ECONOMIC AND BUDGET ISSUE BRIEF

CBO

*A series of issue summaries from the Congressional Budget Office*

APRIL 25, 2007

# Trade-Offs in Allocating Allowances for $CO_2$ Emissions

## Overview

In light of scientific evidence about the potential damages from climate change, the Congress is considering legislation that would impose a "cap-and-trade" program to reduce U.S. emissions of greenhouse gases, including carbon dioxide ($CO_2$) from the burning of coal, oil, and natural gas. The merit of a cap-and-trade program is that, like a tax on $CO_2$ emissions, it could motivate businesses and households to reduce emissions in the least costly way. Such programs have been used successfully in the United States to limit the cost of reducing emissions of other air pollutants, such as lead in gasoline and nitrogen oxides and sulfur dioxide from electricity generators.

Under a cap-and-trade program for carbon dioxide emissions, policymakers would set a limit on the total amount of $CO_2$ that could be emitted in a given period—the "cap"—and would issue rights, or allowances, corresponding to that level of emissions. Entities that were subject to the cap (such as coal mines, oil importers, refineries, or electric utilities, depending on the proposal) would be required to hold allowances for their $CO_2$ emissions. After the allowances were initially distributed, entities would be free to buy and sell them—the "trade" part of the program—and the price of allowances would adjust to reflect the cost of meeting the emission cap.

This brief examines how policymakers' decisions about allocating the allowances would affect the total cost of the policy to the U.S. economy, as well as the distribution of that cost among households in their various roles as workers, consumers, and investors. Although cap-and-trade programs could cover all greenhouse gases, this brief focuses on a program for $CO_2$ emissions.

By capping those emissions, policymakers would create a new commodity: the right to emit carbon dioxide. The emission allowances (each of which would represent the right to emit, say, 1 ton of $CO_2$) would have substantial value—perhaps totaling tens of billions or even hundreds of billions of dollars per year. Who received that value would depend on how the allowances were allocated.

One option would be to have the government capture their value by selling the emission allowances, as it does for licenses to use the electromagnetic spectrum. Another possibility would be to give the allowances to energy producers or some energy users at no charge—the approach that the U.S. government adopted in the sulfur dioxide program and that the European Union has used since 2005 in its cap-and-trade program for $CO_2$ emissions.

Regardless of how the allowances were distributed, most of the cost of meeting a cap on $CO_2$ emissions would be borne by consumers, who would face persistently higher prices for products such as electricity and gasoline. Those price increases would be regressive in that poorer households would bear a larger burden relative to their income than wealthier households would. In addition, workers and investors in parts of the energy sector—such as the coal industry—and in various energy-intensive industries would be likely to experience losses as the economy adjusted to the emission cap and production of those industries' goods declined. Such losses would probably be limited to current workers and investors. Job losses in those industries would be likely to impose a fairly large burden on a relatively small number of households;

This brief was prepared by Terry Dinan and is based on various CBO publications, including *Shifting the Cost Burden of a Carbon Cap-and-Trade Program* (July 2003), *An Evaluation of Cap-and-Trade Programs for Reducing U.S. Carbon Emissions* (June 2001), and *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000). Those and other reports about policy choices associated with climate change are available on CBO's Web site at www.cbo.gov/publications/collections/climatechange.cfm.

Peter R. Orszag
Director

**Table 1.**

## Annual Increase in Households' Costs from a 15 Percent Cut in Carbon Dioxide Emissions

| | Average for Income Quintile | | | | |
|---|---|---|---|---|---|
| | Lowest | Second | Middle | Fourth | Highest |
| Cost Increase in 2000 Dollars | 560 | 730 | 960 | 1,240 | 1,800 |
| Cost Increase as a Percentage of Income[a] | 3.3 | 2.9 | 2.8 | 2.7 | 1.7 |

Source: Congressional Budget Office.

Note: These numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, the numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than as precise estimates.

CBO assumed that the full cost of cutting emissions would be passed along to consumers in the form of higher prices and that the price increase for a given product would be proportional to the amount of carbon dioxide emitted from the fossil fuels used in its production.

a. The cost increases are equivalent to percentage declines in households' after-tax income.

investors' losses, by contrast, would tend to impose a smaller burden on a much larger number of households (because, typically, investors hold diversified portfolios).

