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Does a carbon policy really burden low-income families?

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Will climate policy disproportionately hurt the poor? Many say yes, but let's look at the issue more closely. The purpose here is not to decide what's fair, because readers can decide for themselves. Rather, the purpose is to demonstrate different notions of fairness. For "vertical" distributional effects between those with high- and low-incomes, the conventional view is that carbon policy is regressive (burdens that are a higher proportion of income for those with low income than for those with high income). Yet, new research disputes this conventional view of "vertical" effects, while bringing new attention to potential problems with "horizontal" distributional effects – across families at the same level of income.[1] This policy brief introduces these new ideas and explains these new results.

Background

Questions about distributional effects have become more important with recent debate about the U.S. role in worldwide agreements to reduce greenhouse gas emissions. Only last year, President Obama negotiated and signed the 2015 Paris Agreement for all nations of the world to reduce those emissions.[2] The goals of this agreement are to reduce the risk of global warming and other effects of climate change, including sea level rise and increased frequency of droughts and floods from extreme weather

[1] See Cronin *et al* (2017).

[2] At the Earth Summit in Rio de Janeiro in 1992, the United Nations Framework Convention on Climate Change (UNFCC) committed signing nations to annual meetings of the Conference of the Parties (COP). The Kyoto Protocol was signed at the 1997 meeting, and the Paris Agreement was signed at the 21st COP in 2015.

events. To help satisfy these goals, President Obama issued an executive order for all U.S. states to comply with a "Clean Power Plan" to reduce carbon dioxide emissions from electric power plants.[3]

As we have discussed in previous IGPA *Policy Briefs*, Illinois could comply with the Clean Power Plan by imposing a tax on emissions from Illinois power plants, collecting around $700 million of revenue per year.[4] Some of this revenue could be used to help compensate families for their extra costs, as those electric generating companies could be expected to pass on the cost of the new tax to Illinois rate-payers. Indeed, the general consensus among policy analysts is that any attempt to reduce greenhouse gas emissions will raise the cost of electricity and place a disproportionate burden on families with low income. To emphasize this point, **Figure 1** shows spending on electricity as a fraction of total spending for Midwestern families at different levels of annual income. The graph shows that spending on electricity is almost 4 percent of total spending for the lowest income group, falling to under 2 percent for the highest income group. Those high-income households certainly spend more on electricity, but it is a lower proportion of their total spending than for those who are less well-off.[5]

Thus, any climate policy that raises the price of electricity will impose a higher proportional burden on low-income families than on high-income families. This pattern is the very definition of a "regressive" tax burden.[6] As a consequence, many believe that some of the additional revenue generated by any carbon policy would need to be devoted to help cover those extra costs for low-income families.[7]

In brief, this new research finds three surprising results.

- A carbon tax is not regressive at all, but progressive, as it really imposes a larger percentage burden on those with more income.
- The largest redistributions caused by a carbon tax are not between rich and poor at all, but between families at the same level of income.
- Carbon tax revenue could be used to help the poor by increasing government transfer payments to low-income families, making the overall burden even more progressive, but it introduces even more variation in tax burdens at the same level of income.

We now try to explain these novel results.

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[3] See https://www.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants.

