Proceedings of the 2010 Land Policy Conference

CLIMATE CHANGE AND LAND POLICIES

Edited by Gregory K. Ingram and Yu-Hung Hong

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LINCOLN INSTITUTE
OF LAND POLICY
CAMBRIDGE, MASSACHUSETTS

Library of Congress Cataloging-in-Publication Data

Climate change and land policies /
edited by Gregory K. Ingram and Yu-Hung Hong.
p. cm.
Conference proceedings.
ISBN 978-1-55844-217-7
1. Land use, Urban—Congresses. 2. Climatic changes—Government
policy—Congresses. 3. Climatic changes—Environmental
aspects—Congresses. I. Ingram, Gregory K. II. Hong, Yu-Hung.
HD1391.C64 2011
333.73'13—dc22 2011003415

Designed by Vern Associates

Composed in Sabon by Achorn International in Bolton, Massachusetts.
Printed and bound by Puritan Press Inc., in Hollis, New Hampshire.
♻ The paper is Rolland Enviro100, an acid-free, 100 percent PCW recycled sheet.

MANUFACTURED IN THE UNITED STATES OF AMERICA

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Do U.S. Policy Makers Have Better Alternatives to Cap and Trade?

Ian W. H. Parry and Roberton C. Williams III

Although there is widespread agreement on the need for policies to reduce carbon dioxide (CO_2) and other greenhouse gases, there is less agreement about what form that intervention should take. Cap-and-trade policies initially had the most momentum following the launch of the European Union's Emissions Trading Scheme (ETS) in 2005. However, attempts to introduce a federal cap-and-trade system to reduce emissions in the United States have so far stalled. Thus, it is an opportune time to reevaluate the main options for moving U.S. climate policy forward.

Broad-based cap-and-trade systems are thought to be a cost-effective policy for reducing energy-related CO_2 emissions.[1] By putting a price on emissions, cap-and-trade programs raise the price of fossil fuels, electricity, energy-intensive goods, and so on, and thereby exploit all potential opportunities for emissions reductions throughout the economy. And allowance trading also helps to equalize marginal compliance costs across different emissions sources, thereby minimizing the overall burden of compliance costs for a given target reduction in emissions.

A carbon tax also places a price on emissions and in this regard shares the same advantage as cap-and-trade approaches. The policy landscape is not devoid of carbon taxes, as evidenced by the use of such taxes in northern Europe since the early 1990s and the recently implemented carbon tax in British Columbia. A

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[1] See, for example, early discussions by Baumol and Oates (1971), Dales (1968), Kneese and Bower (1968), and Montgomery (1972).

carbon tax may also be introduced in South Africa prior to the December 2011 climate change meetings in Durban. So far, carbon taxes have had less appeal among U.S. policy makers, however, although this could change down the road, as a carbon tax is an attractive option for reducing emissions and the federal budget deficit at the same time.

A regulatory approach would try to promote behavioral responses—such as fuel switching in the power sector or adoption of energy-saving technologies—that would be automatic under emissions pricing policies. But even if a fairly comprehensive regulatory framework could be implemented, cost-effectiveness would still be sacrificed to the extent that marginal compliance costs differ across different emissions sources (e.g., in the transport and power sectors). Moreover, some behavioral responses to reduce emissions, such as reductions in automobile use, are difficult to exploit under a regulatory approach.

Does this mean there is an open-and-shut case on cost grounds for moving forward with cap and trade or carbon taxes in the United States over regulatory approaches? Not always, because the traditional approach to measuring cost-effectiveness neglects the interactions between emissions control policies and distortions in the economy created by the broader fiscal system, particularly distortions in the labor market created by income and payroll taxes. Carbon policies increase energy costs, and this tends to slightly contract the overall level of economic activity and employment. As we discuss in this chapter, the employment reduction causes a welfare loss, which can be large relative to the costs of carbon policies in energy markets. This additional welfare loss is larger for carbon taxes and cap-and-trade systems because they have a greater impact on energy prices, due to the fact that, unlike regulatory approaches, they involve the pass-through of tax payments or allowance rents in higher prices.

In fact, the superiority of emissions pricing policies over regulatory approaches on cost-effectiveness grounds can hinge on the productive use of the policy rents/revenues. This requires, first, that the government obtains the policy rents (by auctioning allowances under cap and trade or ruling out exemptions under carbon taxes) and, second, uses this rent/revenue to increase economic efficiency by, in particular, cutting other distortionary taxes. This recycling of rents/revenues keeps down the overall costs of emissions pricing policies by counteracting the adverse effect of higher energy prices on compounding prior tax distortions.

