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# KEEPING THE GOVERNMENT WHOLE:

## The Impact of a Cap-and-Dividend Policy for Curbing Global Warming on Government Revenue and Expenditure

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**ABSTRACT**

*When the United States puts a cap on carbon emissions as part of the effort to address the problem of global climate change, this will increase the prices of fossil fuels, significantly impacting not only consumers but also local, state, and federal governments. Consumers can be "made whole," in the sense that whatever amount the public pays in higher fuel prices is recycled to the public, by means of a cap-and-dividend policy: individual households will come out ahead or behind in monetary terms depending on whether they consume above-average or below-average amounts of carbon. In this paper, we consider policy options for "keeping the government whole," too; that is, policies to ensure that additional revenues to government compensate adequately for the additional costs to government as a result of the carbon cap. We compare the distributional impacts of two policy alternatives: (i) setting aside a portion of the revenue from carbon permit auctions for government, and distributing the remainder of the revenue to the public in the form of tax-free dividends; or (ii) distributing all of the carbon revenue to households as taxable dividends. The policy of recycling 100% of carbon revenue to the public as taxable dividends has the strongest progressive impact, yielding the biggest net monetary benefits for the largest majority of the people.*

Key words: Global warming; fossil fuels; climate change; carbon permits; cap-and-dividend; cap-and-auction; cap-and-trade

JEL codes: H22, H23, Q48, Q52, Q54, Q58

## INTRODUCTION

As the United States moves to craft serious policies to tackle the problem of global warming, discussion is focusing on the impacts of a cap on total emissions of carbon dioxide from burning fossil fuels. Carbon permits will be issued up to the cap, the number of permits declining over time as the cap is gradually tightened. From an administrative standpoint, the most efficient way to accomplish this is to issue the permits "upstream" to the few hundred firms that bring fossil fuels into the nation's economy at roughly 2,000 locations – oil terminals, gas pipelines, coal mines – rather than issuing downstream permits to far larger numbers of end-users.

A carbon permit system will raise the prices of fossil fuels throughout the economy, as the cap restricts their supply much as OPEC raises prices by cutting production. The effects will be felt by every household, but the price increases will hit low-income and middle-income families harder than more affluent households because they spend a higher fraction of their incomes on fuels.

To protect the real incomes of American families, and to protect the carbon cap from the political backlash that otherwise is likely to result from substantially higher prices for gasoline, heating oil and electricity, one policy option that is gaining increasing attention is a "cap-and-dividend" system in which revenues from the sale of permits are recycled to the public as equal per capita dividends. In an earlier paper, we analyzed the distributional impacts of such a policy and showed that the majority of American households would be net winners in monetary terms – receiving more in dividends than they pay in higher fuel costs – with the biggest benefits accruing to low-income families (Boyce and Riddle 2007).[1]

The price impacts of a carbon cap will be felt not only by consumers, but also by governments at the local, state, and federal levels. The prices of heating oil and coal-fired electricity will rise for schools and other public buildings, just as it will rise for homeowners. The prices of gasoline and diesel will rise for the Pentagon and other government agencies, just as it will for private citizens. To "keep the government whole" – to compensate for these higher costs and to maintain real government spending at current levels – revenues will need to grow by a corresponding amount.

*The price impacts of a carbon cap will be felt not only by consumers, but also by governments.*

In this paper, we analyze two policy options for addressing the impacts of a cap-and-dividend program on government:

- *Distribute 100% of revenue to individuals as taxable dividends:* In our calculations we assume that dividends are subject to federal and state income taxes at the same rate as ordinary income, and that dividends are spent by households and hence subject to state sales tax. We find that 24.2% of dividends (on average) would be returned to the federal and state governments under this option, an amount sufficient to keep the government whole in that it compensates for the impact of higher fossil fuel prices on government purchasing power.
- *Revenue set aside for government, coupled with tax-free dividends to individuals:* An alternative policy option is to earmark a fraction of the carbon revenue (that is, the revenue from sale of permits) for governments, rather than recycling 100% of this revenue to the public. In this option, dividends to individuals would be treated as tax-free. To facilitate comparison of the two options, we assume that the set-aside is calibrated to keep the government share of total carbon revenue the same as under the first option.