In allocating allowances, policymakers would face a trade-off between reducing the overall cost of the emission cap to the economy or reducing specific sectors' or households' economic burdens. Selling the allowances and using the proceeds either to cut taxes on earnings from labor or capital or to decrease the budget deficit would strengthen the economy and substantially lessen the total economic cost of the cap-and-trade policy. Depending on the stringency of the cap and the type of tax cut, such an approach could reduce the economywide cost by roughly 50 percent, or perhaps substantially more, some researchers suggest. However, it would not significantly mitigate the costs imposed on certain firms or workers or on low-income households.

An alternative approach of giving away allowances (or the proceeds from selling allowances) to certain parties would lower their costs, but at the expense of missing the opportunity to greatly reduce the total cost to the economy. Because most of the cost of the cap would ultimately be borne by consumers, giving away nearly all of the allowances to affected energy producers would mean that the value of the allowances they received would far exceed the costs they would bear. As a result, that allocation strategy would increase producers' profits without lessening consumers' costs. In essence, such a strategy would transfer income from energy consumers—among whom lower-income households would bear disproportionately large burdens—to shareholders of energy companies, who are disproportionately higher-income households.

In the face of those trade-offs, policymakers would not have to distribute all of the allowances in the same way. For instance, they could give a limited amount to producers for free and sell the rest. The free distribution could be phased out over time, since existing shareholders would incur losses but future shareholders would not.

## Where Would Costs Be Felt Under a Cap-and-Trade Program?

A cap on U.S. carbon dioxide emissions would impose costs on the economy by restricting the use of fossil fuels—particularly coal, which has the highest carbon content. Profits and employment would decline for some existing fossil-fuel suppliers. In addition, the restriction would raise fossil-fuel prices and increase production costs for firms that rely heavily on those fuels, creating an incentive for them to decrease their use of fossil fuels. Consumers, in turn, would face higher prices for energy and for goods and services that require substantial amounts of energy to produce, which would give them an incentive to reduce their consumption as well.

Besides imposing costs on the economy, a cap-and-trade program would transfer income from some people to others. The right to emit $CO_2$ would become valuable, with the value depending on how low the cap on total emissions was set and how costly regulated entities found it to reduce their emissions. A review of the existing literature and of the range of $CO_2$ policies now being debated suggests that the value of emission allowances might total between $50 billion and $300 billion per year (in 2007 dollars) by 2020. The actual value would depend on various factors, including the stringency of the cap, the possibility of offsetting $CO_2$ emissions through carbon

sequestration or international trading, and other features of the specific policy selected.[1]

If policymakers chose to sell allowances, such as through an auction, the government would capture that value. If they opted to give allowances away to firms that produce or use energy, recipients could sell them for income or use the allowances themselves. Obtaining allowances (or taking steps to reduce emissions) would become a cost of doing business for firms that were subject to the cap. However, those firms would not ultimately bear the bulk of the cost of the allowances: The ultimate distribution of that cost would be determined by market forces.[2]

## Consumers Would Be Likely to Bear Most of the Cost Burden

Researchers conclude that much or all of the allowance cost would be passed on to consumers in the form of higher prices.[3] Those price increases would disproportionately affect people at the bottom of the income scale. For example, the Congressional Budget Office (CBO) estimated that the price rises resulting from a 15 percent cut in $CO_2$ emissions would cost the average household in the lowest one-fifth (quintile) of the income distribution about 3.3 percent of its average income. By comparison, a household in the top quintile would pay about 1.7 percent of its average income (see Table 1).[4] That regressivity occurs because lower-income households tend to spend a larger fraction of their income than wealthier households do and because energy products account for a bigger share of their spending. The price increases resulting from a cap on $CO_2$ emissions would persist as long as the cap remained in place, affecting both current and future consumers.

## Producers and Workers Would Bear Transitional Costs

As some parts of the energy sector and various energy-intensive industries adjusted to a decline in demand for their goods, current workers and investors in those industries would experience costs in the form of lower wages, job losses, and reduced stock values. Over time, as workers and investors left those industries, wages and stock values would tend to return to their initial levels. Thus, investors and workers who entered those industries after the policy took effect (or was anticipated) would not experience such losses. Policymakers could limit the costs facing current investors and workers by announcing the emission cap well in advance or by phasing the policy in gradually, giving people more time to adapt.

