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Analysis

Is the Gasoline Tax Regressive in the Twenty-First Century? Taking Wealth into Account

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ABSTRACT

Poterba (1991a) has much influenced the literature on the distributional effects of carbon pricing. Poterba argues that the incidence of energy/environmental taxes across households is better appreciated if the relative tax burdens are measured against total expenditure, interpreted as a proxy for lifetime income, instead of annual income. This way, however, since the distribution of total expenditure is structurally more uniform, the incidence of energy price increases is always less regressive than when annual income is used. This outcome is often taken to lessen the relevance of equity concerns regarding carbon pricing. Almost twenty-five years after Poterba (1991a), Piketty (2014) revived the idea that wealth is a dimension of economic welfare constituting an increasingly important source of inequality. We show that omitting wealth in measuring ability to pay means underestimating the regressivity of carbon pricing and its inequity towards younger people. Using household-level data and statistical matching, we revisit Poterba's application and compare the distributional incidence of the US gasoline tax for different measures of ability to pay: total expenditure, income and wealth-adjusted income. Regressivity is not a reason to forgo carbon pricing as a cost-effective approach to climate mitigation, but calls for consideration and compensation of the distributional effects.

1. Introduction

The idea of taxing fossil fuels in proportion to their carbon content goes back as far as the 1970s, when the threat of anthropogenic climate change started to be recognized.[1] In 1990, Finland was the first country to introduce a carbon tax, followed shortly after by the Netherlands, Sweden and Norway. Today carbon pricing, whether in the form of carbon taxes or cap-and-trade systems, is in force in several countries, but overall is far from being sufficiently diffuse or deep to significantly improve the prospects of climate change. Global greenhouse gas (GHG) emissions have been rising steadily since the industrial revolution and will continue to do so unless counteracting policies are ramped up. In this respect, a change of gear seems finally in sight. An intensification of mitigation policies around the world should materialize under the framework set out by the Paris Agreement.[2] Accordingly, in the next few years carbon pricing is expected to become more widespread and deeper than it is currently.

Most economists favour carbon pricing in that it is a cost-effective approach to reducing GHG emissions (Baumol and Oates, 1971). Nevertheless, carbon pricing in the real world is not popular or easy to implement. For carbon pricing to be politically sustainable, its side effects need to be effectively managed.[3] By raising the cost of energy, unilateral carbon pricing can be detrimental to the international competitiveness of domestic energy-intensive firms. At the same time, carbon pricing tends to affect the poor more than the wealthy in relative terms. That is, it tends to be regressive, at least in developed economies.[4] The revenues generated by carbon pricing, be they the yield of a carbon tax or of the auctions of emission allowances under a cap-and-trade system, could be used to at least partially offset these undesirable effects. Though this is easier said than done,[5] the deeper the level of carbon pricing, the more critical it is that both the competitiveness and distributional issues are properly addressed.

This paper offers a new perspective and new empirical evidence on the distributional incidence of gasoline taxes and, by extension, of carbon

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[1] See, for example, the early contributions of Nordhaus (1977a, 1977b), among the first proponents of carbon taxation.

[2] The Paris Agreement is the international agreement, under the United Nations Framework Convention on Climate Change, dealing with climate mitigation, adaptation and finance, starting in the year 2020.

[3] Moreover, a growing literature deals with the public's cognitive difficulties and worldviews that hinder its adoption. Drews and van den Bergh (2015) provide a comprehensive literature review on the determinants of public support for climate policies.

[4] In developed economies, the income elasticity of energy demand is typically smaller than 1. The same is not necessarily true for developing economies, given the different structure of household demand.

[5] Earmarking is somewhat infrequent and unpopular among economists, as it generally means foregoing alternative more efficient uses of the revenues.

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pricing across households. Specifically, it fills a gap in the literature by considering wealth (net worth) as a dimension of economic welfare additional to income. This innovation provides us with a more accurate representation of reality, in which the wealth owned by a person, or a household, contributes to her ability to pay (taxes). In this sense, ignoring wealth is an omission that alters the portrait of distributional effects, because wealth is both more concentrated than income and also imperfectly correlated with it. This issue appears to be increasingly relevant in light of Thomas Piketty's warning, in his *Capital in the twenty-first century* (Piketty, 2014), that wealth concentrations have been rising and may well continue to rise unless corrective policies are undertaken.

While taking wealth into account is generally desirable for the completeness of any equity assessment, it is particularly opportune in relation to carbon pricing. This is the case for different reasons. First, carbon pricing without a redistributive mechanism linked to it effectively amounts to financing a public good, namely climate stability, through regressive taxation. Not surprisingly, it often encounters strong resistance motivated by equity concerns. Second, the need to reduce GHG emissions and the related commitment of the Paris Agreement, suggest that carbon pricing will become deeper in the near future. Third, following James Poterba's (1989, 1991a, 1991b) work in this field, a significant proportion of the literature plays down the relevance of the distributional effects of carbon pricing. This outcome stems from specific methodological choices, notably that of considering (expected) lifetime ability to pay instead of (observable) current ability to pay.