We examine the distributional impacts of both policy options by dividing the U.S. population into ten deciles, ranked from poorest to richest on the basis of per capita expenditure. As in Boyce and

[1] For further discussion of cap-and-dividend policies, see Barnes (2008), DeCanio (2008), and capanddividend.org.

Riddle (2007), our calculations are based on a permit price of $200 per ton of carbon, a price that we estimate would result from an initial cap that cuts U.S. carbon emissions by approximately 7%. We estimate that this cap and price would yield annual carbon revenues of roughly $300 billion/year.

What will happen as the carbon cap tightens in successive years, moving towards the much greater emissions reductions now endorsed by an increasing number of policy makers?[2] As the quantity of permits (and emissions) falls, their price will rise. The percentage increase in prices being larger than the percentage decrease in quantity of permits (because demand for fossil fuels is price-inelastic), total revenue will rise, too. This will increase the *magnitude* of the distributional effects reported below, but not their *pattern:* with a doubling of total carbon revenues, for example, the net benefits for low-income and middle-income households double, as do the net costs for high-income households.

## "KEEPING THE GOVERNMENT WHOLE"

What share of revenue from the sale of carbon permits would be required to keep government whole, that is, to offset the effects of the cap-and-permit policy on the balance between government expenditures and government revenues, with "government" here taken to encompass federal, state and local governments?

The most evident effect of a cap-and-dividend policy (or for that matter, of any policy that includes a cap on carbon emissions) on government is to raise the cost of government's own consumption of fossil fuels and everything that uses these fuels in its production and distribution. Table 1 presents estimates of government carbon consumption, based on government expenditure patterns and input-output data on the fossil fuel content of the various categories of expenditure.[3] Government expenditure accounted for 14.5% of the nation's "carbon footprint" in the year 2002.[4] This is close to the estimate of Dinan and Rogers (2002, p. 205), who put the government share of U.S. carbon emissions in 1998 at 13%.

State and local government accounted for 10.8% of total U.S. carbon emissions, and federal government for 3.6%. These percentages are smaller than their shares in expenditure: the carbon intensity of public expenditure is less than that of private consumption, reflecting the higher proportion of services (e.g., salaries) in the government consumption basket.[5]

In addition to the impact of increased costs due to higher fossil fuel prices, the introduction of carbon permits could have indirect impacts on the balance between government expenditure and revenue. These include increases in government transfer payments (e.g., for Social Security benefits and federal pensions) that are indexed to prices, and reduced personal income tax collections as a result of the indexing of exemptions and tax brackets. Dinan and Rogers (2002, p. 211) estimate that each of these would have impacts roughly equivalent to a further 7% of carbon revenue. If so, adding these to the direct effects of higher fuel prices on government purchasing power would mean that 28% of total carbon revenues will be needed to keep the government whole.[6]

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[2] President-elect Barack Obama, for example, has endorsed the goal of cutting U.S. emissions 80% from the 1990 level by the year 2050. In California, the same goal was established on June 1, 2005, by Governor Arnold Schwarzenegger's Executive Order S-3-05 (for this and other state-level policy targets, see Pew Center on Global Climate Change, 2008).

[3] Breakdowns of government expenditures by industrial sector are taken from 2002 benchmark input-output accounts. Carbon emissions from coal, oil and natural gas are based on Energy Information Administration data. Carbon emissions associated with each industrial sector are calculated by following the use of coal, oil, and natural gas through the economy using input-output accounts. For details on sources, see notes to Table 1.

[4] This includes emissions from government consumption, plus a fraction of emissions attributable to investment expenditure (with the fraction equal to the share of government consumption in economy-wide non-investment expenditure).

