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The Consumer Burden of a Cap-and-Trade Program to Cut Carbon Dioxide Emissions

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In my testimony today I will explore the economic consequences for households if policy makers adopt a cap-and-trade system resulting in an increase in carbon prices and subsequently an increase in energy and other consumer goods prices.

A consensus is emerging today in the United States that climate change is a critical issue requiring a reduction in greenhouse gas emissions. Greenhouse gases have increased by more than 17 percent since 1990. The bulk of this is driven by a nearly 20 percent increase in carbon dioxide emissions since 1990. In the United States, greenhouse gas emissions come primarily from the combustion of fossil fuels in energy use. Energy use is largely driven by economic growth with short-term fluctuations in its growth rate created by weather patterns affecting heating and cooling needs, as well as changes in the fuel used in electricity generation. For instance, some of the factors responsible for the higher emissions since 1990 are the increased demand for electricity for computers and electronics in homes and offices; strong growth in demand for commercial lighting and cooling and increased demand for transportation services as a result of relatively low fuel prices and robust economic growth in the 1990s and early 2000s.

Economists have long argued that market based instruments are more efficient than regulations as a means of addressing the social damages arising from polluting activities. By market-based instruments we mean policies that force firms to "internalize" the cost of polluting activities. In the context of climate change arising from greenhouse gas (GHG) emissions, the polluting activity is the release of carbon dioxide and other greenhouse gases.[1]

One approach that has been popular among policy makers is cap-and-trade. With a cap-and-trade system for carbon dioxide (CO2), policy makers set a limit on the quantity of CO2 that

[1] The major greenhouse gases include carbon dioxide, methane, nitrous oxide, and various fluorocarbons and other gases.

can be emitted in a given period. Emission rights (permits) are created equal in number to the total emissions allowed under this cap. The permits are then either auctioned or freely allocated. At the end of a reporting period, each source must report all emissions and surrender an equivalent number of permits. Since the number of permits is limited, they have financial value. Companies able to reduce their emissions at low cost can sell the permits they don't need to companies for whom the cost of reducing emissions is high. Each company has the flexibility to choose how to meet its emissions target, but market incentives encourage them to develop new, cleaner technologies. Over time, the cap can be lowered to achieve more aggressive emissions-reduction targets.

While cap and trade may be superior to command-and-control regulatory approaches, it is not necessarily superior to other alternatives, such as a carbon tax. As several economists have pointed out, a cap and trade system leads to tremendous uncertainty in energy prices since permit prices may vary from month to month. Economist William Nordhaus uses the sulfur-emissions trading program in the U.S. as an example. SO2 allowances have had a monthly volatility of 10 percent and an annual volatility of 43 percent over the last decade.[2] Economist Robert J. Shapiro similarly observes that this increased volatility in all energy prices will affect business investment and consumption.[3] Further, a carbon tax can be administered more efficiently since carbon taxes can be levied and collected at existing institutions at the federal, state and local level. Emissions trading schemes however require the creation of new trading markets, complete with new regulations and institutions to define and enforce the value of credits. For a brief

[2] William Nordhaus, "Life after Kyoto: Alternative Approaches to Global Warming Policies" (NBER working paper no. W11889, December 2005), 15.
[3] Robert J. Shapiro, "Addressing the Risks of Climate Change: The Environmental Effectiveness and Economic Efficiency of Emissions Caps and Tradable Permits, Compared to Carbon Taxes."

discussion on the advantages of a carbon tax, I would refer you to an article by my AEI colleagues Kenneth Green, Steven Hayward and Kevin A. Hassett (2007).[4]

Cap-and-trade is preferred by policy makers since legislators erroneously assume that they may help soften the "pain" of the climate policy by handing out permits to emit carbon.[5] While it is a common understanding that auctioned permits will result in higher energy and other product prices much the same way that an equivalent fee on carbon emissions would, it is often assumed that free permit allocations will not, i.e., if emitters receive carbon permits for free, there will be no costs to pass on to their consumers. Though intuitive, this reasoning is incorrect. Cap-and-trade systems increase energy and product prices because of the scarcity they introduce. Someone must reduce emissions at some cost. That scarcity is what drives the price increases, not the method of permit distribution. Consider a cap-and-trade system in which emission permits are distributed to polluters for free. To reduce greenhouse gases, fewer permits are distributed than would be necessary to support pre-policy consumption. For a polluting company to maintain production levels, it will need either to undertake abatement or purchase a permit from another polluter. In either case, production costs will go up, and it will pass as much of those costs onto its customers as it can. If it is able to increase prices to cover all of the increased costs, then output can be maintained and the costs will be passed on to consumers. Alternatively, it will choose to reduce emissions by cutting back output. Of course, as supply falls, prices will increase. The end result is that "free" emission permits will indeed cause higher prices, and will increase prices by the same amount as if the permits were auctioned. This scenario has played out in existing cap-and-trade systems and is beyond dispute in the economics profession.