The aim of this chapter is to provide some sense, in the context of U.S. federal climate policy, of what we know about the costs of cap and trade under alternative allowance allocations, carbon taxes under alternative revenue uses, and broad regulatory approaches, taking full account of linkages with the fiscal system. We first consider policy costs in a hypothetical economy with no preexisting tax distortions, and then we discuss how these costs change when we account for distortions in the real economy created by income, payroll, and other taxes. A final section sums up the implications for policy.

Cost Assessment in the Absence of Tax Distortions

Throughout this chapter we focus on the (gross) costs of climate policies and do not consider the benefits in terms of avoided future global warming.[2] And for simplicity, we consider policies affecting only domestic, energy-related CO_2 emissions.[3]

Taxing the carbon content (or CO_2 potential) of fossil fuels causes a variety of price changes throughout the economy, leading to various behavioral responses and sources of welfare costs in affected markets. Here we focus on costs in the gasoline market, the electricity market, and the overall economy, as most of the major policy proposals target one or some combination of these sectors. Gasoline combustion from automobiles currently accounts for about 20 percent of energy-related CO_2 emissions in the United States, and electricity accounts for about 40 percent (EIA 2009).[4] For now, we make the unrealistic assumption that there are no market failures or preexisting policy distortions in the economy.

COSTS OF EMISSIONS PRICING IN THE GASOLINE MARKET

Consider first the gasoline market, as shown in figure 13.1. In this figure, according to economic theory, the height of the gasoline demand curve at any point reflects the benefit to motorists from an extra gallon of fuel consumption, while the height of the supply curve reflects the costs of producing and distributing an extra gallon of fuel. The supply curve for gasoline is drawn as perfectly elastic, which is a reasonable approximation, given the United States' limited market power in the world oil market.

The imposition of the carbon tax, or cap-and-trade equivalent, drives up the price of gasoline and reduces gasoline consumption from G^0 to G. The price increase is the price per ton of CO_2 times the amount of CO_2 produced by burning one gallon of gasoline. The shaded triangle in figure 13.1 reflects the welfare cost in the gasoline market caused by the emissions pricing policy. This can be interpreted as the loss of benefits to fuel users (the area under the demand curve integrated over the reduction in fuel use) less savings in producer costs (the area

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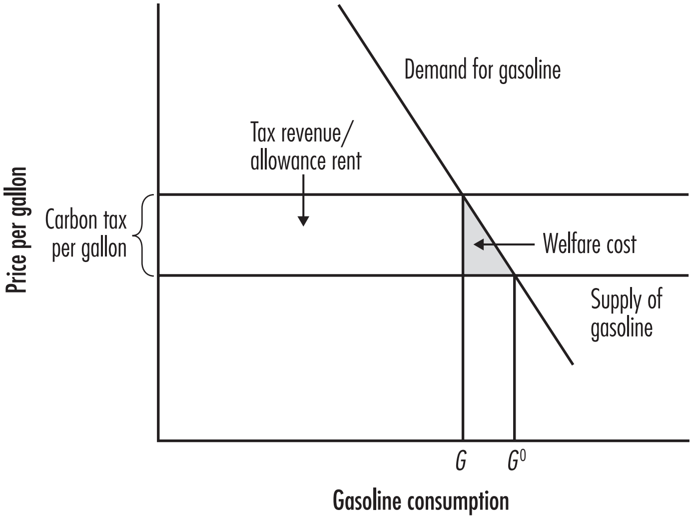
[2] A number of recent surveys put the benefits from avoided climate change on the order of \$10–\$30 per ton of current CO_2 emissions, although much higher benefits are estimated under different assumptions about discounting and modeling of catastrophic risk (e.g., Aldy et al. 2010; IWGSCC 2010; NRC 2009; Tol 2009).

[3] We do not discuss provisions that might enable domestic entities to offset their emissions by, for example, funding carbon sequestration projects in other countries. At present, there is uncertainty as to whether these offset programs can be properly monitored and verified due, for example, to the difficulty of deciding baselines against which to evaluate offset projects.