[5] Government expenditure here refers to spending on goods and services, and excludes transfer payments (such as Social Security) which constitute part of household income.

[6] Dinan and Rogers (2002) also add small impacts imputed to "deadweight losses" and the tax impact of reduced GDP growth, arriving at total net effects on government equivalent to 29.6% of carbon revenue. Both adjustments are

**TABLE 1: GOVERNMENT AND PRIVATE SHARES OF U.S. CARBON EMISSIONS (2002)**

| Sector | Share of expenditure (%) | Carbon intensity ($kgCO_2/\$$) | Share of carbon emissions (%) |
|---|---|---|---|
| **Government: Total** | 19.0 | 0.43 | 14.5 |
| Federal government | 6.5 | 0.31 | 3.6 |
| *Defense* | *4.2* | *0.31* | *2.3* |
| *Other* | *2.3* | *0.32* | *1.3* |
| State & local government | 12.5 | 0.49 | 10.8 |
| *Education* | *5.4* | *0.48* | *4.6* |
| *Other* | *7.1* | *0.50* | *6.2* |
| **Private: Total** | 72.4 | 0.57 | 73.5 |
| Household consumption | 64.6 | 0.57 | 65.7 |
| Non-profit institutions | 7.7 | 0.57 | 7.8 |
| **Exports** | 8.8 | 0.78 | 12.0 |

*Notes:* Authors' calculations. Carbon intensity computed following the input-output methodology of Metcalf (1999). Emissions from investment expenditure are allocated across sectors based on expenditure shares.

Sources:

US Bureau of Economic Analysis, "2002 Standard Make and Use Tables at the Summary Level", available at http://www.bea.gov/industry/io_benchmark.htm.

Non-profit share of household consumption taken from data cited in Garner et al. (2006).

*Additional data from the US Energy Information Administration (EIA):*

Carbon emissions: "International Energy Annual 2005" (available at http://www.eia.doe.gov/iea/carbon.html).

Crude oil consumption: "Petroleum Navigator, US Crude Oil Supply and Deposition" (available at http://tonto.eia.doe.gov/dnav/pet/pet_sum_crdsnd_adc_mbbl_a.htm).

Crude oil use by refineries: "Petroleum Navigator; Refining & Processing; Weekly Inputs, Utilization & Production" (available at http://tonto.eia.doe.gov/dnav/pet/pet_pnp_wiup_dcu_nus_w.htm).

These indirect impacts could be offset, however, by the recycling of carbon revenue to the public under a cap-and-dividend policy. Payment of equal per capita dividends acts as a substitute for indexing transfer payments in response to policy-induced fuel price increases, as both are intended to insulate households from the impact of the price increases on their real incomes. And if the dividends are treated as taxable income, this will augment tax revenues.

A comprehensive strategy to promote energy efficiency and the transition to clean energy sources would likely include public investments, in addition to the cap on carbon emissions. Adding funding "to provide for increased government expenditure on research and development and other measures to address climate change," Burtraw *et al.* (2008, p. 26) take 35% as the share of carbon revenue to be allocated to the government budget. In a separate paper (Boyce and Riddle 2008) we discuss policy options for funding public investment in support of the energy transition. In this paper we focus on the narrower question of how to maintain government purchasing power at current levels.

## ALLOCATING CARBON REVENUE AMONG FEDERAL, STATE, AND LOCAL GOVERNMENTS

Whatever fraction of total carbon revenues is recycled to government, a key issue will be how to allocate these revenues among federal, state, and local governments. This is particularly important in the case of local governments, which typi-

open to question: the "welfare losses" ignore the welfare gains which are the rationale for a carbon policy in the first place; and there is no consensus as to the magnitude or even the sign of the effects of a carbon policy on GDP growth.

cally do not levy income taxes or sales taxes and hence lack any automatic mechanisms to obtain revenues under a cap-and-dividend policy.

There are two stages to this problem. The first is how to allocate carbon revenues across the three levels of government: federal, state, and local. The second is how to allocate revenues among the 50 states, and within states among local governments.

