



Reducing Carbon Emissions

Interactions with the Tax System Raise the Cost

by Ian W.H. Parry

Reducing the amount of carbon dioxide Americans pump into the atmosphere will involve economic costs. These costs are larger than previously thought because emissions reduction policies are likely to aggravate economic distortions created by the tax system. But most of this added cost can be avoided if the policy chosen to reduce emissions raises revenues for the government and these revenues are used to cut other taxes.

Continued accumulation of heat-trapping gases in the atmosphere raises the prospect of future global warming and associated changes in climate. Many countries will attend a conference this December in Kyoto, Japan to consider steps to reduce emissions of carbon dioxide (CO₂)—the most important heat-trapping gas. Introducing emissions targets may produce important benefits in terms of avoided future climate change. Nonetheless, it makes sense to consider which policy approaches might reach these objectives at the lowest economic cost to each country. Recent research suggests that much will be at stake in this respect: the costs of even modest reductions in CO₂ emissions may differ substantially under different types of regulatory policies. To understand why requires a look at how these policies may interact with taxes that already exist in the economy.

The Tax-Interaction Effect

Government spending in the United States is financed primarily by taxes on labor and capital income. Putting aside the potential benefits from these spending programs, the taxes tend to “distort” economic behavior. That is, they reduce employment and investment below levels that would maximize economic efficiency.

For example, because personal income taxes reduce take-home pay, the partner of a working spouse may be discouraged from joining the labor force, an older worker may retire earlier, or a worker with one job may be discouraged from working additional hours in a second job. Employers are likely to hire less labor if social security taxes make employees more expensive. Similarly, capital gains and corporate income taxes reduce the incentives for individuals to save and for firms to invest in new production capacity.

Environmental taxes and regulations tend to discourage economic activity because they raise the costs to firms of producing output. Typically, this leads to a lower overall level of employment and investment in the economy. These “spillover” effects of environmental policies in labor and capital markets add to the distortions created by the tax system. The resulting economic cost has been termed the *tax-interaction effect*.

What would happen if a tax on carbon emissions (as proposed by the European Union) were introduced? The new tax would increase the costs to firms of purchasing coal and oil in particular, which in turn would increase the cost of electricity and gasoline. Most likely, firms would scale back their production activities a little in response to these higher costs,

leading to a fall in the level of investment and employment (as happened, for example, in the 1970s when the price of energy increased). But employment and investment are already “too low” because of pre-existing taxes in the economy. This aggravation of distortions created by the tax system would be part of the overall economic cost of a carbon tax.

This is not the end of the story, however, because a carbon tax would raise revenues for the government. These revenues could be used to reduce other taxes in the economy, such as personal and corporate taxes, and thereby reduce the distortion in the level of employment and investment. The economic gain from this so-called *revenue-recycling effect* could reduce the overall economic costs of a carbon tax significantly.

The Rise and Fall of a Hypothesis

Considerable confusion has arisen recently about the implications of tax distortions in the economy for the costs of carbon and other environmental taxes. In particular, a number of analysts have mistakenly argued that there would be a “double dividend” from environmental taxes. These analysts have correctly pointed to the potential benefits from the revenue-recycling effect, but have failed to recognize the cost from the tax-interaction effect.

Essentially, the double dividend hypothesis asserts that environmental taxes can both reduce pollution emissions and reduce the overall economic costs associated with the tax system. At first glance, this hypothesis seems to be self-evident, if the revenues raised are used to reduce other taxes that discourage work effort and investment. In some European countries, where high taxes, among other factors, have contributed to double-digit unemployment rates, the double dividend hypothesis has been particularly appealing. If environmental tax revenues were used to reduce taxes on labor income, so the hypothesis goes, unemployment and pollution might be reduced simultaneously. More generally, some people have argued that it is better to finance government spending by taxing economic “bads,” such as pollution, rather than economic “goods,” such as employment and investment.

