
The Cost of Carbon: The Economics and Politics of Using Incentives To Reduce Carbon Emissions

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Abstract

Climate change has quickly become an issue of great importance, and as more evidence is discovered, it is also becoming an issue of greater urgency. Warming of the planet has been linked to the burning of fossil fuels and the release of, a large amount of carbon dioxide, among other gases. The accumulation of greenhouse gases in the atmosphere has produced a noticeable warming trend that could potentially lead to global catastrophe. This paper examines two different policy options designed to curb fossil fuel use and carbon emission—a carbon tax and a cap-and-trade system. While the focus here is on the consideration of these measures in the United States, many other countries are exploring them as well. This paper also discusses the international and domestic political considerations concerning climate change policy. I conclude that while a carbon tax would be more effective at reducing carbon emissions, politicians will favor cap-and-trade systems due to these systems' ability to obscure their true costs, thus making them more politically feasible.

Introduction

This paper compares and contrasts two different incentive schemes designed to reduce carbon emissions: carbon taxes and cap-and-trade systems. More and more evidence collected over the past several decades has led to the conclusion that humans are contributing to global warming by emitting greenhouse gases—carbon dioxide being the most abundant—into the atmosphere. These emissions have been linked to fossil fuels, the use of which drives economic activity around the world. In order to prevent the potentially disastrous consequences of climate change, emissions must be cut.

Currently, the two most visible policy options are carbon taxes and cap-and-trade systems. Comparing the two policies using basic theories of economics, this paper analyzes which one is better designed to reduce emissions. It also discusses international and domestic political obstacles that can hinder the effective implementation of climate change policy. I conclude that carbon taxes would be a more effective than cap-and-trade systems due to the benefits of price stability and of the revenue a tax will generate, among other reasons. Despite these benefits, however, most international and domestic efforts have focused on cap-and-trade systems, due primarily to the political difficulty in implementing a new tax.

To evaluate the relative merits and drawbacks of carbon tax proposals and cap-and-trade systems, I researched scholarly publications to find relevant facts and arguments, and analyzed government and media reports. I considered these in light of basic economic theories relating to incentive schemes. Focusing specifically on how each policy deals with long term uncertainty, I evaluated their potential effectiveness in actually decreasing carbon emissions.

Background Discussion on Climate Change Policy

THE GREENHOUSE EFFECT

The greenhouse effect is a natural phenomenon that warms the planet and keeps it habitable. Without it, the temperature on the earth's surface would hover around -19°C (IPCC AR4). The greenhouse gases (GHGs) responsible for the effect include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Put together, these gases make up only a tiny fraction of the earth's atmosphere. Heat energy from the sun warms our planet and then bounces back towards space. GHGs absorb this reflected heat and re-direct it back towards the surface, further warming the planet. This process has gone on for millions of years and keeps our planet hospitable to life. However, a problem arises when the levels of GHGs in the atmosphere are too high and therefore reflect too much sunlight back towards the earth's surface. The result is global warming.

The GHG that humans are most responsible for producing is carbon dioxide, which results mainly from the burning of fossil fuels—coal, petroleum, and natural gas. Since the time of the Industrial Revolution, humans have used fossil fuels to power industrial production. We burn coal to produce electricity and oil to power our vehicles, all the while putting more and more carbon dioxide into the atmosphere. Currently, the atmosphere has a higher concentration of GHGs than ever previously recorded by scientists. The UN Intergovernmental Panel on Climate Change (IPCC) concluded in its most recent report that “global atmospheric concentrations of carbon dioxide, methane and nitrous oxide have increased markedly as a result of human activities since 1750 and now far exceed pre-industrial values determined from ice cores spanning many thousands of years” (IPCC AR4).

The result of this increase is an observed rise in global temperatures. All in all, the IPCC reports a rise of 0.74°C in global mean temperatures between 1906 to 2005. It concludes that “warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures,” and further, that it is very likely that these changes are driven by human activity

(IPCC AR4). That is, increased GHGs are not merely coincident to or correlated with the rise in global mean temperatures, but are the *cause* of the global warming.