*A key issue is how to allocate carbon revenues among federal, state, and local governments.*

With regard to the first stage, one possible allocation rule is to apportion the government share of carbon revenue across the three levels of government in proportion to their respective total expenditures on goods and services. Based on the expenditure shares reported in Table 1, this would translate into roughly 34% of the government carbon-revenue pool being allocated to the federal government, and the remaining 66% to state and local governments. This allocation rule does not take into account differences in the carbon intensity of expenditure across the three levels of government. But as shown in the table, state and local government expenditures tend to be more carbon-intensive than federal expenditures. An alternative rule is to apportion carbon revenue across the three levels of government in proportion to their carbon emissions, that is, in proportion to the extent to which the carbon cap will raise their operating costs. Under this allocation rule, the federal share of government carbon revenue would be 24% and the state and local share would be 76%.

With regard to the second-stage problem – allocation across the 50 states and across local governments – the revenue-sharing formula should provide incentives for governments themselves to improve their energy efficiency and invest in clean energy. In the same way that the cap-and-dividend policy creates incentives for consumers and private-sector firms to reduce their use of fossil fuels, state and local governments should be given incentives to do the same. This implies that inter-state and inter-locality revenue allocation should not simply be based on carbon use. One possible rule is to allocate revenue on the basis of population – that is, on an equal per capita basis – a formula consistent with the cap-and-dividend logic of distributing dividends to households on an equal per capita basis.

## OPTION 1: DISTRIBUTE 100% OF REVENUE TO INDIVIDUALS AS TAXABLE DIVIDENDS

One option is to recycle all of the carbon revenue to households as individual dividends. With a carbon permit price of $200/ton carbon, the dividends would amount to $1161/person/year. Assuming these are treated as ordinary income, we estimate that 24.2% of dividend payments would return to government in the form of federal and state income taxes and state sales taxes.[7] Federal income taxes account for 18.1% of this amount; state income and sales taxes account for the remainder.[8]

Tax rates vary by income class, of course, so not all households will return 24.2% of their dividends to government. We estimate that the share of dividends claimed by taxes would range from 10.2% in the poorest decile to 39.7% in the top decile.

[7] Federal income tax rates were calculated using data from the Internal Revenue Service (2006) that show an average statutory marginal tax rate of 13%. Following calculations by the Congressional Budget Office (2005), we incorporate effects of tax-code provisions that increase the average marginal rate to 14%, and the effect of the 2010 expiry of temporary tax cuts which further increases the average marginal rate to 16.7%. Adjusting for the fact that carbon dividend payments would be unearned income (analogous to rental income), and hence not subject to the provisions of the Earned Income Tax Credit or the refundable portion of the Child Tax Credit, the average marginal rate on dividends rises to 18.1%. Our estimate for state income and sales taxes is based on all-state averages reported by Citizens for Tax Justice (1996).

[8] The income and sales tax revenues are based solely on the dividends received and spent by households. We do not include "multiplier effects" on income tax revenues from firms.

**TABLE 2: DISTRIBUTIONAL IMPACT OF CAP-AND-DIVIDEND POLICY WITH 100% OF REVENUE PAID TO INDIVIDUALS AS TAXABLE DIVIDENDS**

