Greenness and Democracy

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Abstract

Adopting green transition policies may not be politically acceptable or supported by all governments. This paper examines whether countries that have a tradition of electoral democracy are more likely to adopt such policies, and whether this effect is impacted by the level of per capita income of an economy. The relationship is first explored theoretically and then empirically through a cross-country panel analysis over 1995-2020 for a wide variety green policies and outcomes. The results indicate that is difficult to reject the hypothesis that the association of cumulative democratic experience with these outcomes is conditioned on the per capita income of an economy. Relatively rich democracies were more likely to adopt green policies over 1995 to 2020 than relatively poor democracies. High-income democracies could benefit from leading international collaboration and policy coordination to facilitate low-carbon transitions among all democracies.

JEL Codes: D72, Q56, Q58

Keywords: Autocracy, carbon dioxide emissions, electoral democracy, green policies, green transition, income per capita

1. Introduction

Transition to a low-carbon or "green" economy requires considerable structural change. "The creation of a green economy will therefore affect not just a few sectors but the product mix and production processes of virtually the whole economy" (Fankhauser et al. 2013, p. 903). However, it is not clear that adopting green transition policies is politically acceptable or supported by all governments. For one, capabilities and costs of implementing green policies differ considerably between rich and poor countries (Glennerster and Jayachandran 2023). Countries with greater civil liberties, political rights and other democratic freedoms also seem more likely to adopt policies that foster decarbonization compared to more autocratic nations (Clulow 2019; Fredriksson and Neumayer 2013; Stef and Ben Jabeur 2023). A country's long-run experience with electoral democracy appears also to influence its economic and environmental performance (Acemoglu et al. 2019; Fredriksson and Neumayer 2013; Gao et al. 2017; Persson and Tabellini 2009).This raises an important research question: Are countries that have a tradition of electoral democracy more likely to adopt green transition policies and structural change, and is this effect impacted by the level of per capita income of an economy?

This question is first explored through developing an electoral decision model to show the extent to which an autocratic as opposed to a democratic government must consider public support for green policies. An extension of the model then examines how this support, as expressed by the public's willingness to pay for the adoption of green transition policies, increases with per capita income. The overall conclusion is that a more democratic county is likely to adopt policies favoring a green transition, and this relationship is reinforced by rising income per capita.

This hypothesis is examined empirically through a cross-country panel analysis over 1995-2020 for a wide variety green policies and outcomes, such as the green stimulus and recovery share of total stimulus and recovery spending in 2008-09 and 2020-2021, the stringency of climate action and policies, the share of green products in total exports, the wind and solar share of electricity generation, the carbon intensity of

economies, and carbon dioxide emissions per capita. The results suggest that is difficult to reject the hypothesis that the association of cumulative electoral democratic experience with various green policies and outcomes is conditioned on the per capita income of an economy. This outcome also holds for different measures of democracy, including the electoral democracy index and liberal democracy index of V-DEM v.13 and polity2 of Polity5 (2021).

The outline of the paper is as follows. The next section develops the theoretical model to explore the possible relationship between the adoption of green policies, democracy and income per capita. Section 3 then provides evidence of this relationship through examining greenness and democracy trends over 1995-2021. This evidence is important for informing the panel analysis empirical strategy for examining the hypothesis that the association of cumulative democratic experience with green policies and outcomes over 1995-2020 is conditioned on the per capita income of an economy. This empirical strategy is outlined in Section 4, and the results are presented in Section 5. Several robustness checks are then performed, using different measures of democracy and additional green policies and outcomes (Section 6). The conclusion of the paper overviews the main findings and discusses their policy implications.

2. Green policy adoption, democracy and income per capita

The following model explores the relationship between green policy adoption, electoral democracy and income per capita. An underlying assumption is that the set of green transition policies under consideration are significant, require substantial public expenditures and induce structural change (Fankhauser et al. 2013). Recent examples of such policies include fossil fuel subsidy reform, carbon pricing, public support for green R&D, smart grids, electrical vehicle charging networks, and similar long-term investments to speed a transition to a low-carbon economy (Barbier 2020 and 2023; Hepburn et al. 2020; O'Callaghan et al. 2022).The first part of the model adapts the electoral decision model of Farzin and Bond (2006) to show the extent to which an

autocratic as opposed to a democratic government must consider public support for green policies. The second part examines the effect of income per capita on the average person's willingness to pay for green transition policies.

Assume that, at time t when implementation of the green policies is being considered, the population of N adult individuals in the economy consists of two distinct groups $j = 1,2$ based on each group's attitude towards the policies.[1] The group that supports the government adopting the green transition policies is ε_1, and the group that does not agree with implementation is ε_2. This latter group who opposes implementation also includes individuals who are not sure it is a good idea at time t. As all individuals must be in one of these two groups, it follows that $\varepsilon_1 + \varepsilon_2 = N$.

In making its decision, the government places a relative weight on the preference of each group as well as on its own preference for adopting the green transition policies. If $\omega_1 \geq 0$ is the weight given to the preferences of group 1, $\omega_2 \geq 0$ is the weight given to group 2, then the weight that the government places on its own preference for the green policies is $\omega_3 = 1 - \omega_1 - \omega_2$. Following Farzin and Bond (2006), we can depict the government's overall decision whether to adopt the green transition policies in terms of the following linearized objective function

$$v = v\left(\varepsilon_1, \varepsilon_2, v_3; \omega_1, \omega_2\right) = \omega_1\left(v_1\left(\varepsilon_1\right)\varepsilon_1\right) + \omega_2\left(v_2\left(\varepsilon_2\right)\varepsilon_2\right) + \left(1 - \omega_1 - \omega_2\right)v_3 \qquad (1)$$

where $v_j\left(\varepsilon_j\right)$, $j = 1,2$ is each group's average propensity to support or oppose adoption of the green economic policies. This propensity can be thought of as the average willingness to pay of each group with respect to the policies. Finally, $v_3 \geq 0$ represents the government's own preference for adopting the green economic policies, where $v_3 = 0$ indicates that the government does not support adoption. Consequently, if $\omega_1\left(v_1\left(\varepsilon_1\right)\varepsilon_1\right) + \left(1 - \omega_1 - \omega_2\right)v_3 > \omega_2\left(v_2\left(\varepsilon_2\right)\varepsilon_2\right)$, the government will implement the green