ESTIMATING COSTS AND OPERATING UNDER UNCERTAINTY

What will it take to stop global warming? What will happen if we do nothing? Unfortunately, the answer is more complex than can be yielded by simply comparing costs and benefits. Scholars have struggled with these questions for many years due to the vast and inherent uncertainties of the problem. Not only are the exact causes of climate change under debate, but no one can be sure of the timing and extent of the consequences. Furthermore, the exact costs of the effects of climate change, as well as the costs involved in avoiding or mitigating these effects, are unknown. The models scholars use to project the costs associated with halting global warming, no matter how sophisticated, all operate under uncertainty. A model, however, is not a predictor of exact costs, but rather a tool that can mitigate the uncertainty enough to make rational and reasonable decisions today.

The effects of climate change, and the associated costs, are potentially far reaching. Rising temperatures could cause rising sea levels, which could in turn induce migration of populations and inhabitability of land. Changing climate patterns could also adversely impact crop yields, while more extreme weather occurrences such as droughts, floods, and hurricanes could cause massive damage to infrastructure around the world (Weyant 1993).

Estimates of the sum total of these damages have changed over time. William Nordhaus estimated in 1991 that a 3° C rise in global mean surface temperature would cause damages of at most 2% of world Gross Domestic Product (GDP) (Nordhaus 1991). Since then, estimates of the damages have steadily risen. In 2006, the Treasury of the United Kingdom released the Stern Review, which estimates that the warming potential had risen to 5-6° C and that the result could be as much as a 5-10% loss of global GDP (Stern Review 2006). Although some criticize the Stern Review for being too dire, the potential of losing anywhere in the neighborhood of 5% of world GDP is enough to necessitate action.

Other scholars choose to focus on the marginal cost associated with emitting one extra ton of carbon—a measure called the social cost of carbon (SCC). Scholars define the SCC as a “monetary indicator of the global damage done by the emission of one extra ton of carbon today” (Guo et al. 2006). Similar to the marginal cost used to analyze standard costs in basic economic models, the SCC is particularly useful for the establishment of a carbon tax price. Unfortunately, uncertainty plagues estimates of the SCC as well, and rightly so, since those estimates have to account for both scientific data and hypotheses about the damages wrought by climate change as well as the economic costs associated with those damages (Guo et al. 2006). Since we don’t know the exact nature and timing of the consequences of climate change, estimating their monetary value is difficult. A brief look at SCC estimates over time shows uncertainty affecting the estimates. Richard Tol aggregated 103 estimates of the SCC from 28 published studies and found the mean estimate was \$93/tC (ton of carbon), the median was \$14/tC and the mode was \$2/tC (Tol 2005). As we can see from the wide range on these measures of center, there is little agreement among scholars on the SCC. Different assumptions on the discount rate contribute greatly to disagreement in the estimates.

Other costs that need to be addressed are the costs of abatement. Since carbon emissions are tightly connected with economic productive capabilities, the cost of abatement derives from the costs associated with a decreased use of current technology as well as with the necessary investment in new infrastructure and the technology to provide cleaner energy. Both the Stern Review and the IPCC’s fourth assessment report state that the level of emissions in the atmosphere should not exceed 550 parts per million of CO₂ equivalent. The Stern Review estimates that stabilizing the atmospheric CO₂ equivalent at this level would cost around 1% of global GDP annually.

These estimates highlight the important role uncertainty plays in this debate. In light of the uncertainty, the Congressional Budget Office reports, “effective climate policies should consider not only the most likely outcomes near the middle of the range, but also the less likely but more damaging possible consequences of climate change” (Orszag 2007). The potential damage from climate change is uncertain also because the level of carbon in the atmosphere already surpasses the historical record. We can predict the likelihood of certain events, such as sea levels rising, but we cannot predict with certainty the timing and magnitude of both the earth’s response to increased GHGs and the damage that will result from them. Any policy dealing with climate change must be made in light of this uncertainty.

INCENTIVE SYSTEMS

The economic concept of externalities—impacts on parties not involved in a given economic transaction—is useful in discussing the costs associated with climate change. Externalities can be positive or negative. Education is a good example of a positive externality. Those involved in education include the student, teachers, parents, and schools, but society as a whole receives the benefits of a more educated and thus productive person. Conversely, carbon emissions are negative externalities; the damages from climate change hurt people who were not involved in producing or consuming the fossil fuels which emitted the carbon (Wald 2007). The problem with externalities is just that—they are external to whatever the product or service is—and therefore the cost of the product or service does not generally account for them.