[4] Unlike in Europe, fuel prices have not been high enough in the United States to encourage significant adoption of diesel vehicles (which are more fuel efficient). Hence, our focus is on gasoline use only.

Figure 13.1
Costs of Emissions Pricing in the Gasoline Market

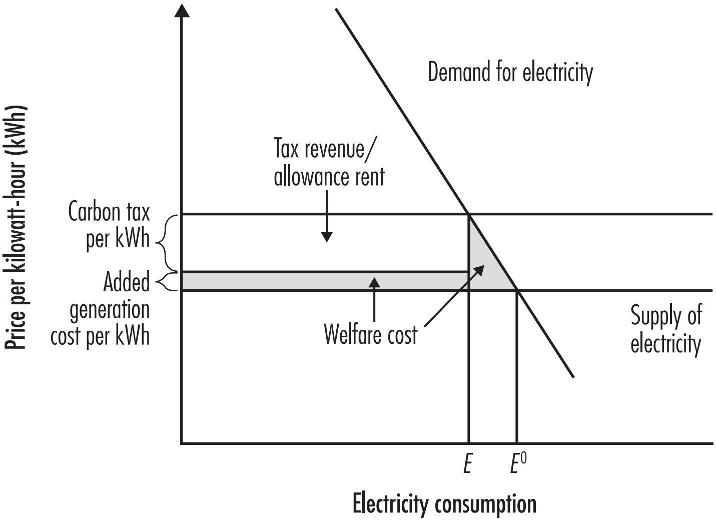


under the supply curve integrated over the reduction in fuel use). The tax revenues going to the government, or rents accruing to those receiving emissions allowances, is a pure transfer in this case and not part of the welfare cost.

COSTS OF EMISSIONS PRICING IN THE ELECTRICITY MARKET

Figure 13.2 indicates the impact of carbon pricing on the electricity market, where the heights of the demand and supply curves reflect the marginal benefit to electricity consumers and the marginal cost of electricity generation, respectively. Carbon pricing drives up electricity prices and reduces consumption from E^0 to E. The price increase consists of two components, assuming full pass-through of additional costs to power generators. First, unit production costs rise as generators switch from carbon-intensive fuels (coal) to zero- or low-carbon fuels (nuclear, renewables, natural gas) that are more costly at the margin. Second, costs also rise to reflect the price on remaining emissions equal to the product of the CO_2 price and emissions per unit of generation (again, therefore, tax payments or allowance rents are passed forward in higher prices). The welfare cost of the emissions pricing policy in the electricity market consists of the shaded triangle in figure 13.2, which reflects foregone consumer benefits from the reduction in electricity consumption of $E^0 - E$, minus savings in supply costs. It also includes the shaded rectangle, reflecting the higher resource costs now involved in generating the new amount of electricity E.