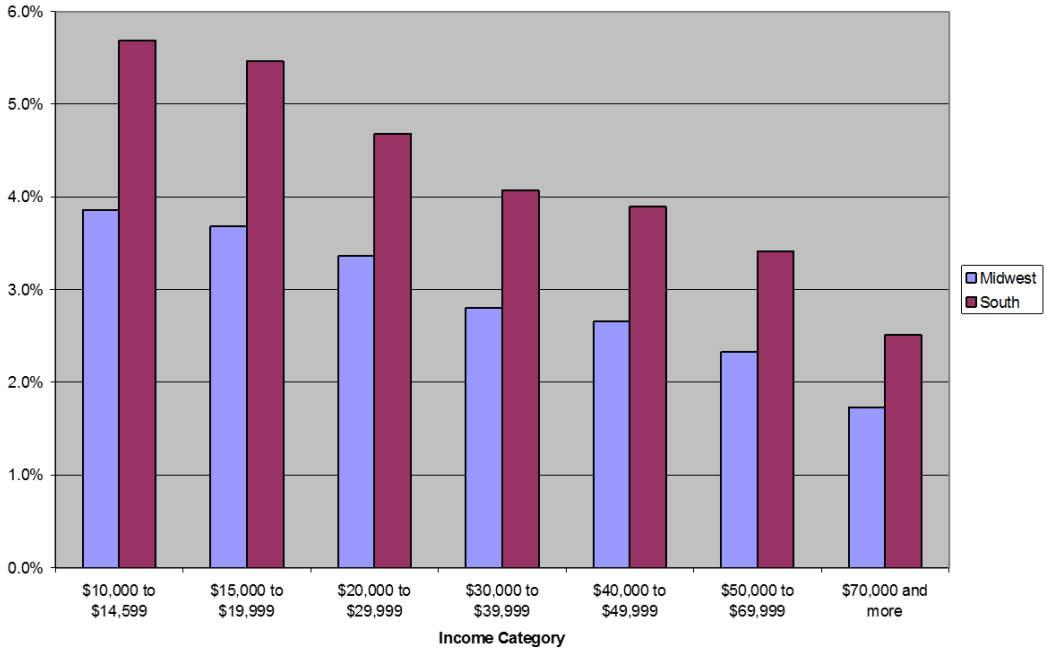
[4] See https://igpa.uillinois.edu/reports/7, but also Fullerton and Karney (2017).

[5] Figure 1 also shows that a carbon tax would have geographic distributional effects. For one example, those who live in the South must use more electricity for air conditioning, so they have higher burdens than those in the Midwest. Similarly, those in the Midwest have higher burdens than those on the West Coast.

[6] The distributional effects of a tax are "proportional" if the burden is the same fraction of income for all families, and it is "progressive" if the burden is a rising fraction of income for those with more income.

[7] Papers that find the carbon tax to be regressive and that suggest rebates to help low-income families include Blonz *et al* (2011), Dinan (2012), Grainger and Kolstad (2010), Hassett *et al* (2009), and Mathur and Morris (2014).

Figure 1: Electricity Spending as a Percent of Total Spending, by Income Group



Point One: Consumption spending is the best measure of who is "rich" or "poor".

To assess the burden of a tax, we must collect data on many different families, rank them from the poorest to the richest, and calculate the burden on each such family as a fraction of income. The first key question for any such study, then, is how to measure "income". And that's not as easy as it sounds. "Taxable" income omits many kinds of tax-favored income. "Cash" income omits wealth from unrealized capital gains and in-kind income, such as employer-provided health insurance, retirement contributions, company car, or free parking. Even if all those types of compensation could be measured for each family, any measure of "annual income" is not a great measure of a family's true well-being. A person's annual income may bounce up and down from year to year, so economists prefer to measure "lifetime income" or "permanent income" to identify who is truly rich or poor.

For example, those with the lowest annual income within a year would include students and other young people who know they will earn more in the future, old people who earned more earlier in their careers, and self-employed people with volatile income who happen to be observed in a bad year. From the perspective of lifetime earnings, we might not consider these people to be truly poor, but they get aggregated into the same annual income group with those who are perennially poor. It is the latter people who are "truly poor" and who are of the most concern to policymakers. In short, the annual income groups arrayed across Figure 1 are not a very good measure of who is really rich or poor.

Economists believe that a better approximation of "permanent income" is a family's total annual consumption spending. The basic assumption is that people know themselves how rich or poor they

really are, and they spend accordingly. A family with volatile income would spend about the same amount every year, an amount that represents their "permanent income".[8]

If a study uses annual consumption to measure family income, then a flat tax on *all* consumption has a proportional burden -- rather than a regressive burden as usually depicted when using annual income to classify families – since those with high annual income save more and, thus, have less burden.

