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ECON 406 - Policy Brief

The Regressivity of Carbon Prices

This policy brief draws on key findings of "Who Pays a Price on Carbon" by Grainger et al. (2010).

Key Result Highlights

Carbon taxes and fully auctioned cap-and-trade programs achieve the same outcomes, although through different mechanisms. Regardless of policy, carbon prices are regressive: low-income households pay a greater share of carbon prices than high-income households. There are differences in the degree of regressivity when using different measures of income (annual, lifetime, equivalent annual and equivalent lifetime), but they all point to the same overall result. Energy consumption also drives the regressivity of the policy.

Abstract

Carbon taxes and cap-and-trade programs both put a price on carbon. Assuming that households absorb the full price or carbon, the research aims to explore how the cost is distributed across income groups, concluding that it is regressive. This paper considers data from the American economy in 2003.

What's at Stake?

As governments seek to control carbon emissions, important policy decisions arise: carbon taxes, or a cap-and-trade program (firms are given an allowance for the amount of carbon they can produce and can exceed this limit by buying another firm's carbon emission share). These policies put a price on carbon; firms usually "cost-shift", passing the price on to consumers.

A firm choosing to reduce their carbon emissions will incur costs, and pass on this burden to consumers, workers or shareholders. In the policies we are considering, these costs take the shape of tax payments, or bidding for permits (if the government is auctioning them). Also, as these policies do not happen in isolation, there is an interplay with other taxes too, such as the income tax.

Who the cost is passed on to is significant to policy decision-making. The burden may come to lie on high-income earners, making the policy progressive. However, if it rests heavily on low-income earners, it is a regressive policy. Taxes should be distributed fairly, such that those who can afford it are charged accordingly. Policies regulating carbon emissions cannot neglect this knock-on effect on consumers.

Research Approach

These researchers used data from the 2003 Consumer Expenditure Survey (CES) and emission estimates from a model built on data from the 1997 US economy to arrive at their results. The price of carbon in this analysis is \$15 per ton of CO_2, but this price level is inconsequential for the distribution of burden across income groups.

The CES reveals the annual consumption patterns of households in different income groups and was used to understand the average level of household expenditure for each level of income.

Researchers chose to exclude the very low-income households, comprising students, retirees and the transitionally unemployed, as they had a very high expenditure to income ratio that skewed the level of regressivity.

To observe how carbon price affects consumption decisions, researchers used the Carnegie Mellon University version of the US Bureau of Economic Analysis' input-output approach. Carbon emissions from primary and intermediate goods (inputs) from other sectors used in the production of the output in a particular sector was factored into calculating the total carbon emission associated with the consumption of a good. This is used to explain the increase in cost (driven by taxes) for that sector. The CMU model is matched to the data from the CES to calculate the amount of carbon tax being paid by households for their given consumption bundles. The amount paid is taken as a proportion of households' incomes, to observe how the distribution of carbon tax incidence. Because of the assumption that full burden of carbon prices falls on consumers, the researchers acknowledge that their findings may overstate the regressivity of the policy.

Researchers note the debate over using current income or lifetime income in calculating tax burden – in this paper, lifetime income was used since it is a more stable measure than current income. Current expenditure is used to measure lifetime income, as it is assumed that most consumers will try to spend the same amount on consumption throughout their lifetime. It is acknowledged that this could also overstate regressivity for low-income households.

It was found that household sizes vary with income groups, which could also affect the results of the analysis. Thus, researchers used equivalence scales that factored in the cost savings of a larger household size to standardize comparisons.

Finally, researchers considered the carbon prices as a price on all greenhouse gas emissions, then as only on CO_2 from the consumption of energy goods.

Key Findings

Overall, it was found that low-income households bear a disproportionately larger amount of the carbon tax burden than high-income households; policies that result in a price for carbon are ultimately regressive.

Researchers considered which sectors would be most affected by the carbon pricing. Fossil-fuel intensive sectors (such as gasoline, electricity, natural gas and food) had the highest carbon emissions, and hence experienced the highest percentage increases in costs.

Differences between high-income and low-income households were evident. High-income households were more efficient, with 0.69 tons of carbon emission for every $1000 of spending compared to 1.99 tons for low-income households. However, aggregating the carbon emissions of each good in households' consumption bundles revealed that high-income households had consumption bundles with a far greater absolute amount of carbon emissions than low-income households. Calculating this effect as a share of household income quickly reveals that carbon prices are regressive. Using annual income as a measure, the poorest quintile's burden was 3.2 times as large as the top income quintile's burden. Using lifetime income (measured by annual expenditure, as explained earlier) instead, the policy appears slightly less regressive: it is found that the poorest quintile's burden was 1.4 times as large as the top income quintile's burden.

Another difference was in household sizes. High-income households were larger than low-income households – the top income quintile had an average of 3.1 persons, while the lowest quintile had 1.8 persons. To account for any confounding factors that may arise from this

difference, researchers used equivalence scales to obtain another measure of household income. The equivalent income measures are more regressive: under equivalent annual income, the poorest quintile's per-capita burden was 7 times greater than the top income quintile's; under equivalent lifetime income, the poorest quintile's per-capita burden is 3.5 times as much.

The degree of regressivity is also affected by the breadth of the carbon regulation policy, i.e. what the carbon price applies to. If all greenhouse gases are included, the policy becomes more regressive, because of the higher consumption among the lower-income group of food and alcohol. If carbon price is only applied to CO_2 emissions from the consumption of energy goods (gasoline, electricity, natural gas and fuel oil), the policy is regressive. Calculating based on annual household income means the poorest quintile pays 4 times as much as the highest; with lifetime income, it is 1.6 times as high; with equivalent annual income, the per-capita burden is 6 times as high; with equivalent lifetime income, it is 2.6 times as high. Direct energy consumption thus significantly affects the degree of regressivity.

Comparing these 4 measures of incomes, using the equivalent annual income measure leads to the most regressive calculation, followed by equivalent lifetime income, then annual income and finally lifetime income. Equivalent (per-capita) income measures are about 2 times as regressive as household-level income measures. Annual income measures are 2 to 3 times more regressive than lifetime income measures. Overall, the policy will be regressive, but there will be variation in how regressive that policy is, depending on which measure of income is chosen to make calculations.

Another factor of the policy's regressivity is in how the tax revenue is used, which will be discussed as a policy recommendation. Governments can further redistribute the revenue, easing the burden on low income households.

Policy insights or recommendations

The regressivity of the policy can be easily offset by the government revenues from the carbon tax. This will help to redistribute the burden of the carbon tax and reduce the harm that the tax incidence will have on lower-income households, making the policy distributionally neutral or even progressive. These new revenues can be distributed as lump sum payments to low-income households. For instance, the paper found that the bottom 4 quintiles of households only need to receive $119, $112, $105 and $76 respectively for the carbon tax to become neutral. The burden of the carbon tax on households would be about 1% of net annual income, which is the share experienced by the top quintile of households. This is feasible too, as governments would still keep a significant portion of revenue.

Revenues could also be used to fund tax cuts for the low-income group. Various taxes are regressive, such as income tax, payroll tax and gasoline tax, and low-income households would benefit from tax cuts from them. Another way to redistribute the carbon tax revenue would be to fund government welfare programs for lower-income households.

References

Grainger, C. and C. Kolstad. 2010. “Who Pays a Price on Carbon?” Environmental and Resource Economics Vol. 46 (3): 359-376.