With carbon emissions, the cost of the damage done to the environment is not included into the cost of burning and consuming fossil fuels. The result is an over-production of carbon. Price incentive policies seek to solve this problem. Both carbon taxes and cap-and-trade policies assign a monetary value to carbon emissions, thereby internalizing what once was external. Once internalized, the costs of carbon emissions become just another input cost that a business must calculate, and since rational firms seek to minimize costs and maximize profit, they will have an incentive to reduce carbon emissions. Similarly, putting a price on carbon emissions will increase the price of fossil fuel products such as gasoline and electricity, which will provide an incentive for consumers of these products to conserve more and be more efficient in their energy choices.

Carbon emissions are viewed as negative externalities to industrial production because the atmosphere is largely considered a public good. One person consuming the atmosphere (by breathing) does not diminish another person’s ability to do so. Also, no one can prevent another from consuming the atmosphere. This is in part because no one “owns” the atmosphere. The responsibility for maintaining public goods and externalities generally exists only when property rights are clearly defined. Property rights confer not only ownership of that good but responsibility for it as well. If you are a homeowner and your faucet is leaking, it is your responsibility to fix it. However, with the atmosphere, no single entity is responsible for cleaning it up, maintaining it, or fixing it, because no one owns it. Putting a price on carbon seeks to address this problem by giving to the government property rights over the atmosphere that would allow it to enforce regulations and to require payment from private actors if they pollute the atmosphere.

Putting a price on carbon has other positive effects as well. The reason we use coal and oil for electricity and transportation is because they are currently the cheapest fuel source. In 2006, coal, petroleum, and natural gas produced 2.9 billion megawatt-hours of electricity compared with the mere 96 million megawatt-hours produced by all types of renewable energy (EIA 2007). Renewable energy sources include geothermal, solar photovoltaic cells, and windmills. The large discrepancy in use of these sources is due primarily to costs: it is cheaper to produce electricity from fossil fuels than from renewable sources. However, if a price were put on carbon, those fossil fuels would no longer be as cheap as they

are now, making the renewable sources more cost competitive and attractive. As the competitiveness of alternative energy continues to increase, more investment will be devoted to developing them. The long run goal is a switch from fossil fuels to renewable fuels—a move that would promote long term energy sustainability.

PROBLEMS ASSOCIATED WITH CLIMATE CHANGE POLICY

The complexity of climate change makes any attempt to implement a comprehensive policy extremely difficult and should not be underestimated. Some of the greatest hurdles to policy-making involve problems of time, space, and uncertainty.

One of the biggest challenges in creating policy is that there is a fundamental disconnect between those who have to incur the costs of emission abatement and those who will receive the resulting benefits. Climate change is a slow process spanning many centuries. The benefits of the actions taken today won't be felt for many generations to come. Yet the costs of those actions would be levied on people today. The length of time involved also brings up a unique problem. Economics deals with future costs and benefits by using appropriate discount rates. A discount rate puts a present value on future benefits, with the assumption that benefits today are worth more than benefits in the future. This concept works quite well in financial markets, where the time periods are fixed and relatively short-term. With climate change, however, the time period is neither fixed nor short-term. Rather, it stretches on indefinitely into the future, making it very difficult to apply standard cost calculations. As shown earlier, different estimates of the discount rate dramatically impact conclusions on the social cost of carbon.

Another fundamental problem is the allocation of the costs. In addition to the temporal difficulty in allocating costs, there is the problem of allocation along geographic lines. A majority of current emissions come from the developed world, yet a comprehensive policy would have to include as many nations as possible. Is it fair for developing nations to incur the costs of mitigating a problem that is the result of the industrial production of developed nations?

Comparing Carbon Tax and Cap-and-Trade Systems

READ MY LIPS: MORE NEW TAXES

A carbon tax operates on the basic principle that if you increase the cost of something, people will consume less of it. In economics, this is known as a Pigovian tax, a tax designed to discourage the consumption of a good. Under a carbon tax, the government would levy a tax on carbon output, which would raise the price of energy produced from fossil fuels. Different fuels (and their derivatives) would be impacted differently since they have different amounts of carbon content. The cost of coal (which is primarily used to produce electricity) would increase the most since it produces the most carbon per unit of energy. Oil (used to produce gasoline) would be next, followed by natural gas.