[4] http://www.aei.org/publications/filter.all,pubID.26286/pub_detail.asp

[5] This can work in a limited way in regulated electricity markets as we discuss later, but not for all prices in general.

An equally forceful reason that economists favor an auction is that it makes available funds that can be used to achieve other goals. Depending on how these revenues are used, they can help to reduce the social cost of climate policy. For the purposes of minimizing the cost of climate policy on the economy and promoting economic growth, some economists favor dedicating the use of revenue from an auction to the reduction of pre-existing distortions. This so called revenue recycling would have significant efficiency advantages compared to free distribution.[6] Others care about the distributional implications of carbon pricing and want to use the revenue to offset regressivity. Still others would address macroeconomic issues such as the fiscal deficit.

To summarize the above argument, the question of who actually pays for the cost of pollution abatement is similar to the question of tax incidence. In a competitive market, the degree that firms are able to charge customers for any change in cost depends on the relative elasticities of demand and supply, but theory clearly indicates that firms will charge customers to the degree they are able to do so. The use of permits constitutes a change in the cost of production. The important idea is that the ability of firms to pass on a change in costs of production does not hinge on how they received the allowances initially.

[6] Bovenberg, A.L., & Goulder, L.H. (1996). Optimal Environmental Taxation in the Presence of Other Taxes: General Equilibrium Analyses. American Economic Review, 86, 985–1000. Bovenberg, A. & de Mooij, R. (1994). Environmental Levies and Distortionary Taxation. American Economic Review, 84, 1085-9. Goulder, L.H., Parry, I.W.H., Williams III, R.C., and Burtraw, D. (1999). The Cost-Effectiveness of Alternative Instruments for Environmental Protection in a Second-Best Setting. Journal of Public Economics, 72(3), 329–360.; Parry, I.W.H., Williams, R.C., & Goulder, L.H. (1999). When Can Carbon Abatement Policies Increase Welfare? The Fundamental Role of Distorted Factor Markets. Journal of Environmental Economics and Management, 37(1), 52–84.; Smith, A.E., Ross, M.T., & Montgomery, W.D. (2002). Implications of Trading Implementation Design for Equity-Efficiency Trade-offs in Carbon Permit Allocations. Washington, DC: Charles River Associates.

Since cap-and-trade programs increase costs for firms which are passed on to consumers, a major concern with a cap-and-trade program to reduce emissions is that the burden of the costs arising from the policy will fall disproportionately on poorer households – or in the terminology of incidence analysis, the policies will be regressive. Further, it is also important to realize that these price increases will occur not only for fuels, but for every consumer good that the average American buys, since these fuels are inputs into every commodity produced in the American economy.

In a paper co-authored with Kevin Hassett at the American Enterprise Institute and Gilbert E. Metcalf at Tufts University, we calculate the price increases for all consumer goods of a cap-and-trade system with a $15 permit price where every permit allows the right to emit one metric ton of CO2. [7]We further calculate the direct and indirect burden of a cap-and-trade system on American households. The direct component measures household burdens from their direct consumption of fuels such as gasoline, home heating and electricity. The indirect component measures the increase in the cost of all other consumer goods that depend upon these fuels for production.

II. Burden on Consumers at Different Income Levels

Table 1 presents our estimated price increases for consumer goods as a result of a cap-and-trade system. As we may expect, fuel prices go up significantly more than all other consumer goods prices, but the increases for the other goods are not insignificant.

[7] "The Consumer Burden of a Cap-and-trade System with Freely Allocated Permits" http://www.aei.org/publications/filter.all,pubID.29113/pub_detail.asp. Also see "The Incidence of a U.S. Carbon Tax: A Lifetime and Regional Analysis,"The Energy Journal, Vol.30, No.2., March 2009.

Figure 1 presents the burden for each household as a fraction of their annual income. For this analysis, we used household level data on income and consumption from the Consumer Expenditure Survey. We have grouped households by annual income and sorted the households into ten income deciles from the poorest ten percent of the population to the richest ten percent. Confirming conventional wisdom, the carbon tax is quite regressive when measured relative to current income for all three years. The total burden in the lowest decile in 2003, for example, is over four times the burden in the top decile when measured as a fraction of annual income. The burden is more regressive when we look at just the direct component, rather than the indirect component.