**Producers' Losses.** Over the long term, producers in industries with high $CO_2$ emissions would adjust to lower levels of demand by leaving the industry or by expanding less. In the near term, however, expectations about earnings on existing capital in those sectors would fall, resulting in losses to shareholders and owners. One study concluded that a cap that cut carbon emissions by 23 percent would lower stock values by 54 percent for companies in the coal sector, by 20 percent for firms in the oil and natural gas sector, and by roughly 4 percent for electric and natural gas utilities.[5]

Although those declines are large in percentage terms, in dollar terms they are modest compared with the total value of the allowances and with the total allowance costs that would be borne by consumers (discussed below). Furthermore, stock losses in affected industries would tend to be widely dispersed among investors, because shareholders typically have diversified portfolios.

1. "Sequestration" refers to the capture and long-term storage of $CO_2$ emissions. For example, emissions could be captured from smokestacks and stored in the ground (geological sequestration) or absorbed by and stored within trees (biological sequestration).

2. The distribution of costs would be largely similar whether the requirement to hold emission allowances was placed "upstream" (on fossil-fuel suppliers) or "downstream" (on users). See Congressional Budget Office, *Issues in the Design of a Cap-and-Trade Program for Carbon Emissions* (November 25, 2003).

3. A survey of economic models suggests that if a cap was announced 10 years in advance, consumers would initially bear between 94 percent and 96 percent of the allowance costs. See Mark Lasky, *The Economic Costs of Reducing Emissions of Greenhouse Gases: A Survey of Economic Models,* CBO Technical Paper 2004-4 (May 2003).

4. See Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading? The Distributional Effects of Alternative Policy Designs* (June 2000). That analysis assumed that all of the costs of the cap would be passed on to consumers in the form of higher prices. The degree of regressivity would be smaller if some of the costs were absorbed by shareholders in affected industries or if the costs were compared with lifetime measures of households' consumption and income rather than with annual measures.

5. See Lawrence H. Goulder, *Mitigating the Adverse Impacts of $CO_2$ Abatement Policies on Energy-Intensive Industries,* Discussion Paper 02-22 (Washington, D.C.: Resources for the Future, March 2002), Table 3, available at www.rff.org/rff/documents/rff-dp-02-22.pdf.

**Workers' Losses.** Any policy that reduced U.S. emissions of carbon dioxide would inevitably create costs for existing workers. Job losses could occur throughout the economy but would probably be especially large (in percentage terms) in industries associated with high-carbon fuels. For example, the study cited above estimated that a 23 percent cut in $CO_2$ emissions would cause U.S. coal production to decline by roughly 40 percent in the long run.[6] In that case, the unemployment-related costs of a $CO_2$ cap would fall disproportionately on the approximately 80,000 people who work in the coal-mining industry.[7] Unlike the costs borne by producers, which would be spread among investors, the costs borne by existing workers would probably be concentrated on relatively few households and, by extension, their communities.

### Pressure on the Federal Budget Would Increase as Well

A cap-and-trade program for $CO_2$ emissions would tend to increase government spending and decrease revenues. Like other consumers, the government would face higher prices for energy and other carbon-intensive goods and services. In addition, by leading to a decline in the production of such goods and services, the cap would cause a decline in the taxes collected on corporate profits. If the government wanted to provide the same level of services without increasing the budget deficit, it would have to either raise taxes or use part of the value of the allowances to cover the changes in federal outlays and revenues.

## Selling Allowances Could Significantly Reduce Overall Costs

Selling emission allowances could raise sizable revenues that lawmakers could use for various purposes, some of which would lower the cap's total cost to the economy. For instance, the government could use the revenues to reduce existing taxes that dampen economic activity—primarily taxes on labor, capital, or personal income, such as payroll taxes and individual or corporate income taxes. Research indicates that a $CO_2$ cap would worsen the negative effects of those taxes: The higher prices caused by the cap would lower real (inflation-adjusted) wages and real returns on capital, indirectly raising marginal tax rates on those sources of income. Using the allowance value to reduce existing taxes could help mitigate that adverse effect of the cap.

