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Power and Politics in the World-System

A Cross-National Analysis of Environmental Governance

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Abstract

While various researchers and practitioners agree that it will be hard to restructure our current global and local systems to adapt to and mitigate climate change, there is unsurprisingly great disagreement in how and if this can be accomplished and on what level(s), or if this is even what needs to be accomplished. These conversations have continued with the introduction of the "Anthropocene." The dominant interpretation of the concept poses several solutions, one being national government restructuring to support environmental efforts and encouraging behavioral change. To join conversations that critically evaluate the conceptualization and implications of the Anthropocene with the world-systems perspective, we consider how the effectiveness of national environmental governance in reducing CO_2 emissions varies by a country's position in the global hierarchy. Using two-way fixed effects regression, this article tests how one aspect of this environmental governance, environmentally related taxes as a percentage of total tax revenue impacts CO_2 emissions for 75 countries from 2000 to 2011. Given inequities in the global division of labor, which reinforce the dominance of higher-income countries and the exploitation of lower-income countries, we expect the effectiveness of environmental governance to vary tremendously by global position. Our results support the idea that the impact of environmental governance on CO2 emissions varies across countries at different income levels in the world-system, and this is due to external constraints. Such external influence is unsurprisingly neglected in dominant interpretations of the Anthropocene. In line with previous critical research, we argue that these external constraints undermine climate change solutions because they fail to address mutually reinforcing global, political, economic, and environmental inequalities.

Keywords: CO2 emissions, Anthropocene, governance, world-systems, cross-national, climate change

The concept of Anthropocene defines the current geological period as an unprecedented era where human activity has been the dominant influence on the environment and climate. While being a relatively new term, coined in 2000 by Paul Crutzen and Eugene Stoermer, it has become extremely influential for the current understanding of the interaction between humanity and nature (Bonneuil 2015; Conty 2016; Moore 2016). While conceptualizing this interaction is not new, it has reinvigorated discussions across disciplines about how humans impact the environment and how the environment impacts humans. While there are several distinct and overlapping perspectives in this ongoing debate, it is clear that the ideologies we are embedded in, academic or otherwise, will impact our interpretation of the Anthropocene, how we resolve the problems of the Anthropocene, and how we think about the supposed nature/culture divide (Conty 2016).

For example, some Critical, Marxist, and Metabolic Rift theorists, among other theoretical perspectives point out that the concept of Anthropocene helps further mask the power dynamics holding up the supposed nature/culture divide (Moore 2014; 2016; Malm 2015; Hornborg 2003). These perspectives view the nature/culture divide as an apparatus that allows for the exploitation of nature through "othering" and perpetuates an exploitative world-system (Moore 2016). Some of these researchers view the Anthropocene as a scapegoat, masking the global political inequalities, exploitations, and power that have created the environmental crises we are currently experiencing (Moore 2016). While the Anthropocene does not exactly "hide" inequalities, it can be viewed as more of a symptom or artifact of dominant paradigms or ideologies, such as the culture of capitalism (Foster, Clark, and York 2011). Critical scholars recognize inequalities when they see how the Anthropocene has been constructed and redefined as a "human struggle," which implies that we are all to share the burden because we as a species exploited nature (Altvater 2016).

However, some countries, groups, and individuals have had a heavier hand in this destruction, and many more reify and hold up the existing structures they are embedded in (Jorgenson 2016). But to pretend like the burden is equal mutes the inequalities in the world-system that, depending on what group of scholars you ask, drives the very nature/culture divide (as well as the idea that there *is* a divide) we see today (Moore 2016; Haraway 2016; McBrien 2016). The way the Anthropocene is framed, with humanity's actions as the cause, erases inequality, which is convenient for the hegemonic powers and ideologies that are responsible for the majority of the environmental damage. Thus, many have argued for the term "Capitalocene," coined by Andreas Malm (2015) instead, to capture what rationalized dogmatic Western science in the current geopolitics of knowledge failed to encapsulate in their nomenclature (Moore 2016). "Capitalocene" captures the inequality the Anthropocene overlooks and sees capitalism as a system that organizes *all* of nature rather than a Green Arithmetic of "society + nature," which further perpetuates a "nature/culture" divide (Moore 2016).

This perspective raises the question, how can the Anthropocene as a way of conceptualizing the current era resolve the nature/culture divide if it pretends nature is separate from humanity, and conveniently leaves out what many of us believe started, or at least furthers the "rift" between nature and humans? Expanding upon this idea, it will be hard to restructure our current global system to adapt to and mitigate climate change. Within our global configuration as nation-states,

the country is often held up as the essential force to enforce and enact strategies to overcome climate change, generally by focusing on reducing their CO_2 emissions, which has been the center of international conferences and treaties such as the Kyoto Protocol or the Paris Agreement (Sommer 2018; Hargrove et al. 2019). Following these global initiatives, which have their own dominant political agendas and narratives, countries were invited to strengthen their own and other country's abilities to limit global warming below 1.5 degrees Celsius through better environmental governance and capacity building initiatives (Gareau 2012). The general suggestion encourages countries to develop and use technological solutions and other management techniques and individual behavior changes to limit current emissions such as adopting new policies and raising environmental taxes, which is consistent with how much of the academy approaches the implications of the Anthropocene (Conty 2016; Duit 2016).

However, many have questioned the country's ability to reduce environmental issues when not actually addressing the roots of climate change. The "roots" of climate change or "rift" between nature and humans has been explored in several ways, including conceptualizing a treadmill of production, an ecologically unequal exchange of resources, and how a culture of capitalism locks us economically, politically, and socially into an over-producing, consuming, wasting, and unequal global society (Schnaiberg, Pellow, and Gould 2008; Bunker 1985; Bartley and Bergesen 1997; Kick et al. 1996; Jorgenson 2016; Shandra, Shircliff, and London 2011; Foster, Clark, and York 2011). In fact, previous cross-national research finds little support that national actions, like government spending, impact environmental outcomes (Jorgenson and Burns 2007; Shandra 2007; ShandraShircliff, and London 2010; Shandra and Shor 2008; Sommer 2018).