Economists generally agree that revenue recycling would reduce the net economic cost of environmental taxes. However, recent studies suggest that environmental taxes are likely to *increase* rather than *decrease*

the costs associated with the tax system overall. As Lans Bovenberg (Netherlands Bureau for Economic Analysis), Lawrence Goulder (Stanford University and RFF), and others have demonstrated, the adverse effects on employment and investment caused by environmental taxes are generally not fully offset, even if the tax revenues are used to reduce other taxes. That is, the tax-interaction effect dominates the revenue-recycling effect.

Thus, if there were no environmental benefits, it would be better to finance public spending by taxes on, for example, labor income rather than on pollution emissions. Why is this? A tax creates economic costs by inducing households and firms to consume and produce less of the taxed activity and more of other activities. The greater the shift away from the taxed activity, the greater the cost of the tax. Taxes on labor income can only be avoided by people working less and spending more time at home. In contrast, environmental taxes have a much narrower focus, and are easier to avoid. A carbon tax can be avoided by an overall reduction in the level of production and employment. However, it can also be avoided by a change in the composition of production away from goods that use a lot of electricity (such as electric ovens and heating appliances) to ones that do not (such as natural gas ovens and heating). Tax economists have long argued that the economic costs of raising revenues are smaller under taxes that have a broad coverage compared with taxes that have a narrower focus.

Of course, this does not mean that environmental taxes should not be implemented. Instead, the environmental and revenue-recycling benefits should be weighed against the costs of reduced production and the loss from the tax-interaction effect. Indeed, recent research generally supports carbon taxes so long as the tax rates are not too high (that is, so long as they do not exceed the incremental value of environmental benefits).

CO₂ Permits versus a Carbon Tax

Instead of imposing a carbon tax, the government may reduce CO₂ emissions by requiring that firms have a permit for each unit of CO₂ emitted. By controlling the total quantity of such permits it gives to firms, the government could limit total CO₂ emissions to a target level. This permit program would cause a similar

reduction in production, employment, and investment, as would a carbon tax. The reduction in employment and investment would add to the distortions created by the tax system, leading to the same cost from the tax-interaction effect.

Whether CO₂ permits could also produce the benefit from the revenue-recycling effect would depend on whether the permits were auctioned by the government or given out free to existing firms. If the permits were auctioned off, the government could use the revenues to reduce other taxes in the economy. But if the permits were given out free, as in the case of the existing permits program for sulfur dioxide emissions, no revenue would be collected and there would be no potential for a revenue-recycling effect.

The table below summarizes the benefits (denoted by '+') and costs (denoted by '-') of carbon abatement policies. The benefits from a carbon tax consist of the potential gains from reducing future climate change (the environmental benefits), and the revenue-recycling effect. The costs consist of the reduced production from industries affected by the tax and the costs of exacerbating tax distortions in the labor and capital markets, or tax-interaction effect. Economists have traditionally focused on (1) and (3) and neglected (2) and (4). This has led to some overstatement of the benefit-to-cost ratio from carbon taxes because the tax-interaction effect generally dominates the revenue-recycling effect.

The Benefits and Costs of Carbon Abatement Policies				
Policy	Environmental benefits (1)	Revenue-recycling benefit (2)	Loss of production (3)	Tax-interaction effect (4)
Carbon tax	+	+	-	-
CO ₂ permits	+	?	-	-
+ denotes benefits				- denotes costs

CO₂ permits would produce three of the same effects as the carbon tax: namely, the environmental benefits from reduced future climate change, the cost from reduced production, and the tax-interaction effect. However, the benefit from the revenue-recycling effect could only be obtained if the government auctioned the permits.

Can the Policies Make Society Better Off?