The decision about whether to sell the allowances and use the proceeds in ways that would benefit the economy could have a major impact. For example, one study estimated that a 23 percent cut in $CO_2$ emissions could cost the economy nearly twice as much if allowances were given away than if they were sold and the revenues used to cut taxes.[8] Another study found that the economywide cost of reducing emissions by 10 percent would vary by a factor of three, depending on how the allowance value was used.[9] Some researchers even suggest that relatively modest cuts in $CO_2$ emissions could provide net gains to the economy (in addition to the benefits from emitting less carbon dioxide) if the allowances were sold and the revenues used to reduce individual income taxes.[10]

Using the proceeds from allowance sales to reduce the economic cost of cutting emissions would have to compete with other aims. For example, policymakers might want to use the revenues to compensate various producers, workers, or consumers for some of the costs they would incur because of the program or devote part of the revenues to funding research and development (R&D) on technologies that could help curb the growth of $CO_2$ emissions.[11]

6. Goulder, *Mitigating the Adverse Impacts of $CO_2$ Abatement Policies on Energy-Intensive Industries,* Table 2.

7. That figure, which is for employment in the industry in 2005, comes from Department of Energy, Energy Information Administration, *Annual Coal Report 2005* (October 2006), Table 18, available at www.eia.doe.gov/cneaf/coal/page/acr/table18.html. Although many of those workers would eventually find employment elsewhere, some might not, and some might need to take lower-paying jobs.

8. See Goulder, *Mitigating the Adverse Impacts of $CO_2$ Abatement Policies on Energy-Intensive Industries.*

9. See Ian W.H. Parry, "Fiscal Interactions and the Case for Carbon Taxes," in Dieter Helm, ed., *Climate Change Policy* (New York: Oxford University Press, 2005), Figure 3. The less stringent the cap, the larger would be the economic consequences of the decision about how to use the allowance value.

10. See Ian W.H. Parry and Antonio M. Bento, "Tax Deductions, Environmental Policy, and the 'Double Dividend' Hypothesis," *Journal of Environmental Economics and Management,* vol. 39, no. 1 (January 2000), pp. 67-95. That conclusion takes into account the distortions that individual income taxes make in people's decisions about consumption, working, and investing.

11. Decisions about what level of R&D funding would be economically efficient rest on available information about the costs and expected payoffs of such funding and need not be tied to the specific amount of revenues raised by selling $CO_2$ allowances.

## Distributing Allowances for Free Could Compensate Some Parties

Proposals to cap carbon dioxide emissions have typically included provisions to give most of the allowances to producers in the energy sector and in energy-intensive industries, as the U.S. government has done in its cap-and-trade program for sulfur dioxide and the European Union has done in its program for $CO_2$ emissions. Free allocation is meant to compensate shareholders in those companies for any declines in stock value they might experience because of the cap. However, available evidence indicates that only a small fraction of the $CO_2$ allowances would be needed to provide such compensation under a U.S. cap-and-trade program. Researchers generally conclude that less than 15 percent of the allowance value would be necessary to offset net losses in stock values in both "upstream" industries (such as suppliers of coal, natural gas, and petroleum) and energy-intensive "downstream" industries (such as electricity generators, petroleum refiners, and metal and machinery manufacturers). The reason is that the cost of holding the allowances would generally be reflected in the prices that producers charged, regardless of whether those producers had to buy the allowances or were given them for free.[12]

A common misconception is that freely distributing emission allowances to producers would prevent consumer prices from rising as a result of the cap. Although producers would not bear out-of-pocket costs for allowances they were given, using those allowances would create an "opportunity cost" for them because it would mean forgoing the income that they could earn by selling the allowances. Producers would pass that opportunity cost on to their customers in the same way that they would pass along actual expenses.[13] That result was borne out in the cap-and-trade programs for sulfur dioxide in the United States and for $CO_2$ in Europe, where consumer prices rose even though producers were given allowances for free.

