Comment on

"Distributional Impacts of Carbon Pricing Policies in the Electricity Sector"

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It is a joy to read and comment on a paper like this one written by Dallas Burtraw, Margaret Walls, and Joshua Blonz. They use comprehensive data and modeling to account for many complications in their major effort to measure the effects on ten different income groups from the way in which a cap-and-trade climate policy like the Waxman-Markey bill that passed the U.S. House of Representatives is likely to raise the price of electricity and generate value from permits that may be distributed to households. The result is well written, clear, and convincing. In particular, they employ 82,000 household observations from the Consumer Expenditure Survey from 2004 to 2006, allocate those households into ten annual income deciles, and calculate the expenditure on electricity of each group. Then they use the "Haiku model", which includes specific differences in electricity pricing regulation in 21 different regions of the United States, "accounting for price-sensitive demand, electricity transmission between regions, system operation for three seasons of the year … and four times of day, and changes in capacity investment and retirement over a 25-year horizon."

Effects would be proportional if all groups spent their income in the same proportions, but the data show that the poorest group spends ten percent of their income on electricity, while the richest group spends only 1.2 percent of income on electricity. Hence the effects are regressive. The main question addressed, however, is about the effects of alternative uses of the permit value to help low-income families.

As a baseline, they calculate the effects on each group from a version of the policy that uses 30% of permit value to provide a lump sum per capita (called "cap and dividend"). Then they show the change in those effects from a version where that permit value is returned to customers via price reductions ("conventional behavior") and from a version that reduces the fixed portion of electricity costs for industrial and commercial customers (where only households think marginal prices are reduced).

I think that the result about regressivity would be a bit more clear if the authors showed all three cases, and not just the two latter variants relative to the first baseline. Also, their initial tables show dollar effects on each group, which need to be divided by income to get relative burdens that would show whether any tax is proportional, progressive, or regressive. They do show those relative burdens in later figures, however, so I will leave my only quibbles to this one paragraph, and turn instead next to the main point I want to develop in this comment.

In my slide presentation at the conference where the paper was presented, I suggested that three words could be added to the beginning of the title of their paper, to clarify that the authors present "*Some of the* Distributional Impacts of Carbon Pricing Policies in the Electricity Sector." This is no major criticism of the paper, as *every* paper on any topic is always intended to cover only some effects and not others. It may help readers, however, to understand better which effects are covered here and which are not.[1]

In particular, the paper studies effects on output prices (called the "uses side" in standard tax incidence analysis), and it looks at part of the distribution of the scarcity rents (the 30-50% of permit value that is returned to households). Those represent about one and a half of what I describe as *six* different categories of distributional effects in Fullerton (2009). And the other four might be big!

To categorize the six distributional effects, consider the market for electricity in Figure 1, where demand reflects private marginal benefits (PMB), and production has rising private marginal costs (PMC). For simplicity assume fixed pollution per unit of output, so that social marginal costs (SMC) include marginal environmental costs (MEC). In this diagram, the private market with no policy restriction would produce to the point where PMB=PMC, namely output Q^o. The optimal output is where SMB=SMC, at Q'. A permit policy could restrict output to Q', and we can now categorize distributional effects.

First, this policy raises the equilibrium output price to a new "gross" price, P^g, and it reduces consumer surplus by the trapezoid area A+D. The amount of this price increase and resulting burden is relatively large, as drawn, because the elasticity of demand for this output is low compared to the elasticity of supply. This first effect is regressive, as captured in the model of Burtraw, Walls, and Blonz.

Second, the permit policy may also impose burdens on producers or on factors of production. Figure 1 shows a simple partial equilibrium model, where the loss in producer surplus (area B+E) is relatively small because the supply curve (PMC) is

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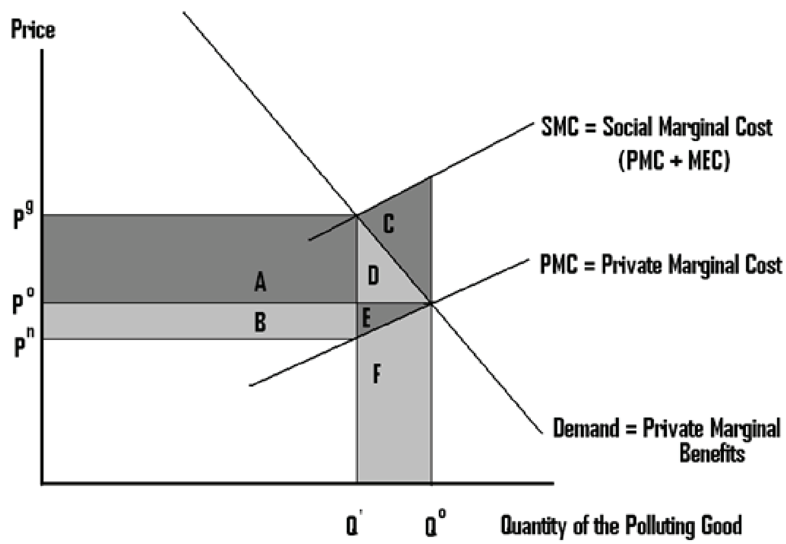
[1] Another good review of environmental policy incidence is in Parry, Sigman, Walls, and Williams (2006).