A tax has unique advantages. It provides a clear price signal to both producers and consumers and does so with little price volatility. This long term stability is crucial because climate change policy must stay in place for a long time to have an effect. A carbon tax would also provide governments with an extra source of revenue, which if used correctly, could help offset the increased cost to consumers of energy.

A tax can mitigate the two major concerns raised earlier, about the difficulty of calculating negative externalities and about the effects of uncertainty. A tax “corrects a distortion, namely the externalities arising from the excessive use of environmental services” (Pearce 1991). The government would set a dollar rate per unit of carbon emitted; thus, firms would know exactly how much impact on profits was due to emitting carbon and could begin to adjust their production methods in response. Furthermore, with the price of carbon being predictable, firms could also do better long-range planning, treating carbon as just another input cost that they would seek to minimize.

One big advantage of a carbon tax over a cap-and-trade system is the revenue that would be generated. Skeptics say that more money in the hands of the government only leads to wasteful spending. However, there is a way to limit that waste if governments adopt a revenue neutral policy (Nordhaus 2007). A revenue neutral program is one that the government does not use to generate revenue for any of its other programs. Rather, the revenue generated could be set aside to offset other taxes such as the payroll tax. In this way, those people in lower income brackets would get help paying for the increased cost of energy. This would be crucial aid for lower income citizens, who spend a disproportionate amount of their income on energy, in order to avoid a severe decrease to their standard of living. Another reason a carbon tax should be revenue neutral is because the goal is decreased emissions: as emissions decrease, so will the revenue the government receives. The government should not become dependent on a source of revenue that will, by design, run out.

One major objection to a carbon tax, as with most taxes, is that government intervention creates market distortions (Victor 2001). Critics state further that a carbon tax would require heavy and difficult government monitoring and enforcement. Economic theory states that all taxes create distortions in the market by artificially reducing supply. As with most taxes, the forced decrease in supply creates not only government revenue, but also a situation of dead weight loss, which can be described as a loss of economic gains, due to inefficiency, that occurs when distortions enter the market. This inefficiency can be partly counteracted if the revenue generated by the carbon tax goes to supplement other disproportionate taxes, such as the payroll tax. These taxes, which we've lived with for the past several decades, are inefficient in the same way as a carbon tax is. If the carbon tax remains revenue neutral, and the funds go towards reducing the inefficiencies of other taxes, the total dead weight loss to the economy is mitigated.

Charles Griffiths, an economist at the EPA, sees another way to address the enforcement issue: "[I]f the government taxes at the point of origin, meaning at the coal mine or the oil well, it can substantially decrease enforcement costs. The number of entities needed to be taxed will fall significantly; the increase in price will flow down the chain of production ending up at the consumer, which will happen anyway, but taxing at the point of origin can save the government a lot of work" (Griffiths, personal interview). Adopting a strategy such as taxing at the source, along with revenue recycling, would go a long way toward mitigating the inefficiencies generated by the tax and make it a more feasible policy option.

PUTTING A CAP ON GAS

A cap-and-trade policy differs from a carbon tax policy in that the government controls the *quantity* rather than the *price* of carbon. A cap is placed on the amount of carbon a firm is allowed to produce. If a firm produces a greater amount, it has to purchase carbon credits from a firm that has stayed below the limit. Over time, the government would lower the cap until reaching an acceptable level of carbon emissions. Cap-and-trade systems are popular with policy makers; as of this writing (December 10, 2007), there were no less than seven congressional bills proposing cap-and-trade systems to control carbon emissions. Furthermore, the most visible international pact addressing climate change, the Kyoto Protocol, uses a cap-and-trade system.

The benefits of cap-and-trade systems are numerous. Climate change is not a localized phenomenon but a global one. A ton of carbon emitted from one firm in one part of the world affects the planet the same as one ton emitted by another firm on the other side of the world (Claussen 2007). Likewise, it does not matter where carbon reductions are taking place as long as the aggregate amount of carbon is coming down. Because of the unimportance of the location of sources, cap-and-trade systems are a more efficient way to allocate the location of emission cuts. The cap-and-trade system allows the market to decide where emission reductions will take place by ensuring that the firms that are most able to cut emissions will do so. Firms would have incentive to reduce emissions not only to avoid paying for credits, but also

to accumulate credits to sell to other firms, producing additional revenue. Firms that can easily make emission cuts will do so and reap the rewards. Firms that cannot make cuts will be forced to incur the extra cost of purchasing credits. Cap-and-trade systems, according to proponents, “provide industry with the flexibility in method, location and timing of emission reductions” (Sandor et. al 2002).