Recent collaborative work by Lawrence Goulder, Roberton Williams, and myself suggests that the tax-interaction effect can raise the overall cost of policies to reduce emissions by a potentially substantial amount. For example, we estimate that the economic costs to the United States from using (non-auctioned) permits to reduce CO₂ emissions by 10 percent below current levels increases by 400 percent when the cost of the tax-interaction effect is taken into account! If instead the permits were auctioned—or a carbon tax were levied—and the revenues were used to finance cuts in other taxes, we estimate that the overall cost of this policy would be reduced by 75 percent.

On top of this, we estimate that the overall economic costs of a free CO₂ permit program would outweigh the environmental benefits—unless these benefits exceeded \$25 per ton of carbon reduced. Estimates by William Nordhaus (Yale University) suggest that the benefits from reducing carbon emissions may be *below* \$25 per ton, although there is much dispute on this point. If so, *even though the policy would correct a market failure associated with carbon emissions, the benefit would be more than offset by the costs of adding to distortions caused by the tax system.*

In contrast, a policy to reduce emissions that produces the revenue-recycling effect can produce a favorable benefit-to-cost ratio as long as environmental benefits per ton are positive. Thus, a CO₂ emissions reduction policy might produce an overall benefit to society only if it raises revenues for the government.

Other Considerations

It is important to keep in mind, however, that the benefit estimates from reducing CO₂ emissions are highly speculative at this stage. They do not take into account the (hopefully small) possibility of drastic changes in climate should global warming disturb some unstable mechanism within the climate system. Nor are the potential ecological impacts well understood. We simply do not know enough yet to judge whether global warming will turn out to be a very serious problem or not.

Moreover, there are other factors to consider in the choice of policy instruments to reduce CO₂ emissions. For example, affected industries may oppose a carbon tax that requires them to reduce emissions *and* pay

taxes to the government more than a free CO₂ permits program. Other important considerations include the potential impact of a given policy instrument on the private incentives to develop more energy-efficient technologies.

Nonetheless, minimizing the economic costs of any action to reduce CO₂ emissions that might be agreed to in Kyoto this December is desirable, not only for its own sake, but also for the likelihood of the agreement to stand the test of time. Recent research warns that even modest emissions reductions might be especially costly if the policies used do not raise revenues for the government that are returned to the economy in other tax reductions.

Ian Parry is a fellow in the Energy and Natural Resources Division. Lawrence Goulder, Paul Portney, Dallas Burtraw, and Marie France provided valuable comments on an earlier draft of this article.



This article is based in part on Parry's paper "When Can Carbon Abatement Policies Increase Welfare? The Fundamental Role of Distorted Factor Markets," written with Lawrence Goulder and Roberton Williams. The paper is available in the RFF discussion paper series. See page 17 to order a copy.

Recycling Revenues

Other Ways to Benefit

Are there other ways that carbon tax revenues might be used to reap economic benefits besides cutting other taxes? Yes, if the revenues were used to reduce the federal budget deficit. In that way, less tax revenue would be required in future years for interest payments and repayment of principal on the national debt. As a result, taxes could be lower, implying less distortion of employment and investment. Of course, in this case the benefits from revenue recycling would occur in the future rather than the present.

The answer is "it depends" if the revenues were used to finance additional public spending. The huge bulk of government expenditure in the United States consists of transfer payments, such as pensions, or expenditures that substitute for private spending, such as medical care and education. Loosely speaking (and ignoring distributional impacts) the benefit to people from a billion dollars of this type of spending is a billion dollars. If instead the revenue were used to reduce other taxes—say the personal income tax—the economic benefits would be greater. Not only would people get a billion dollars but the lower tax rates would favorably alter relative prices in the economy. The rewards for work effort and saving would increase, thereby encouraging more employment and investment. In contrast, increased public spending would not alter relative prices.

However, governments also provide "public goods" that, for various reasons, the private sector may not provide such as defense, crime prevention, and aid to needy families. People may (or may not) value an additional billion dollars of spending on these goods at more than a billion dollars. If they do, the benefits from this type of revenue recycling may be as large as (or even larger than) the benefits from reducing taxes.