Thus, giving away allowances could yield windfall profits for the producers that received them by effectively transferring income from consumers to firms' owners and shareholders. The study of the hypothetical 23 percent cut in $CO_2$ emissions concluded, for example, that if all of the allowances were distributed for free to producers in the oil, natural gas, and coal sectors, stock values would double for oil and gas producers and increase more than sevenfold for coal producers, compared with projected values in the absence of a cap.[14]

In addition, some firms in the energy sector would benefit from a cap-and-trade program regardless of how emission allowances were allocated. For example, electricity generators that use nuclear energy or hydropower could see their profits rise as a result of the program because they would benefit from higher electricity prices but would not face higher production costs. The compensation estimate described above—less than 15 percent of the total allowance value—represents net changes in stock values for key sectors because of the cap, including both losses and gains by firms in those sectors. If policymakers wished to offset the losses experienced by individual firms in a sector without taking into account offsetting gains by other firms, additional compensation would be necessary.[15] However, estimating firm-level losses would be considerably more difficult than estimating the overall change in stock values for a sector as a whole.

12. See, for example, Goulder, *Mitigating the Adverse Impacts of $CO_2$ Abatement Policies on Energy-Intensive Industries;* and Anne E. Smith, Martin T. Ross, and W. David Montgomery, *Implications of Trading Implementation Design for Equity–Efficiency Trade-Offs in Carbon Permit Allocations,* working paper (Boston: Charles River Associates, December 2002). The estimate of less than 15 percent assumes that firms would receive compensation in the form of a permanent stream of free allowances. Smith, Ross, and Montgomery demonstrate that the share would have to be much larger in the initial years of a cap-and-trade program if firms were to be compensated for their losses over a shorter period.

13. One exception is if allowances were given to electricity generators whose rates were set by regulators. In that case, regulators might prevent generators from passing the opportunity cost of holding an allowance along to consumers. For a discussion of that issue, see Congressional Budget Office, *Shifting the Cost Burden of a Carbon Cap-and-Trade Program* (July 2003).

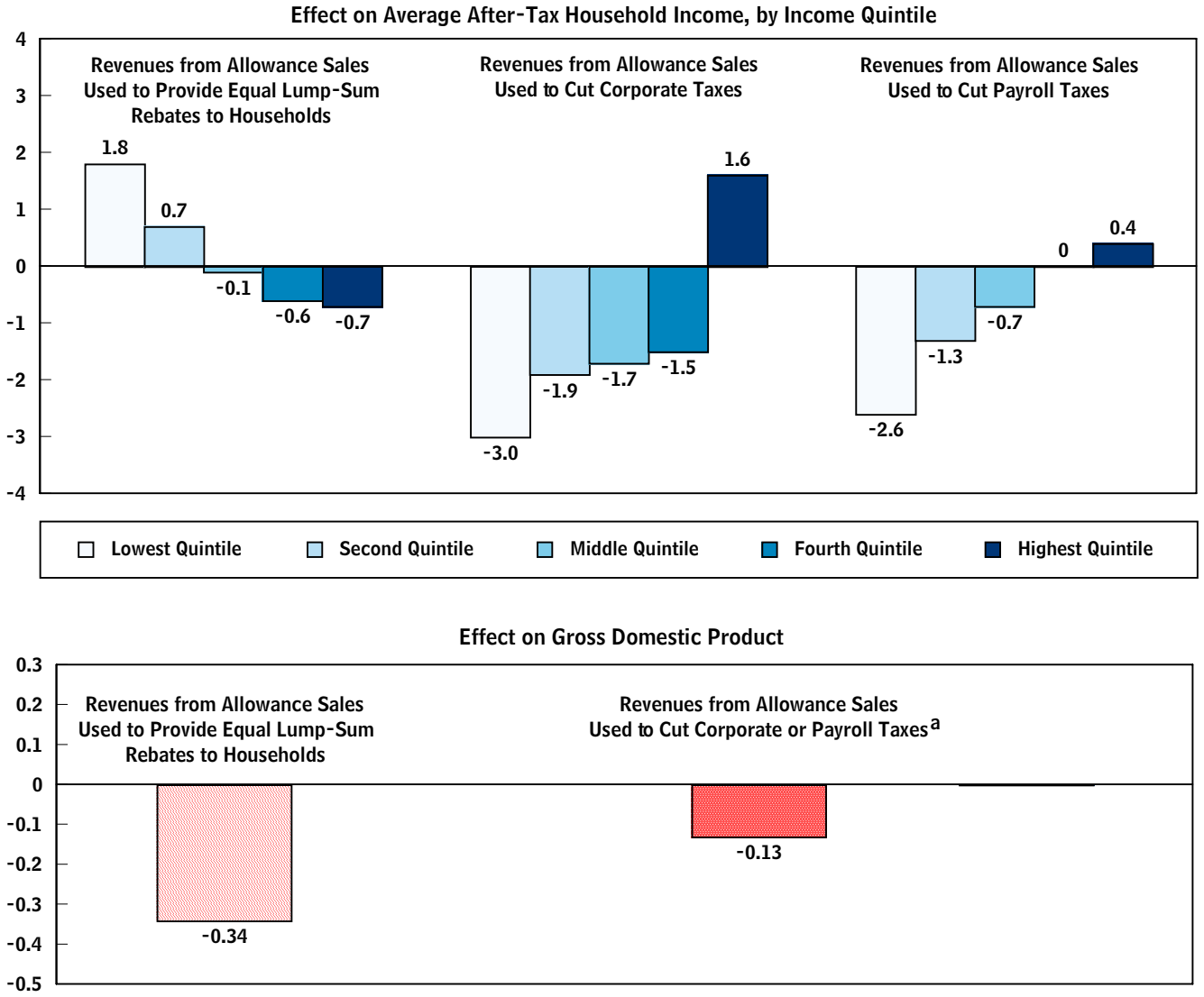
14. See Goulder, *Mitigating the Adverse Impacts of $CO_2$ Abatement Policies on Energy-Intensive Industries,* Table 3.