Figure 13.2
Costs of Emissions Pricing in the Electricity Market

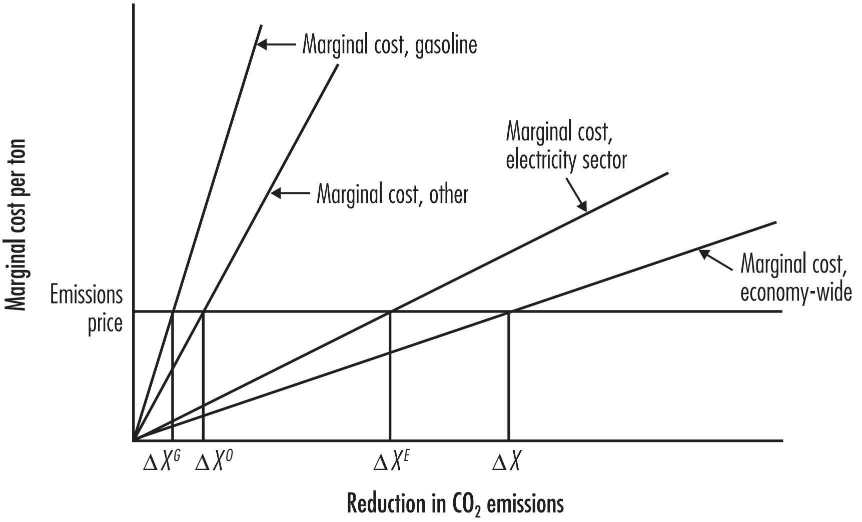


ECONOMY-WIDE COSTS OF EMISSIONS PRICING

Figure 13.3 depicts costs for the whole economy. These costs are represented by the area under the "marginal cost, economy-wide" curve, where this area has height equal to the price per ton of CO_2 emissions and base equal to the reduction in economy-wide emissions, denoted as ΔX. In turn, the economy-wide marginal abatement cost curve is shown as the horizontal summation of marginal costs for emissions reductions from the gasoline market, electricity market, and other sources. For gasoline, the area under the marginal cost curve corresponds to the shaded triangle in figure 13.1, where the emissions reduction, ΔX^G, is the reduction in fuel use times emissions per gallon. For electricity, the area under the marginal cost curve corresponds to the sum of the shaded areas in figure 13.2, where the emissions reduction, ΔX^E, reflects both reduced electricity consumption and reduced carbon intensity of generation. Finally, the other curve in figure 13.3 reflects the combined marginal cost of reducing energy-related CO_2 from other emissions sources (e.g., nonhighway transportation fuels and direct fuel combustion by industry and households), which are reduced by ΔX^O.

For the purposes of this discussion, we assume, based loosely on Krupnick et al. (2010), that 60 percent of the economy-wide reductions from emissions pricing in the United States would come from fuel switching in the power sector, 20 percent from reductions in electricity demand, and 10 percent each from reduced gasoline use and other sources. These assumptions imply, for example, that $\Delta X^E/\Delta X = 0.8$.

Figure 13.3
Economy-Wide Costs of Emissions Pricing Without Tax Distortions



Emissions reductions from automobiles are small relative to those in the power sector for three main reasons. First is the relatively modest impact of carbon pricing on transportation fuel prices. For example, in Krupnick et al. (2010), a \$30 price on CO_2 increases coal prices by around 150 percent, but increases retail gasoline prices by less than 10 percent. Second, there is a lack of widely available and commercially viable alternatives to traditional transportation fuels, while in the power sector coal can be replaced by natural gas, renewables, and nuclear. Third, higher gasoline prices have a limited impact on encouraging future adoption of fuel-saving technologies, given that manufacturers will already be adopting many of these technologies to meet rapidly rising fuel economy standards out to 2016.

COSTS OF OTHER POLICIES

For our purposes, we take all the marginal cost curves as linear over the relevant range, which should be a reasonable ballpark assumption for the scale of emissions reductions considered here.

Rather than pricing economy-wide emissions, suppose the emissions reduction ΔX were to be obtained by a carbon policy applied to emissions from the power sector only (for example, in a downstream program pricing emissions at the point of fuel combustion). In this case, the cost of the policy is given by the relevant area under the “marginal cost, electricity sector” curve in figure 13.3, integrated out to ΔX. By similar triangles, the cost of this policy would be $\Delta X/\Delta X^E =$

1.25 times the cost of the economy-wide pricing policy. The cost markup reflects the inefficiency of the policy, as it places too much of the burden of reduction on the power sector, while failing to exploit any reductions from other sectors, relative to the economy-wide pricing policy.

Alternatively, consider an emissions standard for the power sector where all generators are subject to a maximum allowable rate of CO_2 per kilowatt-hour (kWh). This is similar to the clean energy standard now under serious consideration as an alternative to cap and trade in the United States (Palmer, Sweeney, and Allaire 2010). Also suppose that the regulation is "smart," in terms of allowing full trading of compliance credits. Thus, generators with a high-carbon-intensity fuel mix will purchase credits from generators with a low-carbon-intensity fuel mix. This is probably reasonable, given that cost advantages of credit-trading provisions are now widely recognized and were incorporated, for example, in recent changes to automobile fuel economy regulations.

The emissions standard promotes fuel switching in the same way that a carbon-pricing policy does. However, it avoids a large transfer of tax revenues to the government, or the creation of allowance rent, which is the main cause of higher electricity prices and reduced electricity demand under a carbon tax or cap-and-trade system (see figure 13.2). Firms simply have to lower their average emissions rate without having to pay taxes on, or buy allowances to cover, their remaining emissions. Assuming the policy has a minor impact on electricity demand, and following the same logic as above, the cost of reducing emissions by ΔX under this policy would be $1/0.6 = 1.67$ times the cost of the economy-wide pricing policy. The added cost here reflects the failure to exploit emissions reductions from reduced electricity demand, as well as reductions outside the power sector.