[1] The term "adult" implies all individuals over a minimum age established by law that a person is allowed to vote (usually 18 years old), if the country is an electoral democracy.

transition policies at time *t*. If $\omega_1\left(v_1\left(\varepsilon_1\right)\varepsilon_1\right)+\left(1-\omega_1-\omega_2\right)v_3 < \omega_2\left(v_2\left(\varepsilon_2\right)\varepsilon_2\right)$, then the government will refrain from adopting the policies.

In an autocracy, the decision of whether to implement the green economy policies is taken only by the government, so that $\omega_3 = 1$ in (1). If the autocratic government wants to adopt the policies, then $v = v_3 > 0$ and the policies will go ahead. However, if the government opposes adopting the policies, then $v = 0$. No matter how many people support implementing green economic policies, the government sides with those who oppose the policies, and they will not proceed.

In a democracy, $0 < \omega_3 < 1$.[2] Because a democratic government's decision depends on the relative weight that it places on each group's preference as well as on its own preference for adopting the green transition policies, the government must gauge the extent of public support for the green transition polices across the entire population. Defining v/N as the government's perception of the level of per capita support for implementation, it follows from (1)

$$\frac{v}{N} = \left[\omega_1 v_1\left(\varepsilon_1\right) - \omega_2 v_2\left(\varepsilon_2\right)\right]\frac{\varepsilon_1}{N} + \omega_2 v_2\left(\varepsilon_2\right) + \left(1-\omega_1-\omega_2\right)\frac{v_3}{N} \qquad (2)$$

where $\varepsilon_1/N = \varepsilon_1/\varepsilon$ is the proportion of the population supporting adoption of the green policies. The government will proceed with the policies if

$\left[\omega_1 v_1\left(\varepsilon_1\right) - \omega_2 v_2\left(\varepsilon_2\right)\right]\frac{\varepsilon_1}{N} + \left(1-\omega_1-\omega_2\right)\frac{v_3}{N} > \omega_2 v_2\left(\varepsilon_2\right)$ and it will not adopt the policies if

$\left[\omega_1 v_1\left(\varepsilon_1\right) - \omega_2 v_2\left(\varepsilon_2\right)\right]\frac{\varepsilon_1}{N} + \left(1-\omega_1-\omega_2\right)\frac{v_3}{N} < \omega_2 v_2\left(\varepsilon_2\right)$.

It is clear from this decision rule, that the government's perception of overall support by the average individual for implementing the green policies will be affected by whether the population in favor of the policies ε_1/N is increasing. From (2), this effect is

[2] As pointed out by Farzin and Bond (2006, p. 217), "even in democratic countries, the role of the state is rarely limited to a merely benevolent public agency." Thus, the extreme case of "pure democracy" where $\omega_3 = 0$ is ruled out here.

$$\frac{\partial\left(v/N\right)}{\partial\left(\varepsilon_1/N\right)} = \varepsilon_1 v_1\left(\varepsilon_1\right) - \varepsilon_2 v_2\left(\varepsilon_2\right), \quad \frac{\partial\left(v/N\right)}{\partial\left(\varepsilon_1/N\right)} > 0 \text{ iff } \frac{\varepsilon_1}{\varepsilon_2} > \frac{v_2\left(\varepsilon_2\right)}{v_1\left(\varepsilon_1\right)}. \tag{3}$$

A reasonable assumption is that each group's average propensity to support or oppose adoption of the green economic policies is similar so that $v_1\left(\varepsilon_1\right) \approx v_2\left(\varepsilon_2\right)$. Consequently, if the democratic government is pro-green, then it will presumably give greater weight to constituents who support the policies relative to those who don't. Thus, $v_3 > 0$, ω_1 will be relatively large and ω_2 small, and from (2) the condition that the government proceeds with the policies is more likely to be satisfied, i.e. $\left[\omega_1 v_1\left(\varepsilon_1\right) - \omega_2 v_2\left(\varepsilon_2\right)\right]\frac{\varepsilon_1}{N} + \left(1 - \omega_1 - \omega_2\right)\frac{v_3}{N} > \omega_2 v_2\left(\varepsilon_2\right)$. In addition, if $\frac{\varepsilon_1}{\varepsilon_2} > 1$, then as (3) indicates, an increase in the share of the population supporting green policies will make the government even more likely to adopt the policies. This outcome could be a potential "win-win" for the pro-green government. If the share of the population supporting green policies is increasing and the government implements these policies, then it may be seen as doing the "will of the people" and thus increase its chances of re-election.

Of course, a democratic government can also be anti-green. In which case, $v_3 = 0$, ω_1 will be relatively small, ω_2 large, and the government will refrain from adopting the green policies if $\left[\omega_1 v_1\left(\varepsilon_1\right) - \omega_2 v_2\left(\varepsilon_2\right)\right]\frac{\varepsilon_1}{N} + \left(1 - \omega_1 - \omega_2\right)\frac{v_3}{N} < \omega_2 v_2\left(\varepsilon_2\right)$. This decision is likely to be reinforced if the share of the population supporting the policies is relatively small, i.e. $\frac{\varepsilon_1}{\varepsilon_2} < 1$ and, and thus $\frac{\partial\left(v/N\right)}{\partial\left(\varepsilon_1/N\right)} < 0$. Even if there is an increasing share of the population supporting the green policies, the government will still be less inclined to adopt such policies. However, there may now be a potential "win-lose" risk to the government. In the short term, it has fulfilled its ant-green platform and not implemented the policies, but over the long run as the share of the population

supporting the population rises, the government may be forced to change course or face a reduced change of re-election.