Increased efficiency would also come from the reduced need for government oversight. Under a cap-and-trade system, the price of the credits will be determined by market supply and demand. The government’s role will be limited to setting and periodically revising the cap level. Whether implementing a carbon tax or cap-and-trade system, the government will have to expend resources to ensure accurate reporting of emission cuts, but under a cap-and-trade system, the government wouldn’t need to worry about collection of revenue. Although cap-and-trade systems can be more efficient than carbon taxes, this does not mean that they are necessarily more effective at reducing GHG emissions.

Cap-and-trade policies require the development of a proper method of allocation. If permits are auctioned, the system resembles a tax since firms would have to purchase as many credits as they need to cover their emissions. If permits are given away for free, then energy firms, who are responsible for emitting so much carbon, stand to make windfall profits. Many would argue that it is not fair to suddenly give polluting companies billions of dollars in the form of carbon credits. Another difficulty arises in deciding who gets the permits. Allocating emission permits is akin to allocating property rights. After all, an emission permit can be seen as a right to emit pollution. Is there a fair way to allocate these permits across nations? Land rights, if traced back to their origin, were often obtained by conquest while broadcast rights are auctioned off to the highest bidder by the FCC. While a government could decide how to allocate the permits, whatever companies wind up with the permits would have an advantage, at least in the short run. Those with permits would have extra time to switch their industries to low emission production, while those without the permits would be forced to buy permits and incur the costs of doing so. Stephen DeCanio tackles this problem and argues that although initial allocations may seem unfair and arbitrary, a general equilibrium would be reached within several generations (DeCanio 2007). Although DeCanio himself confesses that this is an oversimplification, the idea that an equilibrium can be reached gives hope that this problem can be resolved.

One big drawback of a cap-and-trade system is the potential for price volatility. The same market that can efficiently decide where and how emission cuts will take place also has the potential to change dramatically the price associated with those cuts. Emission permits will be a very valuable commodity, creating a strong demand, since firms will be required to have them. Additionally, the total supply of permits would be fixed by the government, at least in the short run. The combination of high demand and fixed supply creates great potential for price instability, as firms will constantly be bidding against each other in order to secure the scarce permits. The potential for volatility has already been borne out in the European trading market, where prices for carbon have ranged from \$44.47 to \$143.06 per ton (Nordhaus 2007). Another example comes from the US market for sulfur dioxide, where a cap-and-trade system was set up to limit emissions. From 1995 to 2005, the price for sulfur dioxide permits was much more volatile than both stocks and consumer prices, although it remained lower than oil prices. Volatile prices make long term planning by both private firms and policymakers extremely difficult.

TO TAX OR TO CAP?

So which policy— a carbon tax or a cap-and-trade system—is more likely to be effective at reducing emissions? It depends in large part on how these policies deal with uncertainty. A carbon tax would most likely deal with uncertainty better than a cap-and-trade policy, as a tax rate set by the government would be much more stable than a market-driven price for emission permits. Past examples show the volatility of emission permit prices. A tax sends an unambiguous price signal to consumers and producers of fossil

fuel products, who can adjust their consumption and production accordingly. Clear price signals make long-term planning easier, since actors can see the monetary consequences of their actions. While it is true that initially setting the correct price for the tax is complex, governments can adjust the tax to get the desired cuts.

A carbon tax also provides the benefit of government revenue. Both policies will raise the energy prices for the everyday consumer, but only a carbon tax can generate revenue that can be used to mitigate some of that hardship. Although a tax would distort the market and create dead weight loss in the economy, the revenue generated can be used to offset other distortionary taxes to mitigate the overall loss to the economy. A cap-and-trade system can only provide these benefits if the permits are auctioned. Auctioning the permits, however, effectively transforms the cap-and-trade policy into a carbon tax.