Naturally, a policy that targeted reductions from the automobile sector only would be dramatically more costly in our framework. For example, a gasoline tax that reduced emissions by ΔX would be $1/0.1 = 10$ times as costly as the emissions pricing policy. A fuel economy standard would be even more costly as, unlike a fuel tax, it does not encourage people to drive less. (In fact, it slightly reduces, rather than increases, fuel costs per mile.)

In short, the discussion so far has underscored the traditional case for using economy-wide (rather than sector-specific) and pricing (rather than regulatory) policies to reduce CO_2 emissions.

Is there any reason not to use pricing instruments? Possibly, on practical grounds. As noted, pricing instruments can have a much larger impact on energy prices, which seems to be a key obstacle holding up cap-and-trade legislation in the United States. For example, higher energy prices pose a problem for industries competing in global markets (e.g., aluminum, steel, and cement) and impose a disproportionately large burden on low-income households. Less widely recognized perhaps is that the costs of regulatory approaches may not be that much higher than those for equivalently scaled pricing approaches, and conceivably they could be less costly, depending on how the revenues or rents from pricing policies are used. How can this be?

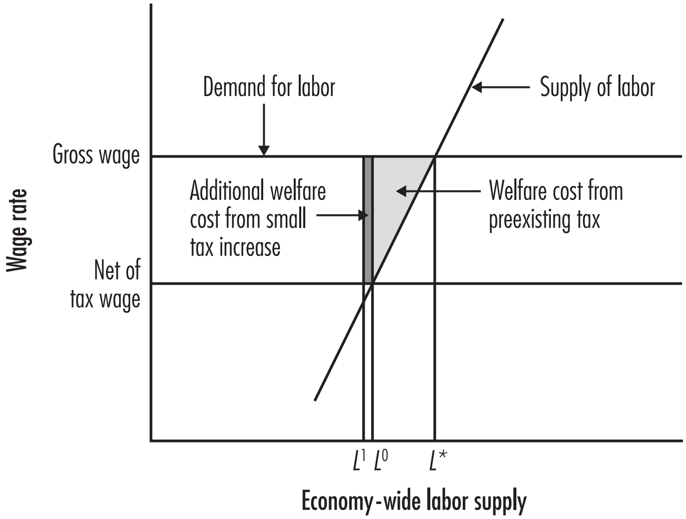
The Role of Prior Tax Distortions in the Costs of Climate Policy

In the public finance literature, it has long been recognized that the welfare cost of any new tax or regulation depends on how it affects prior distortions in the economy (Lipsey and Lancaster 1956). Harberger (1964) developed a general formula for the welfare cost, as a function of the magnitude of preexisting distortions, and the behavioral response induced by the new policy in markets affected by these other distortions. Implicit in this formula is any induced change in the supply of labor and capital at the economy-wide level, multiplied by the distortion in those factor markets created by the tax system. In this section, we take a closer look at this source of welfare change, as applied to the labor market, and how it affects the overall costs of climate policies.

TAX DISTORTIONS IN THE LABOR MARKET

Figure 13.4 shows how taxes distort the labor market. According to economic theory, the height of the "demand for labor" curve reflects the extra value of production from an additional unit of labor supply. The demand curve is drawn as flat, as is consistent with the assumption that returns to scale in production are approximately constant over the longer run (Hamermesh 1986). The height of the "supply of labor" curve reflects the opportunity cost of additional work effort—that is, the value of the time given up to be in the labor force (e.g., the

Figure 13.4
Welfare Cost of Labor Taxes



value of time that could have been spent in child rearing, voluntary work, leisure, etc.). The supply curve is inelastic, though still upward sloping rather than vertical. For example, higher household wages may encourage a nonworking spouse to join the labor force rather than stay home, an older person to delay retirement, or an existing worker to put in more hours on the job.[5] The economically efficient level of the labor supply would be L^* in figure 13.4, where the value of production from additional work effort equals the marginal opportunity cost of labor supply.

In a competitive labor market, like that in the United States, the gross wage rate paid by firms (including employer payroll taxes) reflects the marginal product of labor. And the net of tax wage (the gross wage less income taxes, employer and employee payroll taxes, and taxes on consumption) reflects the opportunity cost of additional work effort. The equilibrium amount of labor supply would therefore be L^0 in figure 13.4. Thus, taxes on labor income create a welfare cost, indicated by the shaded triangle in figure 13.4, by depressing labor supply below the efficient level. (The welfare cost is the value of foregone production less the value of extra time in the nonmarket sector.)