15. A study that examined a proposed regional cap on greenhouse-gas emissions from electricity generators in the northeastern United States concluded that the total profits of generators affected by the policy would actually rise. Thus, sector-level measures would suggest no need for compensation. But the study also concluded that fully compensating the firms that would experience losses (ignoring the firms that would earn higher profits because of the cap) would require roughly one-third of the total value of the allowances. See Karen Palmer, Dallas Burtraw, and Danny Kahn, "Simple Rules for Targeting $CO_2$ Allowance Allocations to Compensate Firms," *Climate Policy,* vol. 6, no. 4 (2006), pp. 477-493.

**Figure 1.**

## Effects on Household Income and GDP from a 15 Percent Cut in $CO_2$ Emissions in 2010, with Allowances Sold and the Revenues Used in Alternative Ways

(Percentage change)




Sources: Congressional Budget Office (top panel); Terry M. Dinan and Diane Lim Rogers (bottom panel), "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal,* vol. 55, no. 2 (June 2002).

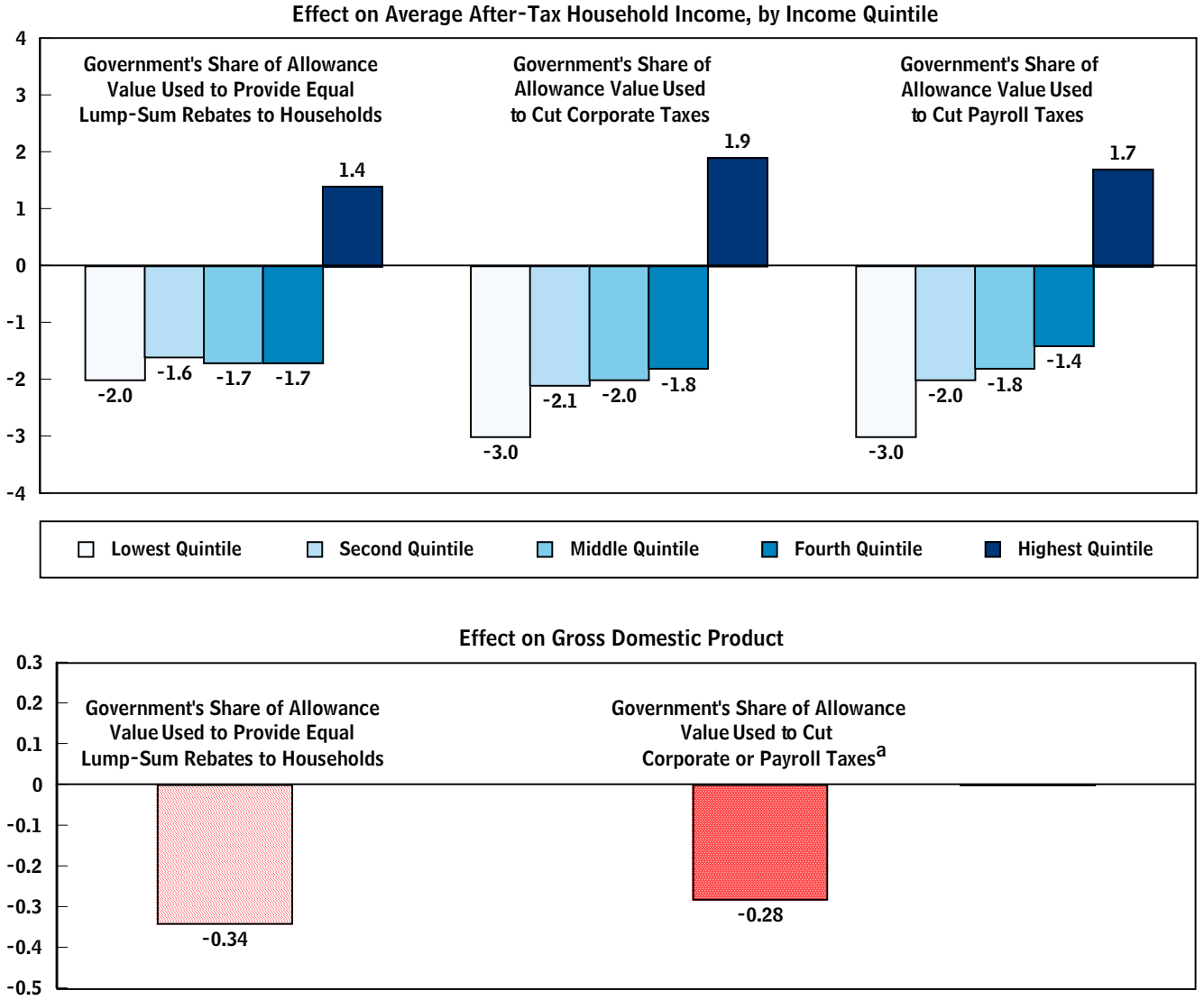
Note: The policy examined in this figure is a cap-and-trade program designed to reduce carbon dioxide ($CO_2$) emissions by 15 percent in 2010. In the top panel, the program's costs are shown as decreases in household income, measured as a percentage of after-tax income before the policy change. Those numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, those numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than as precise estimates.

a. This estimate by Dinan and Rogers does not distinguish between the gains in economic efficiency associated with reducing corporate taxes and the gains associated with reducing payroll taxes. It implicitly assumes that capital and labor respond similarly to changes in the taxes on them and that increases in marginal tax rates on capital and labor have similar costs to the economy.