International and Domestic Political Aspects of Climate Change Policy

THE POLITICS OF INTERNATIONAL EFFORTS

Climate change is truly an international problem. A single country's emission reductions can easily be offset by another country's increasing emissions. Both incentive schemes face unique challenges when brought to the international stage.

In implementing an international carbon tax to which all parties could agree, the Westphalian dilemma—so named for the 1648 treaty that saw the birth of the modern nation state, each one a sovereign entity—presents a significant barrier. Experts in international law constantly struggle with the problem, which, as William Nordhaus explains, occurs because “there is no legal mechanism by which disinterested majorities or even super majorities of countries can coerce non-cooperating countries to provide for global public goods” (Nordhaus 2007). Even if a universal carbon tax is agreed upon, there is nothing preventing a nation from reneging on its commitments. A successful global carbon tax policy, like many international agreements, must find a way to resolve this dilemma.

Stephen DeCanio, a professor of environmental economics at the University of California-Santa Barbara, thinks that the answer lies in the implementation of carrot-and-stick type incentives that would get different nations to agree on a global climate policy: “Countries can implement trade sanctions (the stick), and offer to share technology (the carrot) in order to push other nations to agree to a comprehensive climate policy. However, the main thing needed in the international arena is strong leadership” (DeCanio, personal interview). Indeed, one important factor missing from current international negotiations concerning climate change is the strong leadership of the U.S. During negotiations for the Montreal Protocol, an agreement that reduced the world's emission of ozone depleting chemicals, the U.S. took a clear leadership role and worked hard to drive the negotiations forward. In more recent times, however, the U.S. has played a sideline role, refusing to join the Kyoto Accord, the most visible international treaty concerning climate change. Just recently, Australia began ratification of the Kyoto Accord, reversing a decade of Australian environmental policy (AP 2007). This leaves the United States as the only industrialized nation that has refused to sign the accord. While some say that Australia's signing may put pressure on the U.S., DeCanio does not think so: “[T]his administration has put itself into a corner regarding international climate agreements; there has always been broad but shallow support for climate policy from the public, we will have to wait for a new administration before any substantive talks on international climate control can begin in earnest” (DeCanio, personal interview)

In opening up cap-and-trade policies internationally, the problem of equity and the possibility for corruption present a problem. A cap-and-trade system is designed to locate the emission cuts where they can be made with the least amount of costs. In opening up international emission trading, it is possible

that many developed countries simply pay developing ones to make the cuts. Some argue that it is not fair that developing countries sacrifice their economic development by cutting emissions and then paying the price of a problem that began in large part in the developed countries. However, if the cuts are taking place in developing countries, it means that they are the ones who can make the cuts more efficiently, and they will reap the rewards of doing so. If a cap-and-trade system is established internationally, developing countries have the chance to collect substantial sums of money.

The possibility of these substantial sums, however, creates the opportunity for corruption. Because the system artificially creates a scarcity—namely the emission permits—where none existed before, these permits provide a new source of revenue. It would not be surprising to find that a country had underreported its emission levels and then sold off its permits for easy cash. Furthermore, not every country is a transparent democracy, so enforcement and verification of emission cuts could prove very difficult to implement. The potential for corruption has no obvious solution, even theoretically.

Politics of Domestic Efforts

Within the United States, the debate on climate change has shifted dramatically over the past few years. Just in 2005, Senator Inhofe of Oklahoma said that global warming is the “greatest hoax ever perpetrated on the American people” (Inhofe 2005). Since then, attitudes towards climate change have decidedly shifted towards accepting the possibility of drastic and dangerous changes in climate. All the leading candidates from both major parties in the 2008 presidential race have platforms promising cuts in carbon emissions. However, with all of the policy options available, a cap-and-trade system seems to be the most popular among the candidates. The *New York Times* recently surveyed the major candidates’ websites and speeches and found that, of all the candidates, only Chris Dodd publicly supports a carbon tax. The rest of the Democratic candidates along with John McCain support a cap-and-trade system, and the other Republican candidates do not mention either carbon taxes or cap-and-trade systems (Bennett 2007). The Republican candidates prefer to frame the topic as one concerning national security, speaking about our country’s addiction to foreign oil. However, the real problem is not that the U.S. is addicted to foreign oil; it is that the U.S. is addicted to oil in addition to other fossil fuels. In order to truly address the issue of climate change, all policy options should be brought to the table for open discussion. Some of the candidates have done well in speaking about cap-and-trade systems, but we need an honest discussion involving carbon taxes as well.