A tax on electricity could still be regressive, since Figure 1 shows that electricity spending as a fraction of annual total consumption spending is falling. But a carbon tax on all carbon dioxide emissions is not just a tax on electricity, as it also raises the cost of gasoline, home heating fuel, and every other commodity, since all commodities use electricity in their production. All commodity prices rise, and a uniform general carbon tax burden would be proportional when families are classified by total annual consumption. Thus, the carbon tax is less regressive and more likely proportional, but it does not yet have a "progressive" burden (as shown in the next point).

Point Two: Public transfer programs are indexed to the price level.

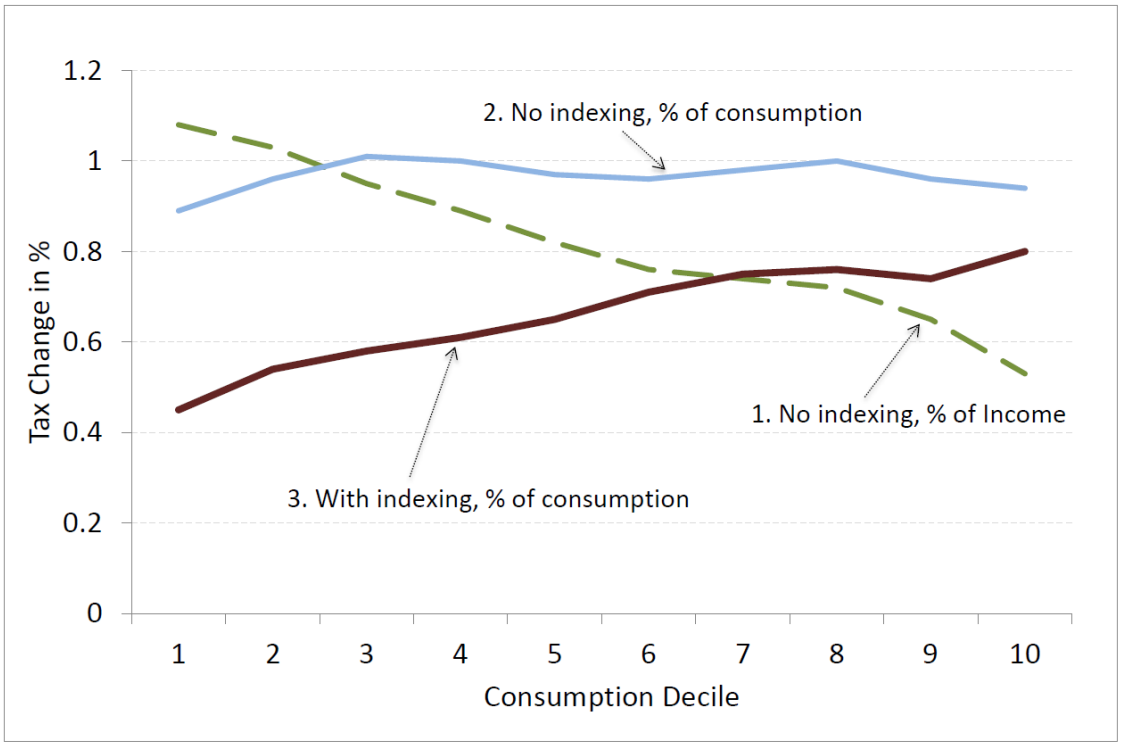
A uniform tax on all carbon dioxide emissions would cause a general and fairly uniform increase in commodity prices.[9] But many social programs, like Social Security, are designed to increase their benefit levels automatically when prices rise, since they are indexed for inflation. This indexing helps protect most low-income families who receive a high fraction of their income from public transfers. Higher income families receive a much lower fraction of their income from indexed transfers, and thus are not protected against a tax on carbon emissions. Therefore, when prices rise, the real income of poor families falls by a smaller percentage than does the income of rich families. Together with our first point, this second point means that the carbon tax burden is not proportional, but progressive.