Put differently, there is a complex matrix of inequalities in systemic power within the world-system that define a country's autonomy in relation to the "environment" (i.e., material resources) and the rest of the world. Building on Evans (1995), we argue that countries have agency to make decisions and shape their governance, but only within an intricate web of external and internal constraints. Thus, our research aims to understand the impact of national actions while considering the broader world-systems hierarchies countries exist in. This intervention is of particular importance given the dominant interpretation that the issues the Anthropocene illuminates can be mended through increased efficiency, technology, and individual behavioral changes. We argue that this interpretation misses the importance of power and ideology in addressing climate change.

Using the aforementioned perspectives, our arguments are threefold: 1). the impact of environmental governance on CO_2 emissions varies across countries at different income levels in the world-system due to the external constraints (which are masked by the dominant interpretation of the Anthropocene); 2). external constraints pose a risk for the ability of the state to overcome climate change using its current approach (environmental governance efforts like increased environmental taxes); and 3). introducing more environmental related taxes further puts the onus of responsibility of the individual rather than acknowledging external and internal historical processes of inequality. The conceptualization of the Anthropocene, like the dominant paradigms before it, ignores how power dynamics in the world-system lead to different levels of effectiveness for the same environmental policy. While some have had a greater hand than others in creating the

nature/culture divide (if and whenever it began), this idea runs the risk of further diffusing the blame on an abstract powerful group, and allows us to distance ourselves from the decisions many of us make every day that hold up the existing power and politics in the world-system.

Specifically, the arguments above are derived from empirical tests presented in this article, which begin to assess how the strength of environmental governance (environmentally related taxes as a % of total tax revenue) impacts CO_2 emissions (metric tons per capita) for 75 countries by world-systems position from 2000 to 2011 using two-way fixed effects regression (Verburg et al. 2016). The main independent variable in this analysis measures one important aspect of a state's environmental governance, as state taxes for the environment is a representation of how much a country values its environment monetarily, while controlling for a county's internal and external constraints. Thus, empirically we ask two main research questions: 1). How does one aspect of environmental governance, environmentally related taxes, impact CO_2 emissions; and 2). How does variation in the strength of environmental governance change across countries at different income levels in the world-system impact CO_2 emissions?

The article is organized as follows: first, we review previous cross-national research on the relationship between state factors and environmental outcomes and research analyzing how a country's position in the global hierarchy can have differential effects on environmental outcomes. We situate this theoretical perspective in a critical understanding of the Anthropocene. Then, we draw on previous theory from the environmental state perspective and world-systems perspectives to explain why environmental governance may impact CO_2 emissions and how global stratification and the global division of labor may lead to differing impacts of environmental governance on CO_2 emissions. After reporting the findings, we discuss how external constraints may pose a risk for overcoming climate change, but we should try to resist others interpreting our focus on externalities as an excuse for a lack of transformation at any level.

Previous Research

State Spending and the Environment

Building on developmental state perspectives (i.e., Evans, Rueschemeyer, and Skocpol 1985), researchers have argued that countries with higher levels of state spending should have less environmental issues because they generally have a greater capacity to create and enforce environmental regulations, the potential to expend resources for environmental protection, and the ability to protect their land from excessive domestic and corporate extraction of natural resources (Crenshaw and Jenkins 1996). This has often been called the environmental state perspective, whereby countries with more resources or activities to incentive environmental protection tend to have better environmental outcomes (Duit 2016).

On the one hand, researchers find support for these ideas. For example, Jorgenson and Burns (2007) find that higher levels of state spending are associated with less forest loss. Moreover, Shandra et al. (2009) find some evidence that higher levels of government spending are related to lower levels of threatened mammal species. However, several researchers find that state spending does not predict significant variation in forest loss (Shandra 2007; Shandra et al. 2010; Shandra and Shor 2008), unless a country has strong levels of governance (Sommer 2018). Still further

analyses find that the environmental state does not predict organic water pollution (Shandra, Shor, and London 2008; 2009).

While previous research has not investigated the impact of government spending as a whole on CO_2 emissions some studies find evidence that other state factors like governance and democracy reduce CO_2 emissions (Gani et al. 2012; Wang, Zhang, and Wang 2018; Neumayer 2002; Gallagher and Thacker 2008; Page and Redclift 2002), though these results are also mixed (Hargrove, Qandeel, and Sommer 2019; Li and Reuveny 2006; Scruggs 1999; 2001; Ergas and York 2012; Shandra et al. 2004; Jorgenson 2009; 2012). Others find that military expenditures increase CO_2 emissions (Bradford and Stoner 2017; Clark, Jorgenson, and Kentor 2010; Jorgenson, Clark, and Kentor 2010). Thus, there has been no cross-national empirical test of how a country's environmental governance or spending specifically impact CO_2 emissions. Though, world-systems theorists have addressed this idea through other avenues.

Differential Impacts by a Country's Position in the Global Hierarchy

World-systems theorists, among others, developed the idea that the world is organized in a single interconnected system through a unified division of labor (Wallerstein 1974). This structure is inherently unequal, whereby more powerful countries exploit weaker countries, reinforcing the dominance of the core (Young et al. 2006). Within this system, activities are mostly valued in terms of their labor, or what is materially produced, rather than something more immaterial, like a sense of belonging or fulfillment. Researchers have long been committed to analyzing the processes and dynamics behind the world-system (Chase-Dunn 1999; Bunker et al. 2007; Jorgenson and Rice 2005). Building on research within world-systems perspective, cross-national researchers argue that CO_2 emissions are unequally distributed across income-levels (Jorgenson 2003).