III. Regional Distribution of Burden

To measure the geographic burden of the cost of carbon permits, we group households by region and measure their average cost of carbon usage under a system of carbon permits using weighted averages of the carbon permit cost burdens. Note that the regional distribution of the carbon burden is affected by the nature of electricity regulation across states. In states with regulated electricity, the burden will differ depending upon whether the permits were auctioned or freely allocated.

Results are shown in figures 2, 3 and 4.[8] Figure 2 depicts the case of a cap-and-trade system with auctioned permits. Since firms have to pay for the permits at the auction determined price, there is no difference between the regulated and unregulated electricity regions. For both,

[8] The states in each region are as follows: New England: Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island; Midatlantic: New Jersey, New York, Pennsylvania; South Atlantic: West Virginia, Virginia, North Carolina, South Carolina, Georgia, Florida, District of Columbia, Maryland, Delaware; East South Central: Kentucky, Tennessee, Missouri, Alabamak, Mississippi; East North Central: Wisconsin, Illinois, Michigan, Indiana, Ohio; West North Central: North Dakota, South Dakota, Nebraska, Kansas, Minnesota, Iowa; West South Central: Texas, Oklahoma, Arkansas, Louisiana; Mountain: Montana, Idaho, Whyoming, Nevada, Utah, Colorado, Arizona, New Mexico; Pacific: California, Oregon, Washington, Alaska, Hawaii.

the entire cost of the permits is assumed to be fully passed forward to consumers. Variation in the average burden is quite modest in 2003. The maximum difference in the average burden across regions is just under one-half of a percentage point in 2003. It is quite remarkable how small the differences are across the regions given the variation in weather conditions and driving patterns across the regions.

The bulk of the variation across regions in energy costs arises from the direct portion of the carbon burden. A closer look at the data reveals that the high regional burden for the Mountain region for instance is due to the relatively higher consumption of gasoline per household in that region, relative to others. By itself, this would have lead to much larger burdens of the energy costs on consumers in this region. However, the other direct energy consumption items such as natural gas, electricity and home heating oil even out the variation in the burden across regions to some extent. For instance, gas consumption is highest in East North Central, electricity in West South Central and home heating oil in New England. The distribution of these burdens (as a fraction of income) is shown in Figure 3.

The indirect results suggest that consumers in different regions of the country buy similar mixes of non-energy commodities. There is little variation across regions, with the highest burden on households in the Mountain region, perhaps driven by greater expenditures on cars and other means of transportation. This region also spends more than the average on car services and airfares. Auto expenditures are also relatively high in the East North Central and West North Central regions. Expenditures on doctors and health care services tend to be high in the Mid-Atlantic, East North and West North Central regions. These have low carbon intensities (see Table 1).

Figure 3 shows the total burden assuming permits are freely allocated to energy providers. It assumes that the permit costs are passed forward into higher electricity prices only in states with deregulated electricity. Those states are CA, CT, DE, MA, MD, ME, MT, NH, NJ, NY, RI, TX, and DC. In all other states, the assumption is that state electricity regulators do not allow utilities to pass forward the cost of using freely allocated permits to residential consumers.

The impact of freely allocated permits and regulators who don't pass forward the price of permits is to shift the regional burden from coal-intensive states to those states that have moved ahead with electricity deregulation. We can see this by looking at the difference in the total burden with and without free allocation. The burden falls by much more in regions such as the South Atlantic, East North Central, East South Central and West North Central regions and much less in the Mid-Atlantic and Pacific Regions. But the lower burden means that we will obtain fewer reductions in emissions than would occur if permits were auctioned (or if regulators allow the cost of using a freely allocated permit to be passed forward into higher electricity prices).

Our results suggest that free allocation of permits in a market where electricity is regulated in some states and deregulated in others leads to a shifting of the regional burden from the regulated to the deregulated states. In fact, it punishes consumers in those regions of the country that have moved to deregulation. This simply aggravates an existing situation where deregulated states have been facing larger price hikes than regulated states making their consumers worse off. A recent report on the electricity price increases in the deregulated states shows that between 2002 and 2006, Connecticut consumers saw a 53.2% increase in prices, Delaware 33.6%, DC 23.8%, Massachusetts 55.6%, Texas 57.7% etc.[9] Therefore, it is important

[9] http://www.usatoday.com/money/industries/energy/2007-08-09-power-prices_N.htm

to take into account the regulation in the electricity market when deciding between free allocation or auctioning of permits.