A small increase in the labor tax will further reduce labor supply, resulting in an additional welfare cost, shown by the shaded rectangle in figure 13.4, with base equal to this reduction ($L^0 - L^1$) and height equal to the difference between the gross and net wage. This welfare cost, expressed per dollar of extra revenue raised, is known as the "marginal excess burden of (labor) taxation."

REVENUE-RECYCLING AND TAX-INTERACTION EFFECTS

Suppose, under a carbon tax or cap-and-trade system with allowance auctions, that all of the tax revenues raised are used to reduce labor income taxes. The resulting welfare gain, termed the "revenue-recycling effect," will equal the amount of carbon tax revenue times the marginal excess burden of labor taxes.

At the same time, as the emissions price is passed forward into the price of fuels, electricity, and ultimately goods in general, this will cause a (slight) reduction in the real household wage. This reduces the real return to work effort in the same way that a direct tax on labor earnings does and will cause a slight reduction in labor supply. The welfare cost from this labor supply reduction is termed the "tax-interaction effect."

Under the assumption that the broad range of goods whose prices rise in response to carbon policy are as a group an average substitute for leisure, the tax-interaction effect exceeds the revenue-recycling effect (Goulder 1995). As a result, the costs of carbon taxes or cap-and-trade systems with auctioned allowances are somewhat higher on net, due to interactions with preexisting tax

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[5] If we defined labor supply more broadly to include effective productivity on the job, the upward-sloping curve would also reflect increased effort on the job in response to higher rewards for working and, over the longer run, increased investment in human capital and other skills.

distortions. A typical estimate is that the net effect increases the welfare cost of a carbon tax by 15–25 percent.[6]

More generally, carbon taxes also interact with distortions created by taxes in savings and investment. These taxes tend to depress the overall level of capital accumulation below levels that would otherwise maximize economic efficiency. In general, analytical and numerical investigations that capture linkages between carbon taxes and tax distortions in both labor and capital markets produce findings broadly similar to those of simpler models with only the labor market distortion.[7]

One further complication is that in the United States (though less so in other countries), the tax system creates important distortions in the pattern of spending, in addition to distorting factor markets. These additional distortions arise through tax exemptions and deductions for employer-provided medical insurance, home ownership, and other tax-preferred items. As a result, the tax system creates an excessive amount of spending on these tax-preferred items and too little spending on ordinary (non-tax-favored) goods (Saez, Slemrod, and Giertz 2009).

With these broader tax distortions, the revenue-recycling effect is greater, because income tax reductions lead to welfare gains from curbing excessive spending on tax-preferred goods, in addition to welfare gains in factor markets. In contrast, the tax-interaction effect is largely unaffected by tax preferences. Higher energy prices induce little substitution between tax-favored and non-tax-favored consumption, given that the energy intensity of these product categories is broadly similar. Consequently, up to a point the costs of carbon taxes/allowance auctions can be very low, or even negative, because the larger revenue-recycling effect now exceeds the tax-interaction effect (Parry and Bento 2000).[8]

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[6] See, for example, Bovenberg and de Mooij (1994), Bovenberg and Goulder (2002), Bovenberg and van der Ploeg (1994), and Parry (1995). For further discussions that are broadly consistent with the conclusions here, see Ballard, Goddeeris, and Kim (2005), Bento and Jacobsen (2003), Bye and Nyborg (2003), Fullerton (1997), Fullerton and Metcalf (2001), and Schöb (1997).

[7] See, for example, Bovenberg and Goulder (1997). One notable point is that when carbon tax/allowance auction revenues are used to cut capital taxes only, as opposed to funding a general reduction in labor and capital taxes, the overall costs of the policy can actually be negative. This is because, according to most models, the marginal excess burden of taxes on capital is greater than that on labor. Thus, a carbon tax swap that helps to shift the overall burden of taxation away from capital can reduce the welfare costs of the preexisting tax system. Recycling revenues in this way, however, likely runs counter to distributional concerns, given the disproportionately large concentration of capital among higher-income groups.