This body of research suggests that CO_2 emissions are higher in some countries rather than others because of different forms of labor they contribute to the global market, which is linked to past historical processes such as colonialism and current inequalities like trade deals. For example, some forms of labor are valued more highly than others and thus are more profitable than others. The labor involved in collecting natural resources, fitting in with critical research on the Anthropocene, is valued very low in the current dominant system as natural resources are considered cheaply exploitable and plentiful. The forest loss, polluted air and water, mining deaths, and conflicts among other atrocities to human life, well-being, and a sense of belonging are not considered in this calculation (Jorgenson 2012; Shandra 2007). Those who have dominance in the world-system define what types of labor are valuable, creating or reestablishing pre-existing inequities. These inequities, among others, have implications for if and how countries experience and reduce environmental damage. However, there is great variation within this simplification of the global political economy.

For example, several researchers have focused on how greenhouse gas emissions vary by world-system position and greenhouse gas emission type (Roberts and Grimes 1997), pointing out how while there is a hierarchy of emitters from more wealthy countries to poorer countries, the core is not alone in its production of greenhouse gas emissions nor is it able to export all its

emissions to less wealthy countries (Burns, Davis, and Kick 1997). While CO_2 emissions are exacerbated by global economic stratification (Dietz and Rosa's 1997), world-system position tends to increase per capita consumption of natural resources, whereas more unequal countries tend to consume fewer natural resources (Jorgenson 2003). Other researchers have begun to see how different factors, like global environmental regime embeddedness (i.e., international environmental non-governmental organization memberships and signing onto multilateral environmental treaties), impact environmental factors. For example, Shorette (2012) finds that there is differential decoupling within the global environmental regime by world-system position for pesticide and fertilizer use.

While variation exists within different categories of the world-system and there are often outliers that diverge from these common conceptualizations (Jorgenson 2003), overall, there is convergence for the idea that more wealthy countries tend to benefit both environmentally and economically than less wealthy countries. Case studies have addressed the mechanisms underlying these processes. For example, Gareau (2012) finds that the Montreal Protocol has failed to remove all ozone-depleting substances due to the United States' actions and influence, as industry actions used U.S. hegemony to reinforce their dominant positions in the global market.

There have been several calls for researchers to continue to explore this variation, focusing specifically on the ways states and social institutions are embedded in global hierarchies that undermine attempts to reduce climate change (Gareau 2012). These calls have also insisted that we aim to differentiate by world-system position more broadly to see the complexity of exploitation and inequality involving environmental matters beyond an increasingly simplistic and antiquated North-South divide (Ciplet and Roberts 2017).

Following these calls, this article aims to combine both the environmental state perspective and world-systems perspectives to understand how the strength of environmental governance in each zone in the world-system impacts the natural environment, specifically CO_2 emissions.

Environmental Governance and World-System Positionality

According to the environmental state perspective, countries that prioritize environmental protection activities, policies, and regulations should experience less environmental damage (Duit 2016; Sommer 2018). Activities to promote the adoption of greener technology (subsidizing), corporate regulation (taxation), and establishing environmental rights for citizens (right to clean air), among others, incentivize activities that protect the natural environment and penalize environmentally damaging behaviors (Shelton 1991; Melo-Escrihuela 2008; Boyd 2012; Lewis 2018). Environmental states are thought to exist on a continuum, ranging from weak to strong in terms of the responsibility they take for environmental protection, including the activities they promote, create, and enforce (Duit 2016).

Theoretically, strong environmental states should make it easy for citizens to adopt environmentally friendly practices, such as subsidizing electric cars to make them affordable, while also incentivizing its companies to adopt greener practices with tax breaks. Likewise, strong environmental states will also penalize citizens for not conforming to environmental laws through fines and tax polluting companies (Melo-Escrihuela 2008; Boyd 2012; Lewis 2018). Such states

will provide these incentives to reduce the barriers for individual and corporate environmental compliance and create penalties for those that willfully ignore environmental obligations despite such support. For example, Sweden can be considered a strong environmental state because it has invested in an affordable and accessible public transportation system to limit emissions as well as disincentivize using cars through heavily taxing gasoline.

Weak environmental states have not yet or have incompletely renegotiated how individuals and groups will be protected from environmental harm and in return comply with environmental duties (made accessible by the state). The failure of the state to protect its citizens from environmental issues, incentivize sustainable livelihoods and businesses, or reduce damaging corporate extraction of natural resources and polluting activities are some signs of a weak environmental state (Sommer 2018). For example, the Democratic Republic of the Congo fails to enforce environmental laws and protect its population from mining-induced pollution hotspots, among others (UNEP 2017). Following this logic, Sweden tends to have better environmental outcomes than the Democratic Republic of the Congo due to its strong environmental state.

While this perspective is straightforward and simple, it tends to lack nuance as to why there are disparities in the environmental strength of states. It fails to recognize the processes that enabled countries like Sweden to have the resources to strengthen its environmental state and the processes that prevented the Democratic Republic of the Congo from having a strong environmental state and that these processes are interrelated (Jorgenson 2016). It also tends to reinforce biased representations of rich countries as environmentally friendly and poor countries as corrupt polluters instead of incorporating long-standing global inequalities, or a less ethnocentric interpretation of the agency of people and countries, as the key explanatory factor.

Thus, it is important to recognize that in practice it would be impossible to put states on a continuum of strong to weak environmental states because countries are complex units that have internal conflicts, competing interests, and external constraints that shape a wide variety of environmental protections and destructions which leave states in something that looks more like organized environmental hypocrisy than a unified green state (Brunsson 1989; Weaver 2008; Sommer et al. 2017). Countries have a kind of embedded autonomy when it comes to environmental issues—they have agency to make decisions and shape their governance within a complex web of external and internal pressures (Evans 1995).