To summarize, an autocratic government ignores whether the population supports or opposes implementation of the green policies. The decision to adopt the policies is determined solely by the government's preference for implementing the policies. A democratic government's decision is more nuanced, as it depends on the relative weight that the government places on each group's preference as well as on its own preference for adopting the green transition policies. If the democratic government is pro-green, it is likely to give greater weight to the group that supports implementing the policies as well as also having a strong preference itself for the policies. The decision to implement green policies will be further reinforced if the share of the population supporting green policies is rising. If the democratic government is anti-green, then it is likely not to implement green transition policies. But if the share of the population supporting green policies is rising, the government may have to either reverse this decision or face the risk of losing re-election.

Such an outcome may also be influenced by a country's level of per capita income. As average standards of living and incomes increase, it is possible that a larger share of the population will be willing to pay, and thus favor, policies that improve the environment and green the economy. One can gain insights into this possible effect through examining the effect of income per capita on the willingness to pay for green transition policies based on the pollution-income models developed by Stokey (1998) and Andreoni and Levinson (2001).

As $\varepsilon_1 > 0$, it follows that at least some individuals among all N adults in the economy should be willing to pay for a transition to a low-carbon or "green" economy. That is, if the average individual in the economy supports green policies, then they may be willing to forego some of their income that would otherwise be spent on consumption to finance policies that would reduce greenhouse gas emissions, pollution and other environmental damages caused by the economy. However, if the average individual does not support

adopting the policies, then they will not be willing to pay anything, and all their income will be spent on consumption.

Thus, the utility function of the average individual in the economy is

$$U = U\left(c, P\right),\ U_c > 0,\ \ U_{cc} < 0, U_P < 0,\ U_{PP} < 0 \tag{4}$$

where c is per capita consumption and P is the overall greenhouse gas emissions and degradation, or "pollution", of the economy.

Let y denote the individual's given level of per capita income. The choice is to allocate a share $z \geq 0$ of this income to fund the green policies to reduce overall pollution P with the remainder spent on consumption, i.e. $c = \left(1 - z\right)y$. If all aggregate consumption generates pollution and $\beta\left(Nzy\right)$ is the reduction in pollution through all individuals' expenditures in support of green policies, then overall pollution by the economy is

$$P = \left[cN - \beta\left(Nzy\right)\right] = \left(1 - z\right)y - \beta\left(zy\right),\ \ N = 1\,, \tag{5}$$

where normalizing the number of individuals maintains the focus on the average individual's decision (e.g., P can now be thought of as per capita pollution levels). It is also assumed that $\beta' > 0,\ \beta'' < 0$ and $\beta\left(0\right) = \beta'\left(0\right) = 0$. For a given income level, pollution reduction is an increasing function of expenditure that financially supports green policies. But no pollution reduction occurs if no money is allocated to these policies.

The individual's problem is

$$\max_{z \geq 0} U\left(\left(1 - z\right)y, \left(1 - z\right)y - \beta\left(zy\right)\right). \tag{6}$$

For the given level of income y, the optimal allocation to fund green policies z^* satisfies

$$-U_c - U_P\left[1 + \beta'\right] \leq 0,\ \ z^* \geq 0\,. \tag{7}$$

The marginal willingness to pay for supporting green policies m_g is therefore governed by the following condition

$$m_g = -\frac{U_P}{U_c} \leq \frac{1}{1+\beta'}, \quad z^* \geq 0 . \tag{8}$$

For the corner solution $z^* = 0$, the marginal benefit of financing green policies $-U_P\left[1+\beta'\right]$ is less than the cost U_c, and thus the individual will not contribute any income to support these policies. All the agent's income will be devoted to consumption. It follows from (5) and (8) that pollution will be at its maximum $P = c = y$ and the marginal willingness to pay for green policies is equal only to the marginal rate of substitution between less pollution and consumption, i.e. $m_g = -U_P\left(y\right)\Big/U_c\left(y\right)$. Consequently,

$$\frac{\partial m_g}{\partial y} = \frac{U_{cc}U_P - U_{PP}U_c}{\left[U_c\right]^2} > 0 . \tag{9}$$

The marginal willingness to pay for green policies increases with income.

For the interior optimum $z^* > 0$, and the marginal rate of substitution between less pollution and consumption must also equal $1\Big/1+\beta'$, the opportunity cost of less pollution in terms of foregone consumption. It follows from (8) that

$$\frac{\partial m_g}{\partial y} = \frac{-\beta'' z}{\left[1+\beta'\right]^2} > 0 . \tag{10}$$

The marginal willingness to pay for green policies again increases with income.

The implication of (9) and (10) is that, regardless of whether the average individual initially supports green policies by willing to forego some of their income to finance them, as the individual's income increases this willingness to pay for the policies should increase. In the case of individuals who do not initially support the policies, (9) indicates that their marginal rate of substitution between less pollution and consumption could rise sufficiently with increasing income so that it eventually equates with $1\Big/1+\beta'$ so that reach the interior optimum $z^* > 0$ and support green policies.

Overall, the model of this section implies that, as average standards of living and incomes increase, it is possible that a larger share of the population will be willing to pay, and thus favor, policies that improve the environment and green the economy. That is, a more democratic county is likely to adopt policies favoring a green transition, but this relationship is reinforced by rising income per capita.