[8] A cautionary note here is that tax preferences are assumed to be fully distortionary, rather than addressing some market failure. In principle, for example, there might be some externality benefits within the community from tax incentives for promoting home ownership if people take better care of their homes. However, there are also counteracting effects, such as loss of open space and increased congestion from encouraging urban sprawl. And our sense

Table 13.1
Estimated Welfare Cost of CO_2 Reductions in 2020 Accounting for Prior Tax Distortions (%)

Policy Instrument	**Emissions Pricing with Revenue Recycling**			**Emissions Pricing Without Revenue Recycling**			**Emissions Rate Standard for Power Sector**		
Emissions Reduction	**5**	**10**	**15**	**5**	**10**	**15**	**5**	**10**	**15**
Components of welfare cost (billions of dollars)									
Cost in energy markets	2.3	9.0	20.3	2.3	9.0	20.3	3.8	15.0	33.8
Revenue-recycling effect	–21.5	–40.7	–57.7	0	0	0	0	0	0
Tax-interaction effect	13.6	27.2	40.9	13.6	27.2	40.9	0.6	2.3	5.1
Total	–5.6	–4.5	3.5	15.9	36.2	61.2	4.4	17.3	38.9

Source: Authors' calculations based on Goulder et al. (1999), Krupnick et al. (2010), and Parry and Williams (2010).

This point is underscored in the first set of columns in table 13.1, which is pulled together from other studies and our own calculations. The table shows estimates of the annual costs of reducing energy-related CO_2 emissions by 5, 10, and 15 percent in 2020 below an assumed baseline of 6 billion tons for that year (figures are in current dollars). Recent U.S. climate bills would have reduced emissions by just less than 10 percent, according to Krupnick et al. (2010).[9] The cost of a 10 percent reduction in emissions in energy markets under pricing policies—corresponding to the area under the "marginal cost, economy-wide" curve in figure 13.3—is $9 billion, based on an assumed emissions price of $30 per ton (Krupnick et al. 2010). Comparable costs for other abatement levels are easily inferred assuming linear marginal cost curves.

The main point here is that, based on estimates from Parry and Williams (2010), the revenue-recycling effect dominates the tax-interaction effect for the emissions reductions considered. As a result, overall policy costs are negative for emissions reductions of 5 and 10 percent, and even for the 15 percent reduction,

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from health economists is that tax preferences for employer-provided medical insurance are more of a historical accident than a benevolent effort to address market failures in health care provision.

[9] Target reductions in greenhouse gases were larger (17 percent below 2005 levels by 2020), but a substantial portion of these reductions was projected to come from domestic and international emissions offset programs.

overall costs are 83 percent lower than the cost in energy markets alone (see table 13.1).

COSTS OF OTHER POLICY INSTRUMENTS

An even more striking implication for the costs of climate policy is the difference between emissions pricing instruments that do not exploit the revenue-recycling benefit versus those that do exploit this effect. An example of the former policy would be "cap and dividend," where allowances are auctioned but revenues are returned to households in lump-sum cash transfers (or similarly under a carbon tax with revenues returned in the same fashion). Lump-sum transfers do not increase the return from participating in the labor force versus staying at home, or the return on savings and investment relative to current consumption, nor do they alter incentives to exploit deductions, exemptions, and other tax loopholes. Another example would be a cap-and-trade system with free allowance allocation to the private sector, where any indirect revenue sources (from the taxation of allowance rents) are not used to improve economic efficiency.

According to the estimates in table 13.1, the costs of the emissions pricing policy without the revenue-recycling effect are \$21.5, \$40.7, and \$57.7 billion more—for emissions reductions of 5, 10, and 15 percent, respectively—than under a comparable policy that exploits the revenue-recycling effect.

What about regulatory approaches? These policies (as typically designed) cannot generate the revenue-recycling effect because they do not involve government allocation of credits (firms create and trade any credits among themselves). However, the tax-interaction effect is also much weaker under these policies because they have a much weaker effect on energy prices (there are no tax revenues or allowance rents to be passed forward). This admits the possibility that regulatory approaches may actually be more cost-effective than market-based instruments with no revenue-recycling benefit. This will be the case if the smaller tax-interaction effect under regulatory approaches more than compensates for their higher costs in energy markets. In fact, according to our calculations in table 13.1, this applies to the CO_2 emissions standard for the power sector. The overall costs of this policy are well below those for the emissions pricing policy with no revenue-recycling benefit, at least for the illustrated level of emissions reductions.