World-systems perspectives can be coupled with the environmental state perspective to enhance its explanatory power in conceptualizing and understanding why the capacity or ability to protect the natural environment varies so much from country to country. Environmental governance, defined as the strength of the state for environmental protection, should vary by a country's position in the global hierarchy given inequities in the global division of labor, which reinforces the dominance of higher-income countries and the exploitation of lower-income countries (Wallerstein 2004). Given this division of labor and power, countries within different income levels may face similar internal and external constraints that can impact their national environmental governance. Thus, breaking down countries into similar income groups is intended to conceptualize the different internal and external constraints one country group may have that

may be different from another country group. Some country groups, given their positionality, have different opportunities than other country groups. It is important to note that higher or lower-income countries do not necessarily have more or less opportunities, but different opportunities. This is not an attempt to depoliticize these categorical distinctions, but rather to invoke the agency of countries, groups, and individuals, among others (Smith 2018). Table 1 below is an attempt to begin to describe how the global division of labor by a country's position in the global hierarchy using the World Bank's income classifications may impact the effectiveness of environmental governance at reducing CO_2 emissions given their potentially shared internal and external constraints. Using these income group classifications, rather than simpler distinctions between a trimodal core, semi-periphery, and periphery, allows for more analytical specificity instead of lumping widely divergent countries together. For example, separating high-income OECD countries from high-income non-OECD countries could provide more clarity in how environment-related taxes impact CO_2 emissions. However, this conceptualization is still limited by homogenous generalizations and may not fit all countries in the group. For example, Jorgenson (2003) finds several countries are outliers in his study of ecological footprints, as they do not conform to common conceptualizations in world-system positionality.

Table 1. Environmental Governance and World-System Positionality

World-System Position[1]	Description	Potential Impact on Effectiveness of Environmental Governance	Sample
High-income OECD (GNI per capita of $12,536 or more)	Capital-intensive production in service and design-based industry, controls global finances and viewed as dominant producer of knowledge	Funds supporting activities that only appear or are misrepresented as environmentally beneficial (greenwashing)	Australia (2000-2011); Belgium (2000-2011); Canada (2007-2010); Chile (2000-2011); Czech Republic (2000-2011); Denmark (2000-2011); Estonia (2000-2011); Finland (2000-2011); France (2000-2011); Germany (2000-2011); Greece (2000-2011); Iceland (2000-2011); Italy (2000-2011); Japan (2000-2011); South Korea (2000-2011); Luxembourg (2000-2011); Netherlands (2000-2011); New Zealand (2000-2011); Norway (2000-2011); Poland (2000-2011); Portugal (2000-2011); Slovak Republic (2000-2011); Slovenia (2000-2011); Spain (2000-2011); Sweden (2000-2011); Switzerland (2000-2011); United Kingdom (2000-2011); United States (2000-2011)

Table 1. Environmental Governance and World-System Positionality *(Continued)*

High-income non-OECD (GNI per capita of $12,536 or more)	Less control on global finance and less global political-economic power, though benefits from higher-income	Funds supporting environmental activities but focused on economic growth efforts that undermine environmental protection	The Bahamas (2000-2011); Croatia (2000-2011); Cyprus (2000-2011); Latvia (2000-2011); Lithuania (2000-2011); Malta (2000-2011); Singapore (2005-2011); Trinidad and Tobago (2000-2011); Uruguay (2000-2011)
Upper-middle-income (GNI per capita between $4,046 and $12,535)	Highly industrialized, less sophisticated technology, manufactured goods	Use environmental funds for sustainability efforts but may focus more on economic growth narrative perpetuated by high-income OECD countries	Argentina (2000-2011); Belize (2000-2011); Brazil (2000); China (2000-2011); Colombia (2000-2011); Costa Rica (2000-2011); Dominican Republic (2000-2011); Ecuador (2000-2011); Hungary (2000-2011); Jamaica (2002-2011); Kazakhstan (2000-2011); Malaysia (2000-2011); Mauritius (2007-2011); Mexico (2000-2011); Panama (2000-2011); Peru (2000-2011); Romania (2000-2011); South Africa (2000-2011); Tunisia (2000-2011); Turkey (2000-2011); Venezuela (2000-2011)
Lower-middle-income (GNI per capita between $1,036 and $4,045)	Industrialized but relies heavily on producing manufactured goods	Aim for environmental sustainability and cleaner production despite less technology, but perhaps less entrenched in fetishizing economic growth and more removed from corporate penetration	Bolivia (2000-2011); Cabo Verde (2000-2006); Cameroon (2000-2011); Cote d'Ivoire (2000-2008); El Salvador (2001-2011); Guatemala (2001-2011); Honduras (2000-2011); India (2005-2011); Morocco (2000-2011); Nicaragua (2000-2011); Paraguay (2005-2011); Philippines (2000-2011); Senegal (2002-2011);
Low-income (GNI per capita of $1,035 or less)	Lower-skill, labor intensive, natural resource and raw material extraction	Environmental efforts may be undercut by transnational corporate involvement and pressure to export natural resources (unequal exchange)	Niger (2000-2011); Rwanda (2000-2011); Togo (2000-2011); Uganda (2000-2011)

[1] By World Bank (2019) income classification

The role of higher-income countries in the global production of goods and services tends to rely heavily on branding and advertising (Wallerstein 1974; Bornschier and Chase-Dunn 1985; Walton and Ragin 1990). While such states generally have the resources to incentivize sustainable goods, the multiple inequalities throughout their supply chains coupled with a compulsion for capital accumulation has the potential to turn well-intentioned, science-based environmental protections and activities into a façade of greenwashing while continuing business as usual (Roberts and Grimes 1997). However, the relative power of OECD countries may be the determining factor in the effectiveness of environmental taxes, as they may pervert environmentalism to reinforce their dominance while posturing sustainability (Shorette 2012). This leaves the appearance of a unified green state along the lines of what the same hegemonic forces constructed the image of the strong environmental state to be. Following this reasoning,

environmental governance may increase CO_2 emissions in higher-income countries, though this may vary by whether the country is part of the OECD.

