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The Case for Direct Methods to Address CO_2 Emissions and Other Negative Environmental Externalities

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Existing policies to reduce emissions of carbon dioxide (CO_2) largely have been structured to subsidize alternative energy technologies. Yet these policies are likely not to be as useful as ones that target CO_2 emissions directly, such as an emissions tax or a "cap and trade" program.

Economists generally recognize that private incentives for energy consumption are likely to result in non-optimal levels of carbon dioxide (CO_2) emissions. Thus, many economists advocate policies that would force the price of CO_2 to be pushed closer to the full "social" marginal cost, a cost that is likely to be higher than the price currently faced privately by market participants. This can be accomplished through either a tax or a "cap and trade" program, recommendations that are standard in economic analyses of situations in which private and social marginal costs do not coincide.

And yet, existing policies don't in general work to raise the price of CO_2 directly. For the most part, these policies include incentives – like tax and investment credits – that subsidize the production of alternatives, such as so-called "clean" energy sources, or subsidize the development and adoption of technologies that reduce energy consumption. In this *Economic Brief*, we argue that if CO_2 abatement is the goal, it is likely to be accomplished most efficiently through policies that change the price of CO_2 emissions directly, as compared to broader approaches that have been suggested.

DEFINING CO_2 "OVER-PRODUCTION"

Though the scientific consensus seems to be that too much CO_2 is produced today, to design efficient policies that address this problem it helps to define precisely what we mean by "too much." If we take as given, for purposes of this discussion, that the link between CO_2 and harmful climate change is definitive, CO_2 emission taken in isolation is a bad thing. Yet CO_2 emissions arise from endeavors that exist precisely to serve human needs.

Most economic activity cannot be conducted independent of our primary (CO_2-producing) energy sources today, and people clearly benefit from having well-lit homes and functional automobiles, for instance. Therefore, it is almost certainly true that the socially optimal amount of CO_2 production is not zero. Rather, the optimal level is where the marginal benefit of activities that produce CO_2 equals the marginal social cost of those activities. Yet private marginal costs, which govern individual decisionmaking, are likely to be too low under unfettered markets to result in the optimal level of CO_2 emission. This is because CO_2 imposes costs to society that individual producers or consumers are not forced to pay, or "internalize." An individual's decision to drive his car,

for example, displays this feature. When you drive, you pay only the direct cost of gasoline and the implicit costs of your time, and the wear and tear on your car. But you are not forced to compensate anyone for the CO_2 that is emitted during your trip, though it imposes an external cost on society. This is what economists refer to as a "negative externality." In so doing, you probably will emit more CO_2 than you would if you had to pay for that right. As a result, the costs to society of your last mile driven will be greater than the benefits you receive. It is in this sense that CO_2 emissions may be "too high." Moreover, because your drive constitutes such a negligible contribution to worldwide CO_2 emissions, you will have little incentive to take into account the social consequences of your driving decisions.

It is useful to further flesh out why negative externalities exist. An externality results when a competitive market is missing. In the case of CO_2, there is no market for the use of atmosphere as a dumping ground. We cannot buy the right to a stock of clean air, protecting ourselves from the pollution of others, nor can we sell the right to pollute the air we own in exchange for some valued good or service. In fact, property rights for air are rarely defined at all.

There is another problem: Even if the market for air (and therefore CO_2 production) existed, individuals from future generations could not participate. Yet, it is precisely out of concern for the welfare of future generations that we generally care about environmental degradation. As a result, unless their interests are represented by current generations, future generations will inherit a stock of air whose quality may not be what they would have chosen.

If consumers of energy could be forced to face the price for CO_2 emissions that would obtain if all people, past and future, could participate in a competitive market, then a socially efficient level of production would result. This is an example of the so-called First Welfare Theorem of economics. In the absence of such a market, however, one solution that would proxy for a competitive price for CO_2 is the imposition of a so-called Pigouvian tax, named after economist Arthur Pigou. (Note that this analysis also works in reverse: In the case of a positive externality, policy can improve social welfare by subsidizing, rather than taxing, production of that good until it meets the social optimum.)

INDIRECT APPROACHES TO ADDRESS NEGATIVE EXTERNALITIES

Instead of taxing CO_2 production, however, the bulk of existing policies take the form of subsidies for energy alternatives. The logic behind these policies is to make "clean" alternative energy sources relatively more attractive (cheaper) than CO_2-producing ones, or to encourage people to purchase technologies that utilize less energy than traditional ones. And while subsidies have the potential to successfully reduce CO_2 emissions, we will argue that, for a variety of reasons, they are less desirable than direct taxes on CO_2 emissions.

Examples today of subsidies to energy alternatives include the following: tax and investment credits for the production of alternative sources of electricity; subsidies for the development of fuel efficient vehicles, like hybrid cars; and subsidies to ethanol and other alcohol fuel sources.[1] Most recently, the stimulus package, the 2009 American Recovery and Reinvestment Act, has expanded and increased many existing subsidies.

Theoretically, it is possible that a subsidy for energy alternatives will successfully move society toward a socially optimal level of CO_2 production. Consider a world in which there are two forms of energy: CO_2-emitting coal and CO_2-free solar power. A subsidy that makes solar energy cheaper will decrease the price consumers must pay for solar energy, likely increasing the amount that is used. The fact that solar energy is now relatively cheaper will (all else equal) then reduce the demand for coal, lower its use, and lower its price. Note that even though the subsidy has not forced producers to face the social costs of dirty coal use, it has successfully reduced coal consumption toward the level consistent with the socially optimal level of CO_2 emission.