Figure 2 demonstrates the relative size and impact of these two forces. The dashed line (1) shows the carbon tax burden as a percentage of annual *income* without indexing of transfers. The burden is regressive, as it falls from about 1 percent of income for the poorest decile to only about 0.5 percent of income for the richest decile. The top, light-colored line (2) shows the same tax as a percentage of annual *consumption* (used to represent permanent income). In that case, the burdens are almost proportional (0.89% of consumption for the poorest decile and 0.94% of consumption for the richest). The third and darker line (3) shows the effect of the final change to account for indexing of the social safety net. In this scenario, the whole line is lower because a quarter of the $100 billion revenue would be required to index transfers, so the burdens are lower, but the clear upward slope indicates those burdens are progressive (0.45% of consumption for the poorest decile and 0.80 % for the richest decile).

[8] See Poterba (1989).

[9] This result is shown in Cronin *et al* (2017).

Figure 2: Carbon Tax Burdens as a Percentage of Annual Income or Consumption, with and without Indexing



Point Three: At every level of well-being, some families spend more than others on carbon-intensive goods.

Some very poor families live in Los Angeles and other moderate climates where residents have little need for fossil-fuel-fired heating in the winter or electricity to power air conditioners in the summer. They might even live near a subway stop and not own a car. Other poor families live in Minneapolis or Oklahoma, where they need both heat and air conditioning. As a consequence, the burdens of a carbon tax even within the poorest group have a wide variance (regardless of whether families are grouped by annual income or annual consumption).

Table 1 shows the distribution of burdens within each group, from those with the lowest to highest annual consumption. As you can see in the third column, the tax burden is progressive, because it rises as a percent of consumption, from 0.45 percent for the poorest group to 0.80 percent for the richest group. These burdens are noticeable, but not huge – less than one percent of consumption. But the fourth column shows that the standard deviation of the burden *within a group* is larger than the burden itself, at least for the poorest four groups. The fifth column is the "coefficient of variation", defined as the standard deviation of the change in consumption (the extra burden) as a fraction of average consumption in the group. Those measures of variation within each group are larger than the average

burden within the group. Even *within* each group from poor to rich, some families have almost no burden, some have the average burden, and some have two or three times the average burden! Thus, the burden of a carbon tax would vary considerably among families at each level of wealth.

Table 1. Burden of a Carbon Tax, by Decile, with Indexing of Transfers but No Rebates

Consumption Decile	Average change in tax burden	Tax change as a % consumption	Standard deviation of burden	Coefficient of variation of consumption (in %)
1	$51	0.45	$64	0.86
2	$95	0.54	$103	1.08
3	$134	0.58	$152	1.24
4	$178	0.61	$195	1.26
5	$245	0.65	$213	1.12
6	$330	0.71	$250	1.06
7	$434	0.75	$342	1.21
8	$544	0.76	$360	1.05
9	$674	0.74	$422	0.96
10	$1,757	0.80	$22,725	22.05

Source: Estimates are from Cronin *et al* (2017).

Point Four: Using public transfer programs to rebate the carbon tax revenue would make the tax even more progressive.

Because so many studies use the annual income measure and therefore find that the carbon tax is regressive, they often discuss the idea that carbon tax revenue can be used to increase public transfer programs – the social safety net.[10] For this reason, the new research by Cronin *et al* (2017) also calculates the net change in burden for each family when *all* of the carbon tax revenue is used to increase government transfer payments. With $100 billion of annual carbon tax revenue, which is estimated to raise commodity prices about 1 percent, these transfers can all be increased by 5.9 percent.