Greg Mankiw writes in the *New York Times* that “Republican consultants advise using the word ‘tax’ only if followed immediately by the word ‘cut.’ Democratic consultants recommend the word ‘tax’ be followed by ‘on the rich’” (Mankiw 2007). While this may be an unfair and stereotyped characterization, there does seem to be a grain of truth behind the statement. The word *tax* has so much baggage associated with it and so many negative connotations that many policy makers simply don’t want to even breathe the word. It seems that “most politicians favor cap-and-trade, in part because it obscures the full cost of curbing carbon emissions” (Redburn 2007). Both carbon taxes and cap-and-trade systems will raise energy prices, but a cap-and-trade system confounds the way those prices will rise. This strategy can be seen in other policy proposals presented on the hill. Policies addressing fuel efficiency in vehicles and promoting alternative fuels such as ethanol, while important topics indeed, seem like a sideways approach to addressing the real problem—our over-use of fossil fuel and our need to stop using less soon.

Regarding the direction of current domestic policy, Griffiths argues that “a country wide policy is hard to fully fathom, it will impact people in many ways all at once, in ways that we may not fully understand. By focusing on sector by sector approaches, like auto fuel economy, the problem becomes much more manageable for a lay person to understand. However, a nation wide approach really would be

better since we need to address all sources of carbon emissions, not just one or two” (Griffiths, personal interview). Although it may be true that sector by sector approaches are more easily digestible, it will take a truly comprehensive nationwide policy to make a significant cut in emissions.

With the federal government seemingly lagging behind with implementing climate policy, some state and local governments have taken it upon themselves to implement local and regional policies. The Regional Greenhouse Gas Initiative, a group of eleven northeastern states that have come together to plan emission cutting policies, plans to cut emissions ten percent below 1990 levels by 2020 using a localized cap-and-trade system (RGGI 2007). More recently, San Francisco has announced that it plans to put a proposal for a carbon tax on the November 2008 ballot (Leff 2007). The San Francisco plan seeks to use the revenue generated from the tax to offset the payroll tax, adopting the policy advanced in this paper. In the absence of federal initiative, state and local politicians are left to take climate policy into their own hands.

Conclusion

At the most basic level, the two policies analyzed in this paper are quite similar, both seeking to put an explicit price on carbon in order to provide an incentive to reduce emissions. Both policies operate under a vast amount of uncertainty, since we are still unsure about the extent and timing of the damages brought on by climate change. Uncertainty is not a reason for inaction; the need to curb emissions soon will improve our chances of avoiding potential future disasters.

In light of this need, carbon taxes seem to be a more effective approach than cap-and-trade systems to reducing carbon emissions. The prospects of long term price stability, a clear unambiguous price signal, and government revenue give the advantage to a carbon tax policy. However, a cap-and-trade policy could be altered—by implementing safety valves and auctioning the permits—to mitigate some of its shortcomings. Both policies face challenges when brought to the international arena, where enforcement and corruption will prove difficult challenges.

Despite the advantages of a carbon tax, politicians continue to focus on cap-and-trade systems. The most visible international accord, the Kyoto Accord, operates with a cap-and-trade system, and the major candidates in the 2008 presidential election promote cap-and-trade systems. Their popularity in comparison with the carbon tax may be because they can obscure their real costs. It seems that a carbon tax’s greatest strength is also its greatest weakness. Its clarity makes good economic sense, but makes for a hard political pill to swallow.

Hybrid approaches that make use of the advantages of both policies would be wise to consider. A cap-and-trade system that employs the use of a safety valve, guaranteeing a minimum and maximum price, would help with the problem of price instability. Furthermore, if a portion of the permits was auctioned off, some benefits of the revenue would be generated while still letting the market decide the most efficient location of emission cuts.

Further research needs to focus on the scientific aspects of the problem. The more we understand the scientific basis of global climate change, the better we can make estimates, and in turn, make better policy choices. Future research could also focus on the economic and political implications of opening climate change policy internationally, as well as the possibility of other international agreements like the Kyoto Accord. Whatever steps occur in the future, solving the problem of climate change will truly demand a global response.

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