Though middle-income countries have less resources and power (given the dominant value system) than higher-income countries, countries at this income range may exploit the relatively cheap prices of raw materials from lower-income countries to sustain their manufactured production with the added benefit of (following higher-income countries) exporting their environmental issues to lower-income countries. However, this relationship may vary within the middle-income category, where upper-middle-income countries may align more closely with higher-income countries while lower-middle-income countries may actually aim to protect the natural environment (perhaps in itself or for social gain) rather than employ greenwashing (Shorette 2012; Frank et al. 2000).

Finally, efforts of low-income countries to strengthen their environmental state may be undercut by external pressures to export natural resources, such as appeasing multi-national corporate interests (Gereffi 1989; Hornborg 2009). Additionally, internal pressures such as providing health and food resources for its population, repayment of loans, and other constraints often linked to colonialism, neoliberalism, and other practices enacted by hegemonic forces to destabilize and dominate low-income countries, potentially rendering their environmental efforts less successful or less pertinent (Bryant and Bailey 1997; Evans 1979). Here too, just as is true within all income categories, accumulating wealth and facilitating corruption will also weaken environmental efforts (Sommer 2017). Therefore, a country's position in the global hierarchy may impact their ability to take responsibility for environmental issues through renegotiating the environmental rights and duties of citizens and providing incentives and penalties to ensure compliance by individuals and various interest groups (citizens, NGOs, small-businesses, corporations, local governments, etc.).

Thus, we suggest the following hypotheses:

1). Environmentally related taxes are associated with lower levels of CO_2 emissions.

2). Environmentally related taxes increase CO_2 emissions in higher-income countries, reduce CO_2 emissions the most in middle-income countries, and increases CO_2 emissions in low-income countries.

Methods and Data

Modeling Technique and Sample

We use two-way fixed effects regression with clustered robust standard errors to analyze the data (Hargrove et al. 2019). This is the most appropriate modeling technique for several reasons. First, due to the availability of panel data, it would be inappropriate to use ordinary least squares regression because it assumes observations are independent. Second, it is common for time invariant unmeasured factors that differ across countries to be present in cross-national longitudinal data (Alderson and Nielsen 2002). Panel regression techniques consider variables on two dimensions: cross-sectional units of observation and a temporal reference (Halaby 2004; Hsiao 2003). Third, we use two-way fixed effects analysis following previous research as it controls for

both time and unobserved factors and estimates general trends for comparisons within countries over time (Jorgenson et al. 2010; Jorgenson and Clark 2013). Fourth, according to the Sargen-Hansen test statistic, fixed effects models are more appropriate than generalized least squares random effects models. Therefore, only fixed effects estimates are provided here.

The sample includes 75 countries across all income levels with 842 observations from 2000 to 2011. The panel is unbalanced with a minimum of 1, an average of 11, and a maximum of 12 years per country. Data is included for each time point available rather than intervals to include more observations instead of averaging across sub-periods to avoid erasing any variation in the data. This analysis includes all data available. The sample is limited to 75 countries using listwise deletion of missing data.

We check for regression assumptions including linearity, multicollinearity, heteroskedasticity, outliers, influential cases, specification error, and endogeneity (Alderson and Nielsen 2002). To ensure linearity, variables are logged when appropriate (indicated in Table 2). To see if multicollinearity is problematic in the models, we calculate a bivariate correlation matrix for all variables in the analysis (Table 3). We also identify the variation inflation factor (VIF) scores for each model by using corresponding pooled OLS regression. There are a few high correlations; namely, democracy, international non-governmental organizations (INGOs), and GDP per capita. Each of these variables are removed from the model one at a time to see if their inclusion biased the statistical significance of and of the independent variables. The main results are substantively the same, so these variables are included in the present models. Heteroskedasticity is also minimized with robust standard errors. To test for outliers and influential cases, we calculate standardized residuals. There are no country years for which standardized residuals exceeded an absolute value of 3, indicating no potential problems with outliers (Frees 2004). While it is difficult to ensure the models are not in violation of specification error, we have aimed to include a similar number of independent variables and specific factors based on recent research that uses similar modeling during the time period the data are available for (Hargrove et al. 2019). Finally, endogeneity can be problematic when one of the independent variables is jointly determined with the dependent variable being explained (Sommer et al. 2020; Wooldridge 2015). In this case, endogeneity may be biasing the estimates because environment-related taxes are not randomly assigned and may be linked to other factors external or internal to a country. For instance, a country might increase its environmental taxes because of its high levels of CO_2. If this is the case, then the regression equation would be capturing the selection of levels environmental taxes as well as the effects of prioritizing environmental taxes in one parameter. To test for this, researchers usually find a variable to be an instrument that is correlated with the independent variable under question but not the dependent variable. After selecting an instrument, we ran the Davidson-MacKinnon test of exogeneity. The results are inconclusive, as it is difficult to find relevant instruments that meet all requirements, though the main findings remain consistent to those reported. It is also important to note that including 1-5 year lags on the dependent variable nor main independent variable does not substantively change the results. From these tests, there

appears to be no egregious issues with violating regression assumptions. A summary of all included variables and descriptive statistics is in Table 2.