**Figure 2.**

## Effects on Household Income and GDP from a 15 Percent Cut in $CO_2$ Emissions in 2010, with Allowances Given Away and the Government's Share of Their Value Used in Alternative Ways

(Percentage change)




Sources: Congressional Budget Office (top panel); Terry M. Dinan and Diane Lim Rogers (bottom panel), "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal,* vol. 55, no. 2 (June 2002).

Note: The policy examined in this figure is a cap-and-trade program designed to reduce carbon dioxide ($CO_2$) emissions by 15 percent in 2010. The government is assumed to distribute emission allowances for free but to regain some of their value by taxing the additional corporate profits resulting from free distribution. In the top panel, the program's costs are shown as decreases in household income, measured as a percentage of after-tax income before the policy change. Those numbers reflect data on each quintile's cash consumption and estimates of cash income. (A quintile contains one-fifth of U.S. households arrayed by income.) Because of data limitations, those numbers should be viewed as illustrative and broadly supportive of the conclusions in this analysis rather than precise estimates.

a. This estimate by Dinan and Rogers does not distinguish between the gains in economic efficiency associated with reducing corporate taxes and the gains associated with reducing payroll taxes. It implicitly assumes that capital and labor respond similarly to changes in the taxes on them and that increases in marginal tax rates on capital and labor have similar costs to the economy.