However, this does not mean that a subsidy's total effect will be equivalent to that of a tax. In the above example, the prices of both forms of energy are now cheaper relative to non-energy goods. Thus, energy use as a whole might well expand relative to all non-energy goods. In other words, subsidies will distort decision-making between energy and non-energy goods. Inducing people to arbitrarily consume more energy (though noting that it is relatively cleaner energy) than they would choose in absence of the subsidy is an unintended consequence.

Perhaps most problematically, subsidies for alternative energy and energy technology will likely cause distortions within those markets, too. The simple example above considers only one possible alternative to dirty energy. In reality, there are many possible alternatives, and subsidies involve choosing winners and losers among them. Given the present state of technology, it is unclear which "clean" energy sources – wind, solar, geothermal, or others – will turn out to be the most fruitful in the future. Yet designing a subsidy program entails delineating a specific process, usually tied to a specific technology, for how that subsidy can be earned.

This arbitrary selection of winners and losers can have harmful effects, including diverting public and private resources away from the most potentially fruitful energy alternatives. Tufts University economist Gilbert Metcalf has illustrated a case where this has occurred in

practice. The Energy Policy Act of 2005 issues credits for vehicles according to whether they utilize hybrid technology and how many vehicles have been sold. The Mazda Tribute Hybrid receives 32 miles per gallon of gas, and is eligible for a $3000 tax credit under the Act. On the other hand, a Toyota Corolla receives 31 miles per gallon of gas, but receives no tax credit because it does not utilize hybrid technology. Though the cars exhibit almost identical levels of fuel efficiency, this particular tax credit treats the technologies asymmetrically, with an arbitrary bias for hybrid technology. As a result, firms are more likely to invest in further developing the hybrid technology utilized by the Mazda Tribute Hybrid than in making the internal combustion engine of the Corolla more efficient. Tax policy, arguably, should promote energy efficiency regardless of the technology used.

There also are likely to be other valid reasons to be wary of subsidies. In particular, they can create rent-seeking, in which there is politically – rather than market – driven allocation of resources. Growth of the ethanol lobby (and the controversy surrounding whether ethanol is, in fact, a relatively "clean" energy source) is an often-cited example of this potential problem.

A contrasting approach is to adopt a Pigouvian tax on goods whose use generates CO_2 as a byproduct, such as coal and gasoline. If reducing CO_2 emissions is the goal, a gasoline tax is likely to be preferable to subsidies for alternative energies. Yet these taxes, too, leave us susceptible to potentially important unintended consequences.

An example may help. Take a setting in which carbon dioxide is created by the burning of fossil fuels, and where the damage has been estimated to be one dollar for each 1000 BTUs generated. A properly set Pigouvian tax on fossil fuel would, in this example, be established at one dollar per 1000 BTUs. If imposed, it then seems that the socially optimal level of CO_2 emissions would result. Or would it? Let's assume that in the presence of this tax, average per capita fossil fuel use implies a monthly tax bill of five dollars. But, what if, for a low, one-time fee of one dollar, households and firms could purchase a CO_2 capturing device to fit onto their cars and factories that would completely eliminate CO_2 emissions from their tailpipes and smokestacks? Would consumers have an incentive to buy this device? After all, it seems the efficient way to proceed, given its cost. The answer is no, and it is because the Pigouvian tax is placed on fuel use, and not CO_2. After all, it costs money, and doesn't help their tax burden at all.

The point of this example is that even seemingly beneficial policies may leave socially useful solutions unused. It is therefore critical that the tax be placed on the specific offending substance. A tax on gasoline, or perhaps coal, would certainly be helpful in bringing private and social marginal costs closer together, but if enacted should at the very least be revisited periodically in light of new innovations.

CONCLUSION: GET THE PRICE OF CO_2 PRODUCTION RIGHT

To say that there is "too much" carbon dioxide produced today by energy usage is equivalent to saying that the price of CO_2 is too (inefficiently) low. Therefore, economists generally believe that the most efficient way to address this problem is to use policy to either proxy for, or literally establish, a competitive price for CO_2. While the proper size of a tax or cap-and-trade program may be hard to decipher in practice (considering, for example, that it must take a stand on how to price in the interests of future generations), it is indeed possible to estimate, and this approach is likely to move society closest to the social optimum with the fewest unintended consequences.

A tax directly on CO_2, or a regime that trades CO_2 permits, notably would preserve private incentives for the adoption – and therefore the development – of CO_2-mitigating technologies.[2] Interestingly, if there is an argument for subsidies for alternative energies, it is here. Competitive industries may provide insufficient incentives for research on energy alternatives because of the "public good" nature of knowledge. ■

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ENDNOTES

[1] For a useful discussion of energy-related subsidies and the difficulty of achieving key policy goals through their implementation, see Metcalf, Gilbert E. "Tax Policies for Low-Carbon Technologies." National Bureau of Economic Research Working Paper No. 15054, 2009.

[2] A tax on CO_2 production or tradeable permits (if auctioned) would also have the side benefit of producing revenue for the government in a way that is non-distortionary, which can be used to reduce other, distortionary taxes, like taxes on income, further improving social welfare. See Mankiw, N. Gregory. "An Open Invitation to Join the Pigou Club." Based on a talk presented at the Eastern Economic Association, March 8, 2008.

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