstein supposedly said that "the most powerful force in the universe is compound interest"—and this mathematical reality is central to the wise evaluation of plans to address the risk of climate change.

The Stern Review—a major report on climate change produced by the British government in 2006—is cited frequently as demonstrating that the world should begin immediate, aggressive abatement of greenhouse-gas emissions. But William Nordhaus, a Yale professor widely considered to be the world's leading expert on this kind of integrated environmental-economic assessment, has pointed out that a crucial feature of the Stern Review was its assumption of a very low discount rate. Nordhaus offers a thought experiment to demonstrate just how unrealistic that assumption is: Imagine a scenario in which global warming would lead to zero costs between now and the year 2200, at which point global economic growth would be permanently reduced by 0.1 percent—in other words, that economic output starting in 2200 would be 99.9 percent of what it would have been had there been no global warming. Under this scenario, how much should we be willing to pay today as a lump sum to avoid this cost? Using the assumptions of the Stern Review, Nordhaus points out, we would pay about $30 trillion, which is more than half of the world's entire annual economic output. Thanks, but no thanks.

Why would sophisticated advocates for rapid, aggressive emissions abatement make such an obviously unrealistic assumption? Because they're politically trapped. Given current global-warming-impact projections and normal economic assumptions, the costs of global warming justify only limited actions for the next several decades—but vocal and growing political constituencies demand action *now.*

Nordhaus's modeling group estimates that the total costs of *all* global-warming-related damage will come to about $22.6 trillion (in present-day dollars), which is roughly 1 percent of the present value of total global income over the next several centuries. In other words, if we simply let

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global warming happen, the world would generate about 99 percent of the present value of wealth it would otherwise have generated had there been no such thing as global warming.

The Nordhaus models indicate that we should simply let $17 trillion (about 75 percent) of that $22.6 trillion in damages happen, because it would be more expensive to avoid the damages than to accept them. Nordhaus further estimates that we could avoid the remaining $5 trillion to $6 trillion of damages by "spending" about $2 trillion on a carbon tax. This would provide a net benefit of around $3.4 trillion, or about 0.17 percent of the present value of global GDP over the next several centuries. So, if the IPCC forecasts are correct, the global-warming hysteria is about the opportunity to create a net economic benefit of less than 0.2 percent of future global wealth creation. While not everything that matters can be measured by money—and this economic calculus doesn't take into account things that have no real price tag, like species that might be endangered by climate change—this at least provides a different perspective than the "Manhattan would be an underwater theme park" rhetoric would suggest.

Why a Carbon Tax Won't Work

The carbon tax that Nordhaus endorses is modest relative to some of the others that have been proposed. But any carbon tax, or its equivalent in the form of a cap-and-trade system, would be so politically and administratively impractical as to be, at best, useless.

First, plainly put, a carbon tax would not be politically feasible. With billions of dollars of assets and tens of thousands of jobs threatened, the political and economic interests that would be hardest hit by a carbon tax would fight it tooth and nail. Those interests would only allow a carbon tax to become law in exchange for huge, economy-distorting side-deals that would likely make the ethanol subsidy look like peanuts.

Second, if the United States were to go it alone and enact a carbon tax without the world's other major economies, it would not only severely damage the U.S. economy but would also fail to appreciably reduce global emissions.

Third, you don't have to be Henry Kissinger to be skeptical of the geopolitical reality of the prospect of a planet-wide carbon tax. A global, harmonized tax on all significant uses of carbon would require the agreement of—just to take a few examples—the French National Assembly, the Parliament of India, the Brazilian National Congress, the Chinese

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Politburo, Vladimir Putin, and John Dingell. Again, imagine all the side deals that would be required to actually negotiate such a binding agreement: they could likely create enough economic drag to more than offset the benefit of that 0.17 percent of present value of global output. Besides, our track record in closing and implementing such deals as the Kyoto Protocol, or even the current round of the General Agreement on Tariffs and Trade process—which, remember, is supposed to make the signatories *richer*—inspire no confidence that the theoretical net benefits will outweigh the costs created by the agreement.