Table 2. Descriptive Statistics and Definitions

Variables	Description (Source)	Mean (Std. Dev)	Range
Dependent Variable Carbon dioxide emissions per capita (ln)	Total CO_2 emissions in metric tons per capita (World Bank 2019; Jorgenson 2012)	.242 (1.786)	-7.452-4.604
Independent Variables			
Environmental Taxes	Environmentally related taxes, % total tax revenue (OECDStat 2019).	7.639 (4.293)	-11.503 – 35.361
Democracy Composition Index of Political Competition and Political Participation	Political competition measures the percentage of votes gained by smaller parties in parliamentary and presidential elections. The political participation variable measures the percentage of the population that voted in a parliamentary and presidential election (Vanhanen 2014).	16.132 (12.099)	0-46.2
International Non-Governmental Organizations	The total number of International Non-Governmental Organizations (Boli and Thomas 1999)	510.008 (702.335)	0-4339
GDP per capita constant USD (ln)	The sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products (World Bank 2019; Jorgenson 2012; Jorgenson et al. 2010)	7.423 (1.691)	3.566-12.175
Total population (ln)	Number of residents in a country (World Bank 2019; Jorgenson 2012; Jorgenson et al. 2010)	14.801 (2.372)	8.361-21.344
Manufacturing as % GDP	Total value added by manufacturing industries standardized by GDP (World Bank 2019; Jorgenson 2012; Jorgenson et al. 2010)	14.097 (7.803)	0-47.344
Trade as % GDP	Total value of trade standardized by GDP (World Bank 2019; Jorgenson 2012; Jorgenson et al. 2010)	77.688 (49.586)	.309-562.060
Foreign Direct Investment Stocks as % of GDP	Cumulative total of external private investment in a country standardized by GDP (Shandra et al. 2004)	40.353 (165.351)	0-4851.724
Arable land as a % of land area	Total arable land standardized by land area (World Bank 2019; Gani 2012)	13.508 (13.488)	.001-73.389

Table 3. Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) CO2 emissions	1.000									
(2) Environmental Taxes	-.118	1.000								
(3) Democracy Index	.621	-.011	1.000							
(4) INGOs	.565	-.116	.670	1.000						
(5) GDP per capita	.857	-.156	.761	.705	1.000					
(6) Manufacturing as % GDP	.198	.031	-.023	.175	.037	1.000				
(7) Total Population	-.025	-.012	-.156	.408	-.124	.388	1.000			
(8) Trade as % GDP	.253	-.117	.067	-.094	.245	.084	-.454	1.000		
(9) FDI as % of GDP	.152	-.010	.102	-.038	.189	-.098	-.279	.380	1.000	
(10) Arable land	-.059	.215	.153	.274	-.054	.086	.194	.028	-.009	1.000

Dependent Variable

Carbon dioxide emissions (metric tons per capita). CO_2 emissions (metric tons per capita) represents the impact on climate change of a country standardized by the size of its population. This variable is logged to correct for skewness. We chose this dependent variable for two main reasons. First, greenhouse gas emissions, especially CO_2, are responsible for unprecedented global temperature rise and have been steadily increasing since 1970 and have accelerated further in the time-period of this analysis. According to the Intergovernmental Panel on Climate Change's (IPCC) 2018 special report, we are in danger of surpassing a 1.5 C increase in global mean temperature compared to pre-industrial levels by 2030. CO_2 emissions are thus an important measurement under the geological conceptualization of the Anthropocene. Such researchers find that temperature increase will lead to catastrophic outcomes for humans and the environment, including rising sea levels, more intense and erratic storms, desertification, extreme water stress, and more severe weather events (IPCC 2018). Second, given the current global economic system of capitalism and culture of waste and pollution it produces through the constant intensifying of production, CO_2 emissions is an important dependent variable to analyze, especially when applying theory concerning world-system positionality. In particular, it is one of few common environmentally related dependent variables used in cross-national analyses where generally, higher-income countries have more outputs than lower-income countries (compared to forest loss which is higher in lower-income, not higher-income countries). Thus, this variable is extremely relevant for the time period the environmental governance data are available for and understanding how internal and external political-economic factors influence CO_2 levels.

Main Independent Variable

Environmental Governance. This variable measures environmentally related taxes as a % of total tax revenue (OECDStat 2019). These data were collected from OECDStat. As detailed above, this measure is intended to capture a state's environmental governance. While there are several ways to characterize environmental governance (i.e., administration, regulation, redistribution, and knowledge production, etc.), this article focuses only on environmental related taxes (Duit 2016) due to theoretical relevance and data availability. Thus, this analysis can only reveal a partial picture of the environmental governance arrangements in countries in the sample.

World-System Position. We also create a variable using the World Bank income classification as a proxy for world-system position (described above). Per the theory section above, we believe that

interacting environmental governance with world-system position will uncover hidden power dynamics in the effectiveness of environmental governance to mitigate carbon emissions.

Other Independent Variables and Controls. Following previous studies, we control for democracy composition (Vanhanen 2014), the total number of INGOs, GDP per capita, total population, manufacturing as a % GDP, trade as % GDP (Jorgenson 2012; Jorgenson et al. 2010), trade, foreign direct investment stocks as a % of GDP (Shandra et al. 2004), and arable land as a % of land area.

Findings

Table 4 contains the two-way effects regression estimates of environmental governance on CO_2 emissions in metric tons per capita. The first equation (4.1) contains the base model of the effect of environmental governance on CO_2 emissions. The remaining five equations include the interactions between high-income OECD (4.2), high-income non-OECD (4.3), upper-middle-income (4.4), lower-middle-income (4.5), and low-income countries (4.6). World-system position is classified using the World Bank's atlas method for income classification (World Bank 2019). These breakdowns by USD are included in Table 1 above. This measurement correlates highly with other breakdowns (Shorette 2012; Kentor 2015; Van Rossem 1996). The number presented is the unstandardized coefficient. We report one-tailed tests corresponding to the directional nature of the hypotheses. In every equation, we include an index of democracy composition, INGOs, GDP per capita, total population, manufacturing as % GDP, trade as % GDP (Jorgenson 2012; Jorgenson et al. 2010), and arable land % of land area.