| Decile (based on per capita expenditure) | Expenditure per capita | Charge (costs from higher fossil fuel prices) per capita | Dividend per capita | Taxes (federal + state) on dividends (%) | Taxes (federal + state) on dividends ($) | Net impact ($) | Net impact (as % of expenditure) |
|---|---|---|---|---|---|---|---|
| 1 | 1927 | 269 | 1161 | 10.2% | 119 | 773 | 40.1% |
| 2 | 3521 | 405 | 1161 | 10.8% | 125 | 631 | 17.9% |
| 3 | 4736 | 493 | 1161 | 17.6% | 205 | 464 | 9.8% |
| 4 | 5991 | 589 | 1161 | 21.2% | 246 | 326 | 5.4% |
| 5 | 7380 | 653 | 1161 | 25.1% | 291 | 217 | 2.9% |
| 6 | 8847 | 732 | 1161 | 26.4% | 306 | 123 | 1.4% |
| 7 | 10711 | 823 | 1161 | 26.6% | 309 | 30 | 0.3% |
| 8 | 13228 | 938 | 1161 | 28.2% | 328 | -104 | -0.8% |
| 9 | 17178 | 1139 | 1161 | 36.5% | 424 | -402 | -2.3% |
| 10 | 29943 | 1639 | 1161 | 39.7% | 460 | -938 | -3.1% |
| Average | 10346 | 768 | 1161 | 24.2% | 281 | 112 | 1.1% |

The distributional impact of this policy option is reported in Table 2. Because a cap-and-dividend policy "charges" households (via higher prices for fossil fuels) in proportion to their carbon consumption, higher-expenditure households generally pay more than lower-expenditure households. Dividends are paid equally to all. In other words, people pay based on their use of the Earth's carbon-absorptive capacities, and receive dividends based on the principle that the resulting revenue belongs equally to all. Richer households pay more than they receive, while poorer households receive more than they pay.

The bottom seven deciles come out ahead, in the sense that what they receive in dividends exceeds what they pay as a result of higher fuel prices. There are two reasons why the number of "winners" – here defined in purely monetary terms, without taking into account the benefits from curbing global warming – outnumber the "losers" by roughly a 2:1 margin. First, expenditure is skewed to the top of the income distribution (put differently, average expenditure is greater than median expenditure). Second, the after-tax share of total carbon revenues retained by households (75.8%) is greater than the household share of carbon emissions and hence carbon charges (65.7%, as reported in Table 1).

At the same time, this policy option keeps the government whole in the sense that the government share of carbon revenue that is recouped via taxes on dividends (24.2%) exceeds the government share of carbon emissions (14.5%). Indeed, it does so by a margin that is large enough to compensate for at least some of the effects of indexation of transfer payments and tax brackets on government revenue (if these were not addressed via other policies), and/or to fund government spending that complements the cap-and-dividend policy by investing in energy efficiency and renewable energy sources.

As can be seen in Table 1, the reason that *both* government and households can come out ahead is that there are two additional sources of carbon revenue: non-profit institutions and buyers of U.S. exports, who like households and government pay higher prices for fossil fuels (and for everything that is produced and distributed by using them) but receive no compensation.[9]

[9] The calculations reported here assume that imports are subject to "carbon tariffs" equivalent to the carbon permit charges that are embodied in the prices of domestically produced goods and services. If no carbon tariffs are levied on imported goods (or, for administrative simplicity, they are levied only on the high-carbon subset of imported goods), this will correspondingly decrease both the charge to con-

**TABLE 3: DISTRIBUTIONAL IMPACT OF CAP-AND-DIVIDEND POLICY WITH REVENUE SET ASIDE FOR GOVERNMENT**

| Decile (based on per capita expenditure) | Expenditure per capita | Charge (costs from higher fossil fuel prices) per capita | Dividend per capita | Taxes (federal + state) on dividends (%) | Taxes (federal + state) on dividends ($) | Net impact ($) | Net impact (as % of expenditure) |
|---|---|---|---|---|---|---|---|
| 1 | 1927 | 254 | 919 | 4.4% | 40 | 624 | 32.4% |
| 2 | 3521 | 390 | 919 | 4.4% | 40 | 488 | 13.9% |
| 3 | 4736 | 486 | 919 | 4.4% | 40 | 393 | 8.3% |
| 4 | 5991 | 586 | 919 | 4.4% | 40 | 293 | 4.9% |
| 5 | 7380 | 654 | 919 | 4.4% | 40 | 225 | 3.0% |
| 6 | 8847 | 733 | 919 | 4.4% | 40 | 145 | 1.6% |
| 7 | 10711 | 825 | 919 | 4.4% | 40 | 54 | 0.5% |
| 8 | 13228 | 941 | 919 | 4.4% | 40 | -62 | -0.5% |
| 9 | 17178 | 1149 | 919 | 4.4% | 40 | -270 | -1.6% |
| 10 | 29943 | 1649 | 919 | 4.4% | 40 | -770 | -2.6% |
| Average | 10346 | 767 | 919 | 4.4% | 40 | 112 | 1.1% |