## Fairness and Efficiency Implications of Different Allocation Strategies

Policymakers' decisions about how to allocate allowances could either offset or intensify the regressive effects of the price increases caused by a cap (shown in Table 1), as well as alter the cap's total cost to the economy. CBO has examined the ultimate distributional effects of a cap-and-trade program that would reduce U.S. $CO_2$ emissions by 15 percent in 2010, including the impact of the initial price increases and the allowance allocation.[16] That analysis considered a few illustrative ways in which policymakers might allocate allowances and use any revenues they received because of the program. (The results of the analysis, which are described below, focus solely on the cost of the cap-and-trade mechanism and how the value of the allowances is allocated; they do not incorporate the potential benefits of reducing emissions and thus mitigating the economic and environmental costs associated with global climate change.)

In one scenario, CBO assumed that policymakers would sell the allowances and use the resulting revenues to pay all households an equal lump-sum rebate. Such a strategy would increase average income for households in the lowest quintile by 1.8 percent in 2010, CBO estimated, while decreasing average income for households in the highest quintile by 0.7 percent (see the top panel of Figure 1 on page 6). However, because it would not use any of the allowance value to lower existing tax rates, that approach would not reduce the net economic cost of the $CO_2$ cap. In a follow-up paper based on CBO's analysis, researchers concluded that such a strategy would decrease gross domestic product (GDP) in 2010 by more than 0.3 percent (see the bottom panel of Figure 1).[17]

In contrast, if the government sold allowances and used the revenues to cut corporate taxes, the program would have a more regressive effect than the cap-induced price increases alone, lowering the average income of households in the bottom quintile by 3.0 percent but raising the average income of households in the top quintile by 1.6 percent. However, such a strategy would reduce the loss in GDP by roughly 62 percent compared with devoting the revenues to lump-sum rebates, researchers estimate. Using the revenues to cut payroll taxes rather than corporate taxes would be less regressive, but researchers suggest that it could produce a similar reduction in the economywide cost of the program.

Freely distributing all of the allowances to producers would be likely to increase profits and ultimately benefit shareholders, although the government would regain part of the allowance value through taxes on higher profits. Giving away all of the allowances and using the government's regained share of their value to reduce corporate tax rates would be the most regressive of the strategies that CBO examined. In that scenario, average household income would fall by 3.0 percent for the lowest quintile and rise by 1.9 percent for the highest quintile (see the top panel of Figure 2 on page 7). The free-distribution strategy would be regressive even if the government used its portion of the allowance value to make lump-sum payments to households. That combination of policies would also reduce GDP by more than 0.3 percent in 2010, researchers suggest (see the bottom panel of Figure 2). That net cost would be 18 percent less, however, if the government used its share of the allowance value to cut corporate or payroll taxes.[18]

Those examples show some of the trade-offs that policymakers would face in deciding how to allocate emission allowances. Strategies that reduced net economic costs would often disproportionately benefit higher-income households, whereas the costs of the cap would tend to fall disproportionately on lower-income households. Giving allowances to energy producers could generate windfall profits and would forgo using the allowance value to offset the regressivity of the cap-induced price increases, provide compensation for dislocated workers, or reduce total costs to the economy. If policymakers opted to give some of the allowances to producers to compensate them for lower returns on existing capital, such allocations could be phased out over time, because producers' losses (unlike those of consumers) would mostly be transitional.

16. Congressional Budget Office, *Who Gains and Who Pays Under Carbon-Allowance Trading?*

17. Terry M. Dinan and Diane Lim Rogers, "Distributional Effects of Carbon Allowance Trading: How Government Decisions Determine Winners and Losers," *National Tax Journal,* vol. 55, no. 2 (June 2002).

18. A more recent study reached conclusions that were consistent with CBO's analysis. See Ian W.H. Parry, "Are Emissions Permits Regressive?" *Journal of Environmental Economics and Management,* vol. 47, no. 2 (March 2004), pp. 364-387.