In equation (4.1), we find that the coefficients for environmental governance are negative and statistically significant. This suggests that environmental governance is associated with lower levels of CO_2 emissions. The remaining models interact environmental governance by a country's position in the global hierarchy. In Equation (4.2), the coefficient that represents the interaction for high-income OECD countries is positive and statistically significant, while equation (4.5),

Table 4. Effects of Environmental Governance at Different Positions in the Global Hierarchy on CO2 Emissions as a % of GDP[a]

	Base (4.1)	High-income OECD (4.2)	High-income non-OECD (4.3)	Upper-middle-income (4.4)	Lower-middle-income (4.5)	Low-income (4.6)
Environmental Governance	-.004*	-.005*	-.004	-.004	-.003	-.006*
Environmental Governance X High-income OECD		.025*				
Environmental Governance X High-income non-OECD			-.004	.		
Environmental Governance X Upper-middle-income				-.001		

Environmental Governance X Lower-middle-income					-.014*	
Environmental Governance X Low-income						.018*
Democracy Index	.002	.002	.002	.002	.003	.003
INGOs	-.001	-.001	-.001	-.001	-.001	-.001
GDP per capita (ln)	.330***	.323***	.330***	.331***	.330***	.334***
Manufacturing as a % of GDP	.014*	.013*	.014*	.014*	.013*	.014*
Total Population (ln)	.417	.414	.432	.419	.370	.452
Trade as a % of GDP	.001**	.001*	.001**	.001**	.001**	.001*
FDI as a of GDP	-.001	-.001	-.001	-.001	-.001	-.001
Arable Land as a % of land area	.007	.007	.007	.007	.008	.009*

[a]Numbers listed are the unstandardized coefficients.
* indicates $p < .05$, ** indicates $p < .01$, and *** indicates $p < .001$ for a one-tailed test

which includes the coefficient that represents the interaction for lower-middle-income countries, is negative and statistically significant. The coefficient that represents the interaction for low-income countries in equation (4.6) is positive and significant, just like the coefficient that represents the interaction for high-income OECD countries. The coefficients that represent the interaction terms for high-income non-OECD countries (4.3) and upper-middle-income countries (4.4) fail to reach levels of statistical significance. Thus, environmental governance is not related to CO_2 emissions in high-income non-OECD countries and upper-middle-income countries. These results are generally consistent with previous research and theory (Shorette 2012) though they reveal additional nuances.

Additionally, we find a number of other factors are associated with CO_2 emissions. First, we find that the coefficients that represent GDP per capita are positive and significant. This suggests that higher levels of GDP per capita correspond with more CO_2 emissions, which is most likely a result of wealthier countries consuming more resources. This finding is consistent with past research (Grimes and Kentor 2003; Jorgenson 2007; 2009; Roberts and Grimes 2003; Shandra et al. 2004). Second, we find that the coefficients that represent manufacturing as % GDP are positive and significant, suggesting that factors such as industrialization increase CO_2 emissions (Longhofer and Jorgenson 2017; Jorgenson and Clark 2012; Jorgenson 2012). Third, we find that the coefficients that represent trade are associated with increased CO_2 emissions, consistent with previous research (Jorgenson 2012; Jorgenson et al. 2010).

There are also non-significant findings. First, the coefficients that represent democracy fail to reach levels of statistical significance, which is mostly consistent with previous research (Shandra et al. 2004; Neumayer 2002; Mayer 2017). I find that the coefficients that represent INGOs also

fail to reach levels of statistical significance. It is surprising that INGOs fail to reach levels of statistical significance as a relationship between these variables has been established in previous research (Shandra et al. 2004), however; other research has shown that this effect varies by levels of FDI stocks and level of economic development and may not impact CO_2 emissions on its own (Jorgenson and Dick 2010; Longhofer and Jorgenson 2017).

Moreover, we find that population is not associated with CO_2 emissions, which diverges from more recent previous research (Hargrove et al 2019; Jorgenson 2012; Jorgenson et al. 2010; Jorgenson and Dick 2010), but converges with older research (Shandra et al. 2004), perhaps due to the disaggregation of population into urban and rural population (Jorgenson, Dick, and Shandra 2011). Also diverging from previous research, we find that agricultural activities are not associated with lower levels of CO_2 emissions (Gani 2012).

Discussion and Conclusion

According to environmental state perspectives, countries that promote and facilitate activities that protect the natural environment should have better environmental outcomes than states that do not. When including all countries in the analysis, on average, environmental governance decreases CO_2 emissions. However, when interacted by world-system position, the impact of environmental governance on CO_2 emissions is different for different income groups. Overall, the findings generally suggest that environmental governance reduces CO_2 emissions the most in lower-middle-income countries, while environmental governance increases CO_2 emissions in high-income OECD countries and low-income countries and has no effect in high-income non-OECD countries and upper-middle-income countries. These divergent patterns across income groups begins to suggest that this differentiation is a meaningful explanatory factor for how power dynamics in the world-system influence how environmental governance impacts CO_2 emissions.

The patterns of these findings can be explained drawing on historical and current asymmetrical distributions of power. Thus, several externalities and internalities linked to level of economic development, rooted in the global division of labor, may be able to explain the variation in the impact of environmental governance on CO_2 emissions. Put differently, since positionality in the global economic hierarchy can constrain or enhance the effectiveness of environmental governance, we should continue to pay attention to these positions or at least the long-term inequalities they aim to represent. These findings support the idea that the capacity for reducing environmental harms is unequally distributed across the global hierarchy and is therefore linked to historical and current asymmetrical distribution of power. Power thus shapes how different types of labor are distributed and how it is valued to support continued dominance of high-income OECD countries, specifically.

Drawing on existing previous research and theory, high-income countries, with their generally service, technology, and design based industries may not experience reductions in CO_2 emissions from environmental governance due to the funds supporting activities that only appear to be or are misrepresented as environmentally beneficial given existing greenwashing practices by companies headquartered in such countries. In the present analysis, high-income OECD countries actually see increases in CO_2 emissions from environmental governance taxes, which is

most likely related to the relative power and dominance over global agendas (including trade, global governance, and narrative control, among others) these countries have compared to high-income non-OECD countries.