In other words, the additional government revenue resulting from 100% recycling of carbon revenues as taxable dividends to individuals would be sufficient to keep the government whole. We again note, however, that in this as any other policy option, a mechanism for intergovernmental allocation will be needed to allocate the government share of carbon revenues equitably among local, state, and federal governments.

*The additional government revenue resulting from 100% recycling of carbon revenues as taxable dividends to individuals would be sufficient to keep the government whole.*

## OPTION 2: REVENUE SET ASIDE FOR GOVERNMENT, AND TAX-FREE DIVIDENDS TO INDIVIDUALS

A second option is to set aside carbon revenue for government to offset the policy's impact on government expenditure, returning the remainder to the public as tax-free dividends. To facilitate comparison of the two options, we assume in our calculations that government again receives 24.2% of the total carbon revenue (primarily via the set aside, with a small amount also coming from sales taxes as households spend their dividends) and the remaining 75.8% goes to households.[10] The distributional impact of this policy is shown in Table 3.

Under this option, the bottom seven deciles again come out ahead in purely monetary terms. The net gains for the lower deciles are somewhat lower, however, as are the net costs for the upper deciles, so the distributional incidence is somewhat less progressive. The difference arises from how the government share is financed. In the previous option, the fraction of dividends returned to government via taxes varies across the deciles, with a higher fraction for more affluent households. In the set-aside scenario, each person's dividend is cut by the same amount – a policy that is, in effect, equivalent to a head tax.

## CONCLUSIONS

Any policy that puts a cap on carbon emissions will increase the prices of fossil fuels, with significant impacts on local, state, and federal governments as well as on consumers. This is true

sumers and amount that households receive as dividends, leaving average net benefits unchanged.

[10] The calculations presented here differ from those in our earlier paper (Boyce and Riddle 2007), mainly because there only 67% of total carbon revenue was recycled to individuals.

regardless of whether the permits (that is, the allocation of rights to emit under the cap) are given away or auctioned to polluters, and regardless of whether auction revenues are retained by the government, recycled to the public, or any mix of the two. Higher prices are the corollary of scarcity, and scarcity (compared to the situation with no carbon cap) is precisely what the policy is intended to create.

Households can be made whole, in the sense that what the public at large pays in higher fuel prices is recycled back to the public, by a cap-and-dividend policy: individuals win or lose in monetary terms from the policy depending on whether they consume above-average or below-average amounts of carbon. To keep the government whole, as well, similar policies are needed to ensure that enough of the carbon revenues flow to governments to compensate for the additional costs they incur as a result of the carbon cap and consequent fuel price increases.

In this paper, we compared the distributional impacts of two alternative policies: (i) distributing all of the carbon revenue to households as taxable dividends, and (ii) setting aside part the carbon revenue for government, while distributing the remainder of the revenue to the public as tax-free dividends. Both policies protect the real incomes of the majority of American households and have a progressive impact on the distribution of income. The policy of recycling 100% of carbon revenue to the public as taxable dividends has a stronger progressive impact.

Apart from recycling a sufficient total quantity of carbon revenues to government, a further issue is how to allocate these monies amongst federal, state, and local governments, by means of a formula that is fair and provides incentives for governments to curb their own carbon emissions. We have suggested a two-step allocation rule for this purpose: first, to apportion the revenue amongst the three levels of government – federal, state, and local – according to their respective shares in GDP; and second, within the state and local-government shares, to allocate revenue on the basis of population.

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