3. Greenness and democracy trends 1995-2021

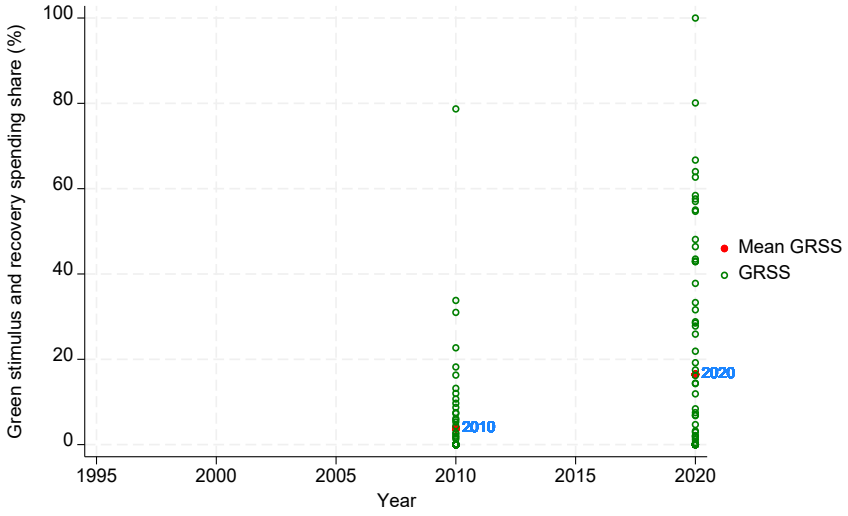
As suggested by the above model, the extent to which an economy is embarking on a green transition can be measured in several ways. For example, one indicator is the adoption of policies that favor such a transition. In addition, greenness can also be measured by key economic or environmental outcomes, such as the share of green products in total exports or carbon emission intensity of output.

Over 1995 to 2021, there were two distinct periods when widespread adoption of green policy interventions occurred: the green stimulus expenditures instigated in response to the 2008-09 Great Recession and the green recovery spending in 2020-21 during the COVID-19 pandemic (Barbier 2023; Hepburn et al. 2020; O'Callaghan et al. 2022). Several studies have tracked green and total fiscal expenditures for 37 economies that were implemented during the Great Recession (Barbier 2010 and 2016; Robbins 2010). In addition, University of Oxford's Global Recovery Observatory estimates COVID-19 green and total recovery spending for 75 countries (O'Callaghan et al. 2021). By combining these two data sets, it is possible to estimate the green stimulus and recovery share (%) of total stimulus and recovery spending in 2008-09 and 2020-21 for 79 countries. These countries comprise 36 high-income and 43 low and middle-income economies.[3] The results are depicted in Figure 1, which for visual purposes clusters the share of green spending over 2008-09 by the 79 countries in 2010 and the green spending

[3]Based on World Bank, World Development Indicators Classification of Countries. Economies are divided among income groups according to 2022 gross national income (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low income, $1,135 or less; lower middle income, $1,136 to $4,465; upper middle income, $4,466 to $13,845; and high income, $13,846 or more.

over 2020-21 in 2020. As the figure indicates, the average share of green spending increased substantially in these two periods of significant green policy adoption, from 3.8% in 2008-09 to 16.5% in 2020-21.

Figure 1. Green stimulus and recovery spending share (%), 1995-2020



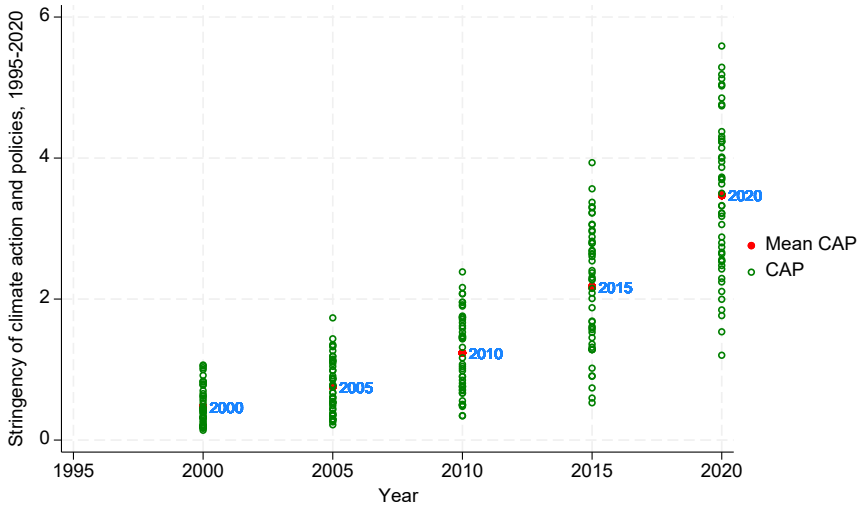
Green stimulus and recovery spending share (%) of total stimulus and recovery spending (GRSS) for 79 countries (36 high income and 43 low and middle income) in 2008-09 and 2020-21. The mean share of green spending was 3.8% in 2008-09 and 16.5% in 2020-21.

Source: Data compiled from Barbier (2010) and (2016); O'Callaghan et al. (2021); Robbins (2010); Global Recovery Observatory https://recovery.smithschool.ox.ac.uk/tracking/.

From 1995 to 2021, many countries both adopted additional climate actions and policies and strengthened their stringency (Dabla-Norris et al. 2023; Eskander and Fankhauser 2020; Eskander et al. 2021; Nachtigall et al. 2024; Setzer and Higham 2023). The Climate Actions and Policies Measurement Framework (CAPMF) of the Organization for Economic Cooperation and Development (OECD) estimates an average climate action and policy stringency value, measured on a 0-10 scale, across sectoral, cross-sectoral and international policies in 49 middle and high-income economies from 1990 to 2022 (Nachtigall 2024). Figure 2 depicts the five-year average climate action and policy

stringency score for these economies from 1995 to 2020, which on average across all 49 countries increased over this period.