Fourth, even if we got to an agreement *de jure*, we would then actually have to *enforce* a set of global laws for many decades that would run directly contrary to the narrow self-interest of most people currently alive on the planet. How likely do you think a rural Chinese official would be to enforce the rules on a local coal-fired power plant? These bottom-up pressures would likely render such an agreement a dead letter, or at least make it in effect a tax applicable only to the law-abiding developed countries that represent an ever-shrinking share of global carbon emissions.

Fifth, a carbon tax would be, most likely, a one-way door: Once we introduce it we're stuck with it for a long time. Therefore, keeping our options open has great value. What if our economic and climate models are too aggressive, and there is no practical economic justification for emissions reductions for centuries—if ever? What if someone invents a non-point-source scrubber that can remove carbon dioxide from the atmosphere at low cost, so that there is really no reason not to emit carbon dioxide all day long? There are very large potential regrets to a carbon tax.

Sixth, and most importantly, the economics of a carbon tax just don't make sense: A carbon tax designed for the expected case can safely be put off for decades, while a carbon tax high enough to ameliorate a low-odds disaster scenario would be insanely expensive. Suppose we agree to focus only on climate externalities in setting a carbon tax. Based on the analysis of Nordhaus's group, the optimal tax burden would be relatively low for the next several decades and then ramp up over time. In everyday terms, the gasoline tax, for example, would be about 9 cents per gallon through 2010, and would then ramp up to about 25 cents per gallon by 2050. To put this in perspective, the typical U.S. state already has about a 40 to 50 cent per gallon gas tax, and a typical Western European country has gas taxes of several dollars per gallon. We are not going to transform our economy with such a tax; major changes would really start in the latter half of the upcoming century. The low incremental taxes for the next several decades put into even starker contrast the relative practical risks

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of implementing a new global tax regime in return for such small immediate changes in tax loadings.

All that said, the possibility remains that our climate and economic projections might be wrong, and global warming could turn out to be substantially worse than forecast. This is the common argument for immediate, aggressive emissions abatement—and it isn't completely unreasonable. Long-term climate prediction is in its infancy. Estimating the cost impact of various potential warming scenarios requires us to concatenate predictions made by non-validated climate models with those made by economic models that purport to understand the economy of the twenty-first, twenty-second, and twenty-third centuries. It is hubris to imagine that these can guarantee accuracy, and impossible to validate such claims. Epistemological humility requires us to admit that we can predict reliably neither what impact human activities will have on the climate nor the resulting impact of these climate changes on the economy over multiple decades and centuries.

If it turns out that our predictions for global-warming impacts are enormously conservative and that disaster is imminent if we don't change our ways radically and this instant, then we really should start shutting down power plants and confiscating cars tomorrow morning. We have no evidence that such a disaster scenario is looming, but nobody can conceivably prove it to be impossible.

It comes down to how we think about the risk of very dangerous events we consider very unlikely. One could argue that we should have much higher carbon taxes immediately. To take one such benchmark, if we introduced a tax high enough to keep atmospheric carbon concentration to no more than 1.5 times its current level (assuming we could somehow get the whole world to go along), we would expect (following Nordhaus's numbers) to spend about $17 trillion more than the benefits that we would achieve in the expected case. Al Gore has a yet more aggressive proposal that if implemented through an optimal carbon tax (again, assuming we can get the whole world to go along) would cost more like $23 trillion in excess of benefits in the expected case. That's a heck of an insurance premium for an event so low-probability that it is literally outside of a probability distribution—but some would argue that even *that* isn't enough. Once you leave behind the world of prudential handicapping and enter the world of the Precautionary Principle, there is really no principled stopping point: you could forever chase an endlessly receding horizon of zero risk.