Shifting to the other end of the world-system power hierarchy, low-income countries' environmental efforts may be undercut by transnational corporate involvement in addition to external pressure to export natural resources to fulfill activities such as paying back loans or being able to afford imports. This suggests that the environmental governance efforts made by low-income countries are stymied by their relatively weak position in the world-system and the history of power imbalances that have led to their exploitation. Additionally, their decisions may undermine environmental efforts to focus on other internal needs or interests such as health care or exploit their environments to profit from natural resource exports. Any interpretation of the Anthropocene that overlooks these inequalities will suggest that low-income countries adopt similar policies and strategies as the rest of the world. This generalization will lead to ineffective solutions since our analysis shows that environmental taxes in low income countries do not reduce CO_2 emissions.

Like high-income countries, middle-income countries also have divergent findings. While upper-middle-income countries' focus on producing manufactured goods rather than natural resources, their environmental governance efforts are still not improving their CO_2 emissions. Following economic growth agendas (perhaps in the hopes of shifting their world-system position to join higher-income countries) seems to still weaken environmental governance (Shorette 2012). The efforts of upper-middle-income countries may be seen as greenwashing or only focusing on environmental policies/technologies that will increase economic growth. This focus could be undermining the effectiveness of environmental taxes in these countries. On the other hand, lower-middle-income countries appear to use environmental funds in accordance with activities that ultimately create sustainable activities instead of just promoting them. Thus, the global division of labor may help explain the differential impacts of environmental governance on CO_2 emissions and provide more grounding for environmental state perspectives.

These findings also suggest that the dominant interpretation of the resolution of the Anthropocene as a "human struggle" rather than a power struggle overlooks the responsibility of larger polluters and more powerful groups in addressing climate change. The national government-based solutions for increased environmental funding for environmental activities does not effectively reduce CO_2 emissions in several world-system positions and tends to increase CO_2 emissions in high-income OECD countries and low-income countries. These findings provide additional evidence for the critique that the dominant conceptualization of the Anthropocene masks inequality while promoting solutions that do not address the political, economic, and social causes of climate change (Moore 2016; Haraway 2016; McBrien 2016). This especially rings true given the patterns of effectiveness of environmental governance in this analysis.

Moreover, environmental taxes allow the state to offset or push its responsibility onto tax-paying citizens. In this arrangement, the citizen takes the monetary burden of environmental protection. Even worse, in many cases across the world-system these taxes have no effect or do

not reduce CO_2 emissions – with the exception of the lower-middle-income country group. This further exemplifies the failure of the state in addressing climate change. While there are other ways to measure environmental governance that future research must accomplish, the present findings provide evidence that suggests that many world-systems country groups lack the ability or will to use its citizenry's taxes to reduce CO_2 emissions. Thus, failing to break down the present analysis into income groups would reify the onus of responsibility of reducing CO_2 emissions on the individual and fail to acknowledge the external and internal historical processes of inequality that shape the autonomy and decision-making of countries.

However, there is a difference between failing to acknowledge pre-existing inequities and historical processes that shape current inequalities *and* putting the blame on an abstract powerful group. It is important to make sure our global political economic tradition in studying and conceptualizing the Anthropocene does not also become an argument used to give up on solutions and transformations or hold up the existing power and politics in the world-system. Reducing the Anthropocene and its conceptualization, dominant or not, to an ethnocentric understanding of the relationship between humans and climate change that cannot break away from the power imbalances that created it removes agency from individuals and groups, especially less wealthy ones, while also diffusing responsibility into further abstraction will not help anyone (Smith 2018). Put differently, the aim in identifying external and internal constraints and pressures and how they shape or are shaped by external and internal processes is not to reinforce biased representations of rich countries as environmentally friendly and poor countries as corrupt polluters, but instead to recognize how both long-standing global inequalities and the agency of individuals, countries, and other groups interact in complex ways (Smith 2018). We are trying to recognize how global inequalities *and* the agency of individuals, countries, and other groups mutually construct each other.

Although the analysis includes the full extent of data available, care should be taken when making claims beyond the time period and sample in the analysis. Future work may use updated data to strengthen or expand upon the analysis. In particular, the main independent variable in this analysis measures one specific aspect of a state's environmental governance. Data availability on this measure severely reduces the sample and time period for which CO_2 emissions are usually analyzed, which may impact the results of the study. Future data collection efforts, therefore, must expand to include administration with interest in environmental protection, environmental regulations, redistribution of government funds toward environmental efforts and away from carbon-intensive activities, and environmental education, among others (Duit 2016). While the data used in the study only reveals a partial picture of the environmental governance regime in countries, it is still an extremely important part of the picture, as state taxes for the environment is a representation of some combination of what proportion of funds they can collect from their tax payers for the environment and what the state thinks the environment deserves. Put differently, this measure captures how much a country values its environment monetarily, which in the current capitalist world-system is an important assessment of what a state cares about.

Moreover, while this research does attempt to differentiate grouping of countries within a global hierarchy beyond a trimodal system, it still homogenizes countries that are very different from one another, that have divergent external and internal constraints. The classification of countries also relies on economic data and decision-making from the World Bank (2019), which makes these distinctions particularly biased. Thus, those who interpret this research should be cognizant of this generalization and bias and work toward more encompassing conceptualizations.

Despite these shortcomings, the present research reminds us of the importance of breaking down data and analyses by income level to arrive at a more nuanced understanding of how factors impact CO_2 emissions (Shorette 2012). Given the findings, it is important for future research to continue to understand how long-standing global power imbalances, especially within the global division of labor, impact a country's ability to reduce environmental issues. Going forward, we must continue to problematize the role of environmental governance in the future of the Anthropocene from a critical perspective using world-systems and other global political-economic perspectives while also attempting to interrogate the ways in which we are embedded in and perpetuate the current geopolitics of knowledge through our research.

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