Figure 2. Stringency of climate action and policies, 1995-2020



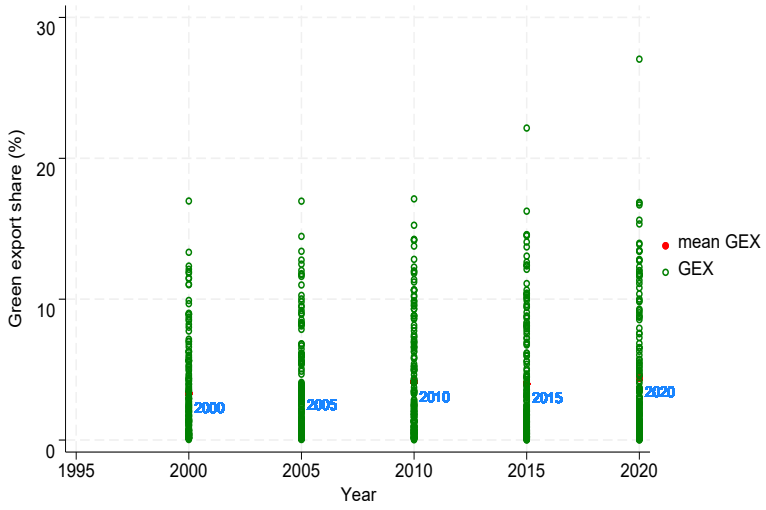
Average climate action and policy stringency value (CAP), measured on a 0-10 scale, across sectoral, cross-sectoral and international policies in 49 economies (37 high income and 12 middle income) from 1995 to 2020. Data are averaged over five-year periods, and the data listed for each year is the average over the preceding five years (e.g. CAP in 2005 is based on average values over the period 2001-2005). The mean CAP was 0.5 in 2000, 0.8 in 2005, 1.2 in 2010, 2.2 in 2015 and 3.5 in 2020.

Source: Climate Actions and Policies Measurement Framework (CAPMF) https://oe.cd/dx/capmf. See also Nachtigall (2024).

If green policies have been effective for some countries from 1995-2020, there should be evidence of the improving "green competitiveness" of their economies (Andres et al. 2023; Fankhauser et al. 2013; Mealy and Teytelboym 2022). One such indicator is the share (%) of green exports in total exports, which is available for 172 countries from the University of Oxford's Green Transition Navigator (https://green-transition-navigator.org/). Figure 3 displays the five-year average green export share for these

economies from 1995 to 2020, which on average across all 172 countries increased slightly over this period.

Figure 3. Green export share (%), 1995-2020

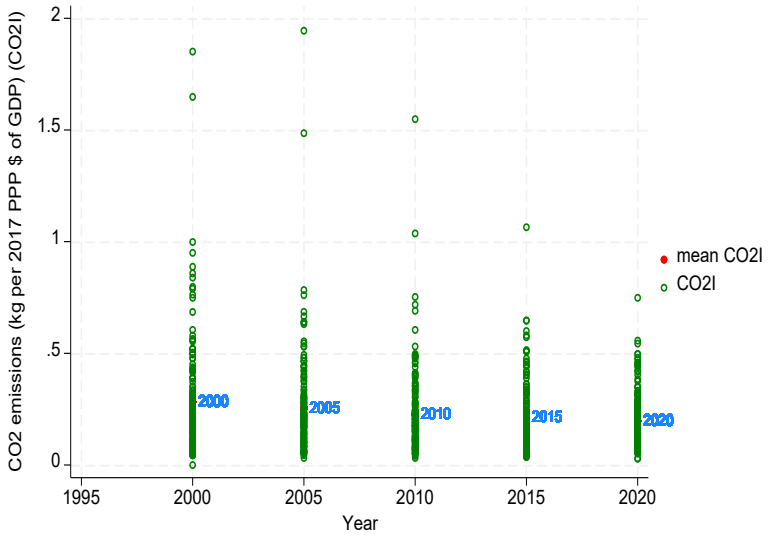


Exports of green products as a share (%) of total exports (GEX) for 172 countries (52 high income and 120 low and middle income). Data are averaged over five-year periods, and the data listed for each year is the average over the preceding five years (e.g. GEX in 2005 is based on average values over the period 2001-2005). The mean GEX was 3.3 in 2000, 3.6 in 2005, 4.1 in 2010, 4.0 in 2015 and 4.4 in 2020.

Source: Green Transition Navigator (https://green-transition-navigator.org/). See also Mealy and Teytelboym (2022).

Alternatively, for the 172 countries over 1995 to 2020, green policies may have impacted the carbon intensity of their economies, which is measured by the World Bank's World Development Indicators as CO_2 emissions from fossil fuels and cement per dollar of gross domestic product (kg per 2017 PPP $ of GDP). Figure 4 displays the five-year average carbon intensity for these 172 economies from 1995 to 2020, which on average across all countries declined over this period.

Figure 4. Carbon intensity, 1995-2020



Carbon intensity (CO2I) is CO_2 emissions from fossil fuels and cement per dollar of gross domestic product (kg per 2017 PPP $ of GDP) for 172 countries (52 high income and 120 low and middle income). Data are averaged over five-year periods, and the data listed for each year is the average over the preceding five years (e.g. CO2I in 2005 is based on average values over the period 2001-2005). The mean CO2I was 0.28 in 2000, 0.26 in 2005, 0.23 in 2010, 0.21 in 2015 and 0.20 in 2020.

Source: World Bank, World Development Indicators (https://databank.worldbank.org/source/world-development-indicators).

Since the early to mid-2000s, global democracy has declined markedly (EIU 2024; Gorokhovskaia and Grothe 2024; Nord et al. 2024). In 2023, the level of democracy for the average person in the world fell to 1985 levels, and by country-based averages, democracy declined to 1998 levels (Nord et al. 2024). Although there are currently 91 democracies and 88 autocracies, 71% of the world's population – 5.7 billion people – live in autocracies – an increase from 48% ten years ago (Nord et al. 2024). From 2022 5o 2023, democracy fell in 52 countries and improved only in 21 countries (Gorokhovskaia and Grothe 2024).