Table 2 shows how this tax and rebate plan essentially takes from some families and gives to others. First, it is even more progressive than the carbon tax alone (in Table 1). The net average burden as a

[10] These programs include the Earned Income Tax Credit (EITC), Social Security, Supplemental Security Income (SSI), the Supplemental Nutrition Assistance Program (SNAP), and the supplemental program for Women, Infants and Children (WIC), Temporary Aid to Needy Families (TANF), Workers Compensation, Unemployment Compensation, Veterans Benefits, other state assistance, and the Low Income Home Energy Assistance Program (LIHEAP).

percent of consumption rises from -0.96% (a gain) for the poorest group to +0.50% burden for the richest group.

Table 2: Burdens of a Carbon Tax, by Decile, with Indexing and Rebates (5.9% Increase in Transfers)

Consumption Decile	Average change in tax burden	Tax change as a % consumption	Standard deviation of burden	Coefficient of variation of consumption (in %)
1	-$109	-0.96	$233	3.09
2	-$187	-1.07	$339	3.55
3	-$224	-0.97	$469	3.83
4	-$254	-0.87	$613	3.98
5	-$212	-0.56	$736	3.86
6	-$108	-0.23	$813	3.46
7	-$31	-0.05	$913	3.23
8	-$5	-0.01	$1,022	2.97
9	$59	0.06	$1,155	2.61
10	$1,090	0.50	$22,773	22.10

Source: Estimates in Cronin *et al* (2017).

Point Five: Using public transfer programs to rebate the carbon tax revenue triples the variation of burdens within each decile.

While Table 2 shows that the average carbon tax is progressive, with its burden rising from poorer groups to richer groups, this average burden masks considerable variation within each group. The coefficient of variation is 3 percent of mean consumption in the poorest group – more than three times the average gain within that group – and it is 22 percent of consumption in the richest group.[11] Even the second-richest group has an average burden of 0.06 percent (almost zero), while having variation within the decile of 2.6 percent of consumption. So a significant percentage of those families have a burden greater than 2.6 percent of consumption, while others gain more than 2.6 percent of consumption.

The reason is that those public transfer programs are not uniform within each group. Some families in the richest group receive social security – now 5.9 percent higher – while others do not. Even within the

[11] Actually, that 22 percent number is not really comparable to the other groups' coefficients of variation, because 10 percent of that richest decile is extremely rich, having *much* higher consumption than the rest of their group, so the richest decile also has much more variation in consumption of carbon-intensive commodities.

poorest group, only some families receive the Earned Income Tax Credit, and only some families receive Temporary Aid to Needy Families. Thus, a 5.9 percent increase in transfers helps poor families more than it helps rich families, but it leaves *some* poor families with no protection against the price increases caused by the carbon tax. In other words, much of the increase in transfer income goes to those in Los Angeles who do not have higher costs of heating and air conditioning. The use of carbon tax revenue to increase transfers can make the overall burden more progressive, but then the net tax burden varies tremendously within wealth groups.

Summary

When using consumption, rather than annual income, as a measure of wealth, the average carbon tax burden is progressive – rising in percentage terms for those with more money. But this progressive effect is not huge. The use of social safety net programs to rebate the carbon tax revenue to the poor makes the whole package considerably more progressive, but it also introduces considerable variation in the burden within each wealth group. Only some families within each group are eligible for public transfers, and even some of those eligible for such transfers do not apply for them. As a result, an increase in transfers helps only some of the families in each group, and not necessarily the households with the most carbon tax burden.

Is it fair to burden those who live in the middle of the country and therefore need more heat and air conditioning than those on the coasts? Some might say yes, since they are the ones causing more greenhouse gas emissions that contribute to climate change. Others might say no, since those folks cannot choose where to live and need to heat their homes. Either way, policymakers ought to know and understand what are the distributional effects of any climate policy they might impose. This policy brief shows that horizontal redistributions can impose large losses *and* gains within an income group, effects that are much larger than the vertical redistributions between rich and poor.

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