Table 1: Consumer Goods Price Increases as a Result of the Carbon Permits

	CEX categories	**2003**
1	food at home	0.70%
2	food at restaurants	0.58%
3	food at work	0.86%
4	tobacco	0.67%
5	alcohol at home	0.58%
6	alcohol on premises	0.58%
7	clothes	0.40%
8	clothing services	0.41%
9	jewelry	0.43%
10	toiletries	0.72%
11	health and beauty	0.42%
12	tenant occupied non-farm dwellings	0.31%
13	other dwelling rentals	0.42%
14	furnishings	0.55%
15	household supplies	0.71%
16	electricity	12.55%
17	natural gas	12.28%
18	water	0.63%
19	home heating oil	9.56%
20	telephone	0.26%
21	domestic services	0.49%
22	health	0.39%
23	business services	0.50%
24	life insurance	0.31%

25	automobile purchases	0.90%
26	automobile parts	0.65%
27	automobile services	0.40%
28	gasoline	7.73%
29	tolls	0.64%
30	automobile insurance	0.31%
31	mass transit	0.90%
32	other transit	0.62%
33	air transportation	1.86%
34	books	0.34%
35	magazines	0.49%
36	recreation and sports equipment	0.42%
37	other recreation services	0.51%
38	gambling	0.31%
39	higher education	0.30%
40	nursery, primary, and secondary education	0.34%
41	other education services	0.30%
42	charity	0.41%