relatively elastic. These losses could be larger if instead production involves industry-specific resources in relatively fixed supply, such as a specific type of energy, land with specific characteristics, or labor with industry-specific skills. If so, then the cut-back in production burdens the owners of those limited resources. A general equilibrium model could be used to solve for the new economy-wide wage, rate of return, or land rents, and a more sophisticated dynamic general equilibrium model could be used to solve for short run effects, capital deepening, and the transition to a new balanced growth path with a new labor/capital ratio.[2]

Figure 1: Categories of Gains and Losses



Third, when the quantity of the polluting good is restricted in Figure 1, the restriction makes the good scarce and gives rise to scarcity rents (area A+B). To the extent that the permits are auctioned, the government captures some of those scarcity rents as revenue that can be used for any purpose, such as rebates to households. The

[2] Rausch et al (forthcoming, this volume) build a general equilibrium model of carbon pricing that incorporates factor price effects on the sources side as well as output price effects on the uses side. While the effects through output prices are decidedly regressive for reasons explained above, the effects through reduced capital returns and wage rates are progressive and completely offset the uses side.

paper considers 30-50% of permit value that is returned to households. But Waxman-Markey hands out a lot of permits to industry, so much of area A+B becomes profit.[3]

Fourth, a policy to abate pollution also provides environmental benefits. In Figure 1, the gains are represented by area C+D+E, the sum of "marginal environmental costs" over the range that pollution is reduced (from Q^o to Q'). Indeed, the main reason for a carbon policy is to reduce greenhouse gas emissions that cause global warming. The benefits of the policy are reduced disruption to agriculture, sea level rise, and extreme weather events like hurricanes, floods, or droughts. Different income groups may benefit to different degrees. For example, the rich might own more beachfront property that would be saved by an international agreement to reduce emissions.

Fifth, households may be differentially affected by adjustment and transition costs. In Figure 1, area E+F represents the value of inputs no longer employed in this industry. They are often assumed to be re-employed elsewhere, with no loss. Yet a change in policy can be very disruptive, especially for a local economy highly dependent on extracting a particular resource used in electricity generation. Coal mining is often a predominant occupation in a town that can be virtually annihilated by environmental protection. Those individuals may acquire a great deal of industry-specific human capital, the value of which is lost by the shrinking of that industry. This human capitalization effect can imply a much larger percentage loss for individuals than other asset price capitalization effects of environmental policy discussed below.

Sixth, and finally, any of the first five effects might be capitalized into stock prices or land prices, in a way that magnifies gains or losses to particular individuals. The expected future handout of permits or "scarcity rents" (area A+B) is capitalized into corporate stock prices, and the benefits from environmental protection (area C+D+E) is capitalized into land prices. Certainly the saving of beachfront property has an effect on those house prices! The entire present value of the gains described above can be captured by whoever owns a house site at the time of the change. Capitalization effects also apply to human capital, with even greater proportional gains and losses to individuals.

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[3] Parry (2004) uses a stylized analytical model with explicit formulas that show impacts of underlying parameters. He also looks at other pollutants (SO_2 and NO_X) and other policies (performance standards, technology mandates, and taxes on dirty inputs). He finds that grandfathered permits benefit stockholders and thus can provide gains to high-income groups while imposing large costs on the poor.

Interestingly, these capitalization effects move the gains and losses around, sometimes in unpredictable ways. A new environmental mandate on firms imposes costs on shareholders at the time of enactment, not on those who buy later and actually write the check for the pollution abatement equipment. Any gains or losses on waterfront property affect owners at the time, not those who buy later (at a premium or discount).

In general, as pointed out by Burtraw, Walls, and Blonz, higher electricity prices have regressive effects, and rebates to low-income households can offset those regressive effects and allow for environmental protection without adverse distributional consequences. More permits might need to be auctioned, to acquire the revenue necessary to offset these and other unintended distributional effects of climate policy. This point makes it all the more important to use emissions taxes or the auction of permits, rather than to hand out permits to firms in a way that benefits relatively wealthy stockholders.

References

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