Under the expected case, it is cheap to wait. Raising a carbon tax high enough fast enough to realistically change the economy fast enough to

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blunt (at most) the impact of a potential disaster scenario within the next several decades would be enormously expensive—an impractical, panicky reaction unworthy of a serious government. If a climate disaster were really in the offing, we would be much better off armed with the options that would result from a focused program to build technologies for averting the worst outcomes.

Technology, Not Taxes

A sensible, science-based approach to climate change would be one that hedges by providing support for *prediction*, *mitigation*, and *adaptation* technologies.

We should start with the development of better climate-prediction tools. The climate-modeling community has made real progress, but needs to mature rapidly if we are to use climate models as the basis for trillion-dollar decisions. Today, climate modeling shows all the classic symptoms of poor supervision of smart analysts, including: excessive analytical complexity driven by researcher interest rather than a focus on the task at hand; lack of rigorous validation studies; software-engineering quality standards more appropriate for exploratory research than for reliable predictions; lack of transparent data standards; and an over-weighting of investment in analysis, as opposed to data collection and validation. The federal government should redirect funding in this area to develop a better software-modeling process, in combination with networks of physical sensors that can provide early-warning systems for the most plausible of the potential catastrophic climate scenarios.

Our economy is on a long-term trajectory of de-carbonization as it becomes less energy-intensive and as the relative prices of alternative energy sources continue to drop compared to the price of fossil fuels. Accelerating this process is valuable for many reasons beyond those of climate change. Developing tactical technologies, such as carbon sequestration and cleaner-burning engines, would enable us to invent lower-emissions production facilities, automobiles, and so forth in the United States, and export this technology to countries like China and India, where it would make the biggest difference (as these countries build up basic infrastructure). Using U.S. or European technology to increase the energy-conversion efficiency of coal-fired Chinese power plants as they come on-line over the next few decades is a decidedly non-glamorous measure; but it's probably the single most important action we can take to reduce carbon emissions over the next century.

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Adaptation should take center stage, as it is by far the most cost-effective means of addressing climate risk. We can reduce the climate impact of carbon that is emitted, often using such simple techniques as planting more trees or using more reflective paint. Prosaic efforts—such as developing strains of crops that grow better in slightly warmer temperatures, better buttresses for buildings, and more intelligent zoning codes for coastal areas—can dramatically reduce losses from temperature swings, hurricanes, and floods today, and also reduce vulnerability to any potential future problems caused by climate change.

The government can catalyze improvements in the relevant technologies, but it's absolutely essential that we avoid turning this into yet another huge corporate-welfare program: The last thing we need is a repeat of shale-oil subsidies to Exxon or the multibillion-dollar fiasco of funding the development of a totally uneconomical wind turbine by Boeing. The agency for funding any government-sponsored research in this area should be explicitly modeled on the Defense Advanced Research Projects Agency (DARPA)—an agency with highly intelligent staff, who have wide flexibility in providing small grants for demonstrated progress in closing crucial technological gaps. We also need to place a strong emphasis on large prizes for accomplishing measurable and audacious goals. The British entrepreneur Richard Branson has offered a $25 million prize to anyone who demonstrates a device that removes carbon from the atmosphere; what if the U.S. government upped the ante to $1 billion and pledged to make any resulting technology freely available to the world? That would hold the potential for solving any global-warming problem that might develop—for a one-time cost of less than 0.01 percent of U.S. GDP. The incremental cost of this approach could be single-digit billions per year, possibly with partially offsetting spin-off benefits. DARPA's total annual budget is about $3 billion, and—unlike Al Gore—it really did invent the Internet.

Global warming is a manageable risk, not an existential crisis, and we should get on with the job of managing it. Conservatives should propose policies that are appropriately optimistic, science-based, and low-cost. This should be an attractive political program: It is an often-caricatured, but very healthy, reality that Americans usually respond well to the conversion of political issues into technical problems. After all, we're very good at solving the latter.

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