However, the year-to-year state of democracy in a country may matter less to its adoption of green policies than its experience with democratic institutions, traditions and legacy. Studies suggest that the economic and environmental performance of an economy appears most influenced by the long-run experience with electoral democracy

(Acemoglu et al. 2019; Fredriksson and Neumayer 2013; Gao et al. 2017; Persson and Tabellini 2009). As Fredriksson and Neumayer (2013, p. 12) conclude, "Today's environmental policies are the result of numerous historical institutional and policy choices, all influenced by the level of democracy at the time." Similarly, citing other studies as well as their own findings, Gao et al. (2017, p. 1278) suggest "that it takes at least 5–10 or 20 years for democracy to produce socioeconomic outcomes."

A measure of a cumulative democratic experience of a country over 1995-2020 can be constructed following the approach of Persson and Tabellini (2009), who assume that a country's "democratic capital" is built up over time, based on past levels of electoral democracy, and is more valuable the closer to the present. Thus, cumulative democratic experience D_{it} for country i in any year t can be expressed as

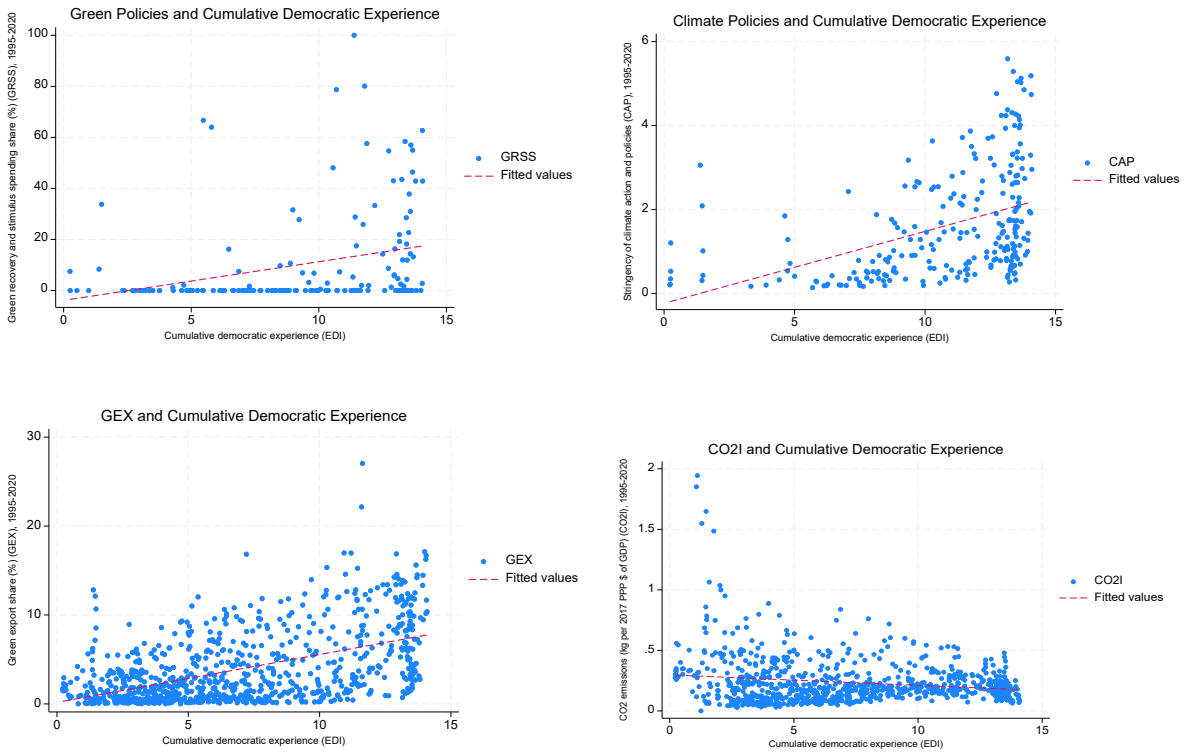
$$D_{i,t} = \sum_{\tau=0}^{\tau=t-t_0} \rho^{\tau} d_{i,t-\tau}, \tag{11}$$

where $d_{it\text{-}\tau}$ is the level of electoral democracy in country i in year $t-\tau$ based on the V-Dem v.13 dataset (Coppedge et al. 2023), ρ^t is the annual rate of decay (discount) factor associated with past experience of democracy from t_0 to t, and $t-t_0 = 40$ years is the length of time period for accumulating experience with democracy.[4]

Each of the four panels of Figure 5 display a two-way scatter plot and fitted regression for all observations of each of the four greenness measures of Figures 1-4 against cumulative democratic experience D_{it} for the relevant years. As the panels indicate, there is a positive relationship between green stimulus and recovery spending share (GRSS), green export share (GEX) and carbon action and policies (CAP) with cumulative democratic experience (EDI), whereas there is a negative relationship between carbon intensity (CO2I) and EDI.

[4]The variable $d_{it\text{-}\tau}$ is based on the V-Dem dataset's electoral democracy index (variable v2x_polyarchy), which measures the extent to which political leaders are elected under comprehensive suffrage in free and fair elections, and freedoms of association and expression are guaranteed. The index reaches from 0 to 1 (most democratic). See Coppedge et al. (2023). Following Persson and Tabellini (2009) and Fredriksson and Neumayer (2013), the decay factor ρ^t is 0.94. As some countries were not independent 40 years prior to the starting year 1995, then the approach of Persson and Tabellini (2009) is used, who use the year of independence as the initial year of democratic experience.