Using household-level data from the 2012 round of the US Consumer Expenditure Survey (CE) and from the 2013 Survey of Consumer Finances (SCF), we revisit Poterba's 1991 seminal paper *Is the gasoline tax regressive?* (Poterba, 1991a). Poterba's analysis is extended, empirically, by imputing observed wealth in the SCF to households in the CE and, theoretically, by considering wealth as one dimension of economic welfare and, hence, as a complementary measure of ability to pay. Based on annual gasoline expenditure, we estimate the economic burden of the federal gasoline tax ($0.184/gal) relative to three alternative measures of ability to pay: *a)* annual total expenditure, as a proxy for lifetime income (Poterba's approach), *b)* annual income and *c)* annual wealth-adjusted income, which is annual income augmented with a wealth annuity and imputed rental income (for home owners). The analysis of the results consists in the comparison of the three measurements of the relative tax burdens, first, across the respective distributions of ability to pay measures and, then, across the distribution of the head of household's age. The positive correlation between wealth and age, due to the first accumulating over time, indeed implies that the distributional incidence of carbon pricing across age groups changes depending on whether wealth is considered. Considerations about intergenerational equity are generally relevant to climate policy given the difference between the young and the elderly in both the responsibilities for causing climate change and the related costs faced in prospect.

The rest of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 explains why wealth should be considered in this context. Section 4 derives and compares the distributional incidence of the US federal gasoline tax according to alternative measures of ability to pay. Section 5 concludes.

2. Literature Review

The connections between gasoline taxation and carbon pricing are such that our analysis while dealing with the former can be relevant also to the latter. Focusing on gasoline taxes simplifies the analysis in terms of data availability, methodology and assumptions, while remaining sufficient to highlight the role of wealth in the equity assessment of any policies affecting energy prices.

Apart from the substitution between motor fuels with different carbon content (principally gasoline and auto diesel), studying the economic effects of gasoline taxes is effectively equivalent to studying the effects of carbon pricing in the road transportation sector. A second connection between gasoline taxes and carbon pricing concerns the relative degree of regressivity. Price increases in motor fuels are typically less regressive than price increases in home fuels (principally electricity and natural gas), as the demand for the first is more income elastic than that for the second (e.g., Barker and Köhler, 1998; Tiezzi, 2005; Callan et al., 2009; Ekins et al., 2011; Hassett et al., 2012; Kosonen, 2014; Flues and Thomas, 2015; Verde and Pazienza, 2016). As a result, gasoline taxes are usually less regressive than carbon pricing when this is operating in sectors of the economy other than transportation, notably electricity generation and the residential sector.

The following literature review focuses on the methodological aspects most relevant to our analysis. It first covers the empirical studies on gasoline taxes and, subsequently, those on carbon pricing.

2.1. The Distributional Incidence of Gasoline Taxes

The empirical literature on the distributional incidence of gasoline taxes largely uses household survey data to estimate tax burdens, usually quantified by tax payments (or welfare changes, when price changes are considered within demand systems), across income levels or socio-demographic characteristics. The frameworks used are either static or allow for demand response to price changes, sometimes within demand system models estimated under separable utility assumptions. In the applications to developed economies, gasoline taxes are found to be regressive to varying degrees or approximately proportional, in this case often with middle-income households bearing the heaviest burdens.[6] Importantly, however, the results are not independent from some methodological choices. As noted by Sterner (2012a), at least two types of choice can affect the distributional outcome significantly. One concerns the inclusion or exclusion of the households that do not own any vehicles. Since most of these households are at the bottom of the income distribution, their inclusion (exclusion) in the calculations results in a less (more) regressive outcome. The second choice concerns the variable measuring the ability to pay or, rather, the time horizon over which the ability to pay is valued. This is typically the present or, in an ex-ante perspective, a person's lifetime. The longer the time horizon, the less variable is the distribution of economic welfare, due to both earnings patterns over time and income mobility, so gasoline taxes are less regressive over a lifetime. For a number of countries, Sterner (2012b) contrasts the different distributional incidence of the same gasoline taxes obtained using the current ability to pay approach and the lifetime approach.

The present paper deals with the implications of the second choice above. In addressing this question, we are not the first to take a critical stance: Chernick and Reschovsky (1992, 1997, and 2000) were the first, but also the last as far as we are aware. They brought arguments and evidence that fundamentally question James Poterba's lifetime approach to estimating the distributional incidence of gasoline taxes (Poterba, 1991a) and carbon taxes (Poterba, 1991b). Poterba's approach, which leads to the conclusion that these taxes are not regressive over a lifetime, consists in the use of current total expenditure as a proxy for lifetime income and, therefore, as a measure of lifetime ability to pay. Chernick and Reschovsky point out that this approach, which emanates from Milton Friedman's permanent income theory of consumption (Friedman, 1957) and the companion life-cycle model of saving (Ando and Modigliani, 1963), rests on a set of very strong assumptions, namely: *a)* income mobility is very high; *b)* gasoline consumption decisions are made on the basis of lifetime income; and *c)* total consumption is a constant fraction of lifetime income. Using longitudinal data, they cross-check Poterba's results by deriving the distributional incidence of the US gasoline tax over an 11-year period, finding that, with the exception of the bottom 11-year average income decile, the incidence is in fact only slightly less regressive than when annual income is used. The authors emphasize that the main reason for the similarity between annual and intermediate-run tax burdens is low

[6] In developing economies, gasoline taxes are generally progressive (Sterner, 2012a).