Figure 1: Household Burden of a Cap-and-Trade Program

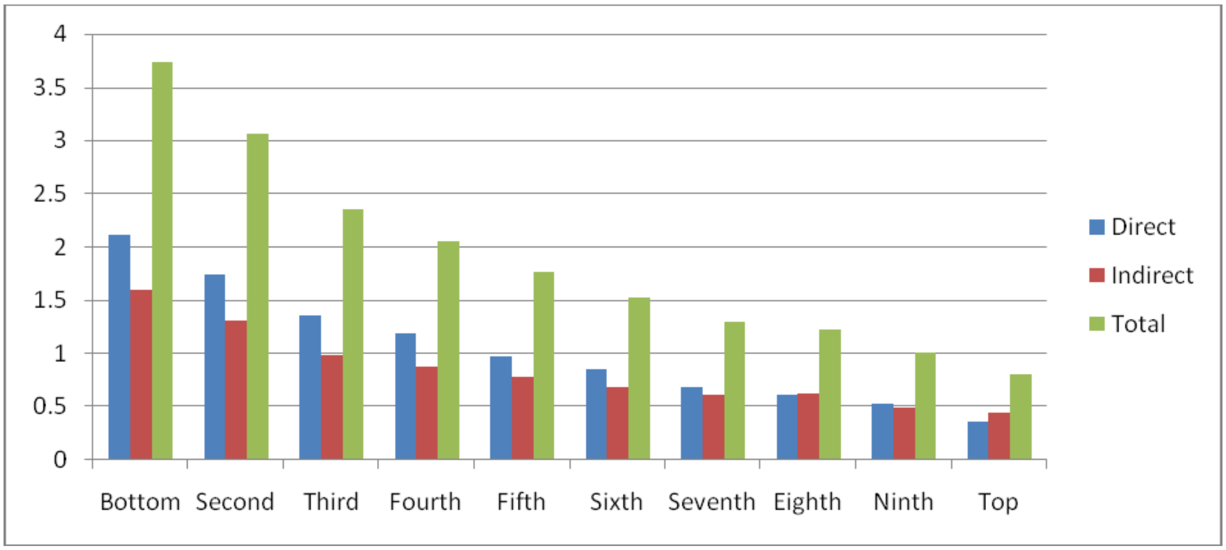

Figure 2: Regional Burden of Cap-and-Trade with 100% auctioning of Permits

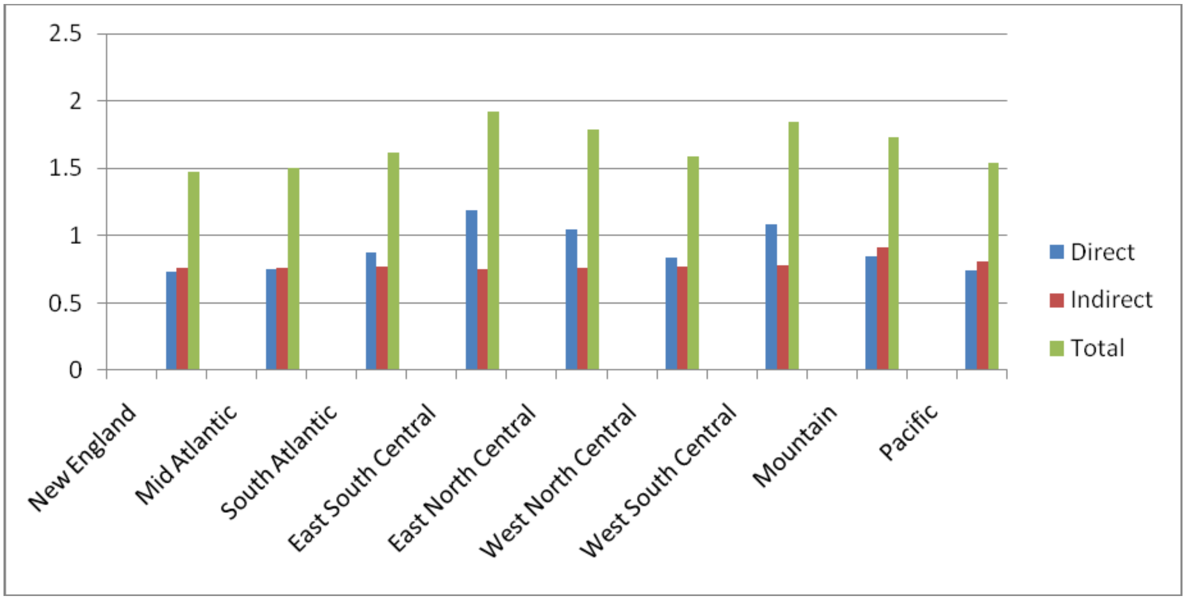

Figure 3: Regional Fuel Burden of Cap-and-Trade

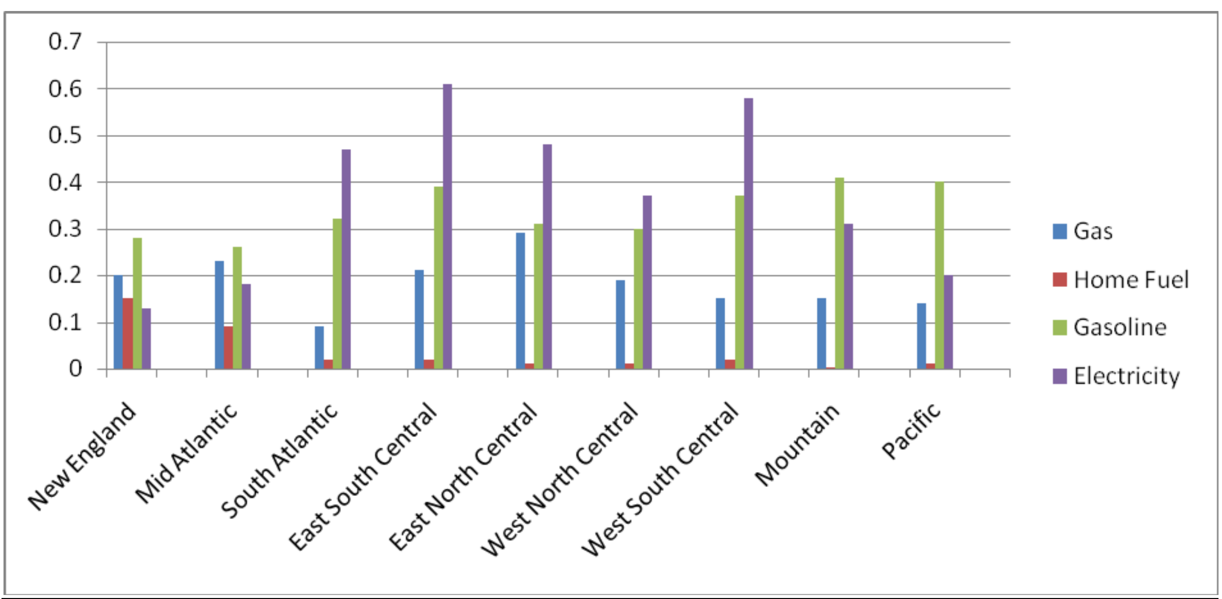

Figure 4: Regional Burden of Cap-and-Trade with Freely Allocated Permits