Figure 5. Greenness and cumulative democracy, 1995-2020

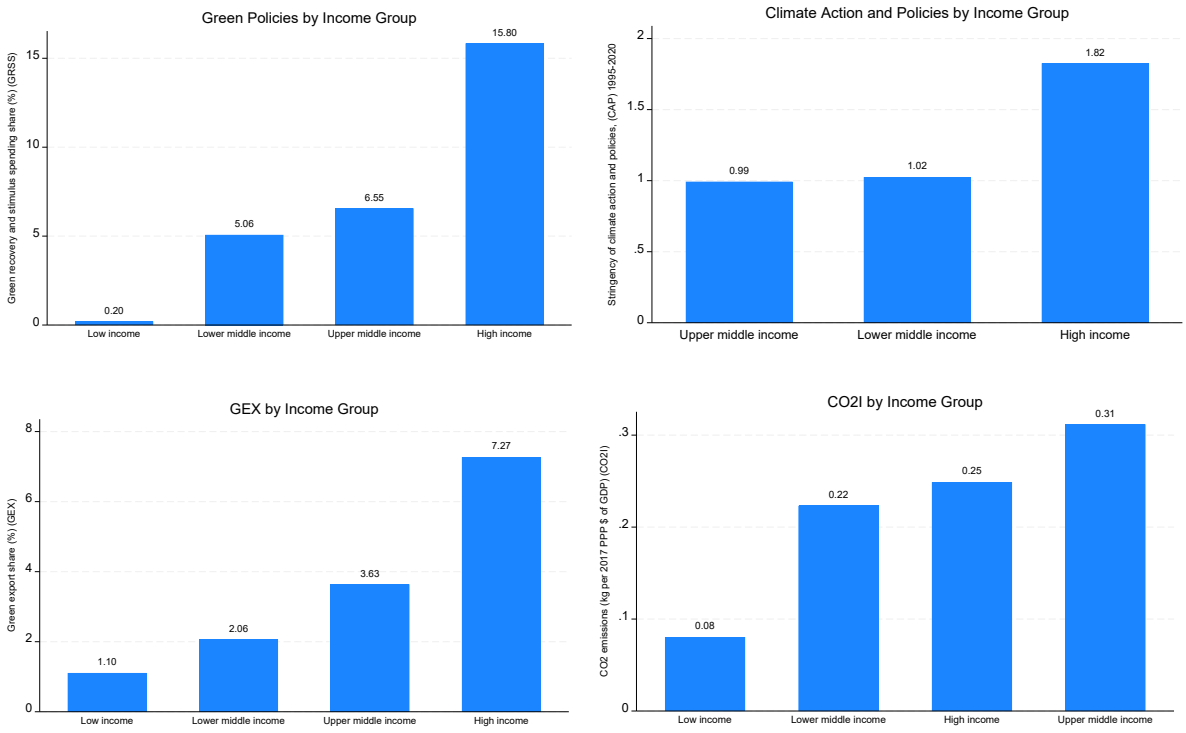


A two-way scatter plot and fitted regression for all observations of each of the four greenness measures of Figures 1-4 against cumulative democratic experience (EDI) for the relevant years. EDI is constructed according to equation (11) and is based on the V-Dem v.13 dataset variable v2x_polyarchy. See https://www.v-dem.net/data/the-v-dem-dataset/country-year-v-dem-core-v13/ and Coppedge et al. 2023).

However, as Figure 6 shows, green policy adoption and outcomes over 1995-2020 varied significantly by income group. Green stimulus and recovery spending share in 2008-09 and 2020-21 was only 0.2% on average for low-income countries, 5.1% for lower middle-income economies, 6.6% for upper middle-income countries and 15.8% for high-income economies. Lower and upper middle-income economies on average had the same level of stringency of climate actions and policies (0.99 and 1.02, respectively), but stringency was greater across high-income countries (1.82). Green export share also increased by income group – 1.1% on average for low-income countries, 2.1% for lower middle-income economies, 3.6% for upper middle-income countries and 7.3% for high-income economies. High-income economies had on average higher carbon intensity (0.25) than lower

middle-income (0.22) and low-income economies (0.08), but upper middle-income economies displayed the highest carbon intensity on average (0.31).

Figure 6. Greenness by income group, 1995-2020



Averages of the 1995-2020 observations in Figures 1-4 by country income group, based on World Bank, World Development Indicators Classification of Countries that divides economies among income groups according to 2022 gross national income (GNI) per capita using the World Bank Atlas method. Applying this classification to the 2020 GDP per capita at constant 2017 national prices from Penn World Tables 10.01, this leads to the following classification of countries by income group: $815 to $2,285 (low income), $2,286 to $8,252 (lower middle income), $8,253 to $20,566 (upper middle income) and $20,567 or greater (high income).

In sum, the greenness and democracy trends over 1995-2020 provide some evidence in support of the results of the theoretical model of Section 2. The cumulative democratic experience of a country may have influenced its green policy adoption and outcomes over this period, but the country's level of per capita income may also matter to this relationship. This suggests as a hypothesis that the association of cumulative democratic

experience with green policies and outcomes over 1995-2020 is conditioned on the per capita income of an economy.

4. Empirical strategy

A straightforward way of examining the above hypothesis is to estimate the following panel analysis regression

$$g_{it+T} = b_0 + b_1 x_{it} + b_2 y_{it} + b_3 x_{it} y_{it} + b_4 Z_{it} + u_{it,T}\,, \tag{12}$$

where g_{it+T} is the green policy adoption or outcome variable for country i in period $t+T$ over 1995-2020, x_{it} is the country's cumulative democratic experience up to time t, y_{it} is the conditioning variable of ln income per capita of country i in time t, Z_{it} is a set of various macroeconomic controls, and $u_{it,T}$ is the error term. It follows from (12) that the null hypothesis that there is no association of x_{it} with g_{it+T} over 1995 to 2020 conditioned on y_{it} is $b_1 = b_3 = 0$.