BROADER USES OF REVENUES

It is difficult to make general statements about the welfare consequences of broader uses of climate policy revenues. If revenues are used to fund additional public spending, we would need estimates of the costs and benefits of that specific spending to assess the welfare effects. Even if revenues are used to pay down the federal deficit, this may lead to welfare gains through lowering the future burden of distortionary taxes, or it may instead result in higher future spending, with opaque welfare implications. Alternatively, revenues might be used for program-enhancing measures, such as subsidies to develop carbon capture and storage or other clean energy technologies, or for energy conservation programs. We would need some quantitative sense of the magnitude of possible market failures (e.g., technology spillovers) in order to estimate the welfare effects of this type of spending.

In sum, the best way to ensure that new revenues are used to enhance economic efficiency is to include revenue neutrality provisions in climate policy legislation. These provisions would specify automatic offsetting reductions in other distortionary taxes.

HOW RELIABLE ARE THE COST ESTIMATES?

Several critiques might be leveled at the cost adjustments for fiscal interactions. One is that there is considerable variation in empirical estimates of labor supply elasticities (Blundell and MaCurdy 1999, tables 13.1 and 13.2), and therefore uncertainty about the magnitude of the revenue-recycling and tax-interaction effects (although the uncertainty is reduced somewhat when averages are taken over male and female workers, as well as hours worked and participation margins, to obtain economy-wide responses). One counterargument to this is that there is always uncertainty over the parameters of a model. The environmental tax literature chooses what appear to be plausible mid-range values for labor supply responses and then indicates the sensitivity of results to alternative assumptions.

Nonetheless, it is fair to say that we have less confidence in the magnitude of the tax-interaction effect than in the magnitude of the revenue-recycling effect, as the former depends on a more complex chain of indirect effects—emissions prices to energy prices to the general price level to real wages to factor supply. For example, the tax-interaction effect will be weaker if CO_2 prices are not fully passed forward into energy prices, which is possible if they are partly borne by inframarginal rents earned on sunk capital investments in (baseload) coal generation plants.

Another valid point is that the magnitude of fiscal interactions, relative to the costs of policies in energy markets, declines as the extent of abatement increases (this can be seen in table 13.1). The tax-interaction effect, for example, is a “rectangular” welfare cost that increases approximately in proportion to the level of abatement, while welfare costs in energy markets are “triangular” and increase approximately with the square of the abatement level. Presumably, the level of CO_2 abatement will steadily increase as climate policy evolves over time, which would progressively reduce the relative cost disadvantage of emissions pricing policies with no revenue-recycling effect.

Conclusions

It is not possible to make sweeping statements about the superiority of carbon taxes versus cap and trade, nor of market-based approaches versus regulatory approaches to reducing emissions, even if policy makers' only concern was cost-effectiveness. Costs depend critically on how these instruments are designed—the scale of emissions reductions; whether or not they generate the revenue-recycling effect in the case of emissions pricing approaches; and the breadth of coverage across emissions sources. More generally, the costs of regulatory approaches hinge on whether there are flexible credit-trading provisions that allow the equalization of marginal compliance costs across different firms. Instrument choice becomes even murkier when policy makers are also concerned about distributional incidence and feasibility. In short, we cannot definitively answer, either way, the question posed in the title of this chapter.

Nonetheless, a couple of broad lessons can be drawn. One is the sharp trade-off between cost and distributional objectives. From a cost-containment perspective, it is important to meet any distributional objectives with the minimal amount of required compensation. Overcompensation (through free allowance allocation or lump-sum transfers) has a high cost in terms of crowding out large gains in economic efficiency that could otherwise be obtained through revenue recycling.

Another lesson is that well-designed regulatory approaches could potentially provide a viable alternative to market-based policies, at least initially when target emissions reductions below baseline levels are not that dramatic. For one thing, it is conceivable that regulatory policies, such as a CO_2 emissions standard for the power sector, might be more cost-effective than market-based approaches (such as cap and dividend) that for political or other reasons are unable to exploit the revenue-recycling effect. The prospects for regulatory approaches to be relatively cost-effective are greater, the less ambitious the economy-wide targets for CO_2 reductions are; the more they are able to mimic behavioral responses that would be forthcoming under emissions pricing; and the more flexible they are in terms of allowing credit trading. From a political, though not a cost-effectiveness, perspective, the other attraction of broad-based, flexible regulatory approaches is that they avoid large increases in energy prices, which appear at present to be a roadblock for cap-and-trade policy in the United States.

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