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Income Inequality and Carbon Emissions in the United States: A State-level Analysis, 1997–2012

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ABSTRACT

This study investigates the relationship between U.S. state-level CO_2 emissions and two measures of income inequality: the income share of the top 10% and the Gini coefficient. Each of the inequality measures, which focus on unique characteristics of income distributions, is used to evaluate the arguments of different analytical approaches. Results of the longitudinal analysis for the 1997 to 2012 period indicate that state-level emissions are positively associated with the income share of the top 10%, while the effect of the Gini coefficient on emissions is non-significant. The statistically significant relationship between CO_2 emissions and the concentration of income among the top 10% is consistent with analytical approaches that focus on political economy dynamics and Veblen effects, which highlight the potential political and economic power and emulative influence of the wealthy. The null effect of the Gini coefficient is generally inconsistent with the marginal propensity to emit approach, which posits that when incomes become more equally distributed, the poor will increase their consumption of energy and other carbon-intensive products as they move into the middle class.

1. Introduction

Inequality has become a salient political issue in the United States, following the emergence of Occupy, the publication of Piketty's *Capital in the Twenty-first Century*, and continuing economic distress in many parts of the country. Over this same time period, researchers across various disciplines have begun to pay more attention to the role of inequality in climate change. The bulk of attention has been given to international and global inequalities, such as global North-South differences in historic CO_2 emissions (Chancel and Piketty, 2015; Jorgenson, 2014; Rosa and Dietz, 2012), disproportionate impacts of climate effects (IPCC, 2014; Roberts and Parks, 2006) and power imbalances between nations in the global North and South with respect to climate policy (Ciplet et al., 2015; Dunlap and Brulle, 2015). A relatively unexplored question is the role that income inequality plays as a driver of anthropogenic CO_2 emissions. Does the existence of income inequality itself contribute to the volume of emissions? Are societies with more inequality higher emitters? Or is greater income equality associated with higher levels of emissions because there are more middle-class people with carbon-intensive lifestyles?

To the extent that this question has been addressed, most of the studies have taken their unit of analysis as the nation state, asking how domestic measures of income inequality affect CO_2 emissions across countries and over time (Ravallion et al., 2000; Grunewald et al., 2012; Jorgenson, 2015; Jorgenson et al., 2016). The results of these studies are mixed, with findings differing by group of countries, time periods, and modeling techniques (Borghesi, 2006). This is not surprising, as there are a number of different pathways through which income inequality might affect emissions.

In this study, we shift the analysis of CO_2 emissions and income inequality to a different scale—the sub-national, and more specifically the U.S. state level. We analyze anthropogenic emissions across all 50 U.S. states and the District of Columbia, over the period 1997–2012, asking how the level of income inequality within a state is associated with its CO_2 emissions. To our knowledge, with the exception of a preliminary analysis using a more restricted measure of emissions (Jorgenson et al., 2015), the present study is the first to analyze the relationship between CO_2 emissions and inequality in a longitudinal, U.S. cross-state context.[1] Furthermore, we focus on two measures of income inequality that capture different characteristics of inequality within income distributions: the Gini coefficient and the income share of the top 10%. As we note in the following literature review, each of these measures is well suited for empirically evaluating the arguments of different analytical approaches.

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[1] Jorgenson et al. (2015) conduct a preliminary U.S. state-level analysis of the effect of one measure of income inequality – the Theil index – on CO_2 emissions from just the residential sector. Their estimated models include a limited number of control variables, and the literature review and theoretical discussion are short and relatively narrow in scope.

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2. Literature Review

There are a variety of pathways through which income inequality can potentially affect emissions. The research literature, while relatively small, includes multiple approaches that identify different possibilities. The first approach, attributable originally to Boyce (1994, 2007; Boyce et al., 1999), is a political-economy explanation in which income concentration operates mainly via political influence on environmental policy. Boyce argues that the wealthy reap disproportionate economic benefits from polluting activities, both via their ownership of companies that engage in them and because they are better able to protect themselves from negative impacts. They convert their preference for less environmental protection into influence in the political sphere. Studies in this tradition were originally about environmental policies and outcomes other than greenhouse gases, although there are a few recent analyses which address climate change. A second approach, which we term "propensity to emit," argues that at different levels of income, individuals' or households' propensity to consume carbon-intensive goods varies as consumption patterns change (Borghesi, 2006; Grunewald et al., 2012; Ravallion et al., 2000). For this reason, changes in the income distribution across households yield changes in emissions. A third approach posits that greater concentrations of income at the top of the distribution lead to heightened consumption competition and longer hours of work, which in turn increases energy consumption and emissions (Bowles and Park, 2005; Schor, 1998). This is a kind of Veblen (1934) effect in which the wealthy consume expensive, publicly visible goods and services to gain status. We discuss these three approaches in turn.

The political economy approach developed by Boyce (Boyce, 1994, 2007; Boyce et al., 1999) argues that inequality is likely to be associated with higher levels of energy use (e.g., fossil-fuels), pollution and environmental degradation. Increased fossil-fuel consumption has both global and local consequences, given that it leads to higher levels of CO_2 emissions as well as other pollutants with more localized effects, including increases in the emission of carbon monoxide (CO) and nitrogen oxides (NO_x). While Boyce offers a number of arguments about these relationships, a primary one is that the wealthy prefer more pollution. This is both because they are more likely to be owners of polluting firms and because they consume more goods and services, which are in themselves polluting. Thus, environmental protection is costlier for the wealthy, and the wealthy are better equipped to protect themselves from environmental harms while shifting such burdens onto the poor. Boyce concludes that the wealthy are likely to use their economic power to gain political power, which they use to dominate the policy environment.

Boyce identifies a "power-weighted social decision rule" in which those with more economic power, and thus political power, have a larger influence on policy outcomes and use that power to prevent environmental protection. It is worth noting that these dynamics can be occurring even under the standard assumption that the environment is a normal good, that is, people want to consume more "environmental amenities" and by extension "environmental policy," as their income rises. Boyce's hypothesized effects operate alongside the increasing demand for "the environment" as income rises.

Using data from across the U.S. states, Boyce and collaborators (Boyce et al., 1999) estimated a model in which income inequality predicts political power, political power predicts environmental policies, and environmental policies predict environmental stress and subsequently public health outcomes. Environmental sociologists have similarly argued that reducing environmental harms may first require a shift toward greater political and economic equality (Ciplet et al., 2015; Downey, 2015; Roberts and Parks, 2006).

In the second approach, which focuses on the marginal propensity to emit (MPE), there is not a single hypothesis, although Ravallion et al. (2000) find that higher levels of within-country inequality are associated with lower emissions. Thus, they argue, there is a conflict between distributional policies to enhance equality and climate policy to reduce emissions. One argument is that the MPE declines with income, an empirical finding from previous research (Ravallion et al., 2000, citing Holtz-Eakin and Selden, 1995; Schmalensee et al., 1998; Heil and Selden, 1999). However, Ravallion et al. (2000) identify a variety of possible effects operating in different directions such that the relationship between within-country inequality and emissions is theoretically ambiguous. These include the factors identified by Boyce as well as an Ostrom-type effect on the ability to cooperate to achieve policy outcomes (see also Heerink et al., 2001).

In these studies, it is generally argued that consumption demand is the key factor determining MPE. However, this approach does not consider one class of Keynesian effects. In a Keynesian model, lower-income households have a higher marginal propensity to consume than higher-income households, so increases in inequality that lower incomes for the poor should reduce emissions. Accordingly, there is an additional mechanism by which higher inequality may reduce emissions, which is that the poor have a higher propensity to consume.

Finally, the relationship may not be linear. If there are three classes of households—poor, middle class, and wealthy—the propensity to consume and emit may rise and then fall, which would make the relationship between inequality and emissions curvilinear. This is partly supported by the results of Grunewald et al. (2012), who find that the inequality-emissions link varies with the level of inequality. In high inequality countries, reductions in inequality yield lower emissions; in low inequality countries, less inequality yields higher emissions.

The third approach argues that higher inequality leads to more consumption competition (Schor, 1998), which in turn increases emissions. There are two pathways for this effect. The first, a Veblen effect, is that inequality induces status consumption as households increase their spending to keep up with the visible lifestyles of high-income households. (Veblen, 1934; Schor, 1998). Second, growth in inequality has been shown to increase working hours (Bowles and Park, 2005), and cross-national research suggests that longer working hours are drivers of energy consumption and CO_2 emissions via both their impacts on economic growth and on households' consumption choices (Fitzgerald et al., 2015; Knight et al., 2013).

In addition to these approaches to inequality and emissions, there is a growing body of research that investigates how CO_2 emissions are distributed across households. While these studies do not explicitly test for the impact of inequality, a main finding in this research is that higher income households emit more CO_2 than lower income households. For example, Pattison et al. (2014) find that counties in the U.S. with the highest average household incomes have greater consumption-based CO_2 emissions but lower production-based emissions than less affluent counties. They conclude that rich communities are able to avoid some of the consequences of their carbon-intensive consumption by shifting carbon-intensive industrial activities into poorer areas, which is similar to arguments in the international inequality literatures within environmental sociology and ecological economics on the outsourcing of environmental harms from wealthier nations to poorer nations (Dunlap and Brulle, 2015; Martinez-Alier and Muradian, 2015). Weber and Matthews (2008) also find large differences by income, with the highest expenditure households emitting 10 times that of the lowest (see also Boyce and Riddle, 2009; Kunke and Kammen, 2011).

In this study of U.S. state-level emissions, we explore these questions by focusing on two measures of income inequality: the income share of the top 10% and the Gini coefficient. We suggest the former is a more appropriate measure for capturing political economy and Veblen effects than the Gini coefficient, because the potential effect of the top 10% measure depends on the economic and political power and the emulative pull of the wealthy. By contrast, the Gini coefficient does not directly capture the location in the distribution where inequality is occurring, and variation in Gini coefficients can be due to differences between low and middle income households. For the MPE approach, the Gini coefficient remains relevant, although as noted, that approach does not yield clear theoretical predictions.