The above regression is applied to the four green policy adoption and outcome variables identified in the previous section: the green stimulus and recovery share (%) of total stimulus and recovery spending in 2008-09 and 2020-21 for 79 countries (GRSS), the five-year average climate action and policy stringency score (CAP) for 49 economies from 1995 to 2020, the five-year average green export share (%) of total exports (GEX) for 172 countries from 1995 to 2020, and the five-year average carbon intensity (CO2I) for these 172 economies from 1995 to 2020. When the dependent variable g_{it+T} is CAP, GEX and CO2I, there are five time periods in the panel analysis regression (e.g., $t+T$ is 2000, 2005, 2010, 2015 and 2020). However, when g_{it+T} is green spending share (GRSS), then there are just two time periods (e.g., $t+T$ is 2010 and 2020).

The variable of interest x_{it} is a country's cumulative electoral democratic experience up to time t, which is measured following D_{it} in equation (11) and as explained in Section 3 is based on the V-Dem v.13 dataset electoral democracy index variable v2x_polyarchy. The conditioning variable y_{it} is (ln) GDP per capita at constant 2017 national prices,

which is obtained from Penn World Tables (PWT 10.01). The set of macroeconomic controls Z_{it} include human capital index (from PWT 10.01), trade openness, investment share of GDP, government expenditure share of GDP, resources rent share of GDP, rule of law and other variables obtained from the World Bank's World Development Indicators. These controls are consistent with those used in recent studies of the impacts of democracy on environmental and economic outcomes (e.g., Acemoglu et al. 2019; Balamatsias 2018; Clulow 2019; Guo et al. 2017; Stef and Jabeur 2023) All independent variables are averaged over the preceding five-year period; e.g., if $t = 2005$, then x_{it}, y_{it} and Z_{it} are average values of these respective variables over the period 2001-2005. Table 1A of the Appendix indicates the summary statistics and data sources for all the dependent and independent variables used in the analysis.

These four versions of equation (12) are estimated using fixed-effects regressions to control for unobserved factors and employing country-clustered robust standard errors. Where appropriate, regressions with and without time-period fixed effects are also compared. As independent variables are averaged over the preceding five-year period up to t whereas each outcome is defined over $t+T$, the identifying assumption is likely to be satisfied that the panel regressors are strictly exogenous conditional on the unobserved effect and that there is no simultaneity or reverse causality bias in the fixed-effects regressions (Cunnigham 2021; Imai and Kim 2019).

Several robustness checks are performed. Regression of (12) is replicated for all 172 countries and five time periods using two alternative dependent variables for g_{it+T} - the share (%) of wind and solar energy in electricity generation (from EMBER's Global Electricity Review 2023) and CO_2 emissions per capita (World Development Indicators). In addition, all six of the green policy and outcome regressions are repeated basing cumulative democratic experience on the liberal democracy index (v2x_libdem) from V-DEM v.13 and on polity2 from the Polity 5 (2021) database. Appendix Table 1A provides the summary statistics and data sources for the additional variables used in the robustness check.

5. Results

Table 1 reports the regression results for the two green policy adoption variables, the green stimulus and recovery share (%) of total stimulus and recovery spending (GRSS), the five-year average climate action and policy stringency score (CAP). For each outcome variable, regressions with and without controls are shown. Because the estimations of GRSS and CAP involve a small number of panel observations, these regressions did not include time-period fixed effects. The small number of panel observations also limits the number of controls in the GRSS regression displayed in column (2).

In all four regressions of Table 1, the coefficients on cumulative democratic experience, i.e. b_1 in (12), and its interaction with ln GDP per capita, i.e. b_3 in (12), are significant. Consequently, it is difficult to reject the hypothesis that the association of cumulative democratic experience with green policy adoption over 1995-2020 is conditioned on the per capita income of an economy. In addition, the estimated marginal effect of democratic experience on green policy adoption is positive, and the marginal effect increases with per capita income. Finally, for each regression, Table 1 also reports the threshold level y^* of real GDP per capita for the estimated marginal effect. That is, for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a higher green spending share (GRSS) or more stringent climate action and policies (CAP).

Table 1. Green policy adoption, 1995-2020

	(1)	(2)	(3)	(4)
VARIABLES	GRSS	GRSS	CAP	CAP
Cumulative democratic experience (EDI)	-29.192*	-41.166*	-3.878***	-3.523***
	(14.954)	(22.269)	(0.728)	(0.664)
Ln GDP per capita	-5.677	-7.082	0.336	-1.434*
	(11.511)	(25.728)	(0.889)	(0.789)
Interaction	3.447**	4.564**	0.408***	0.361***
	(1.576)	(2.228)	(0.076)	(0.069)

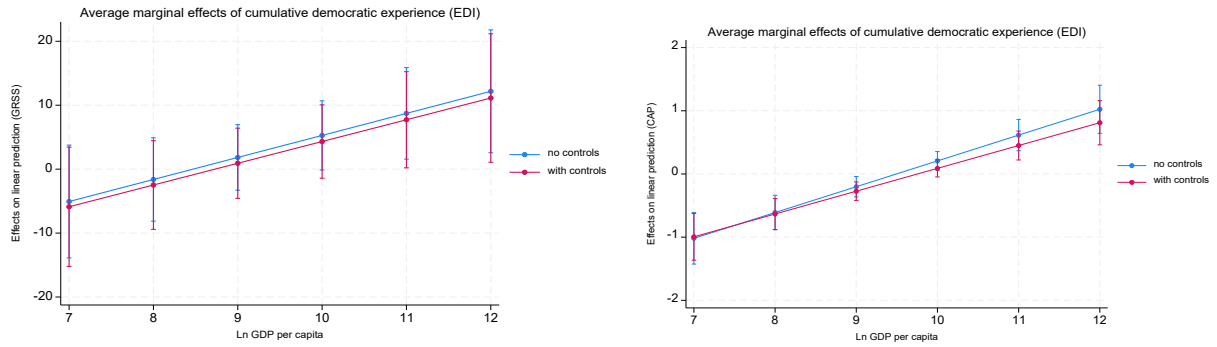
Trade (% GDP)		10.553		0.805*
		(11.288)		(0.460)
Gross fixed capital formation (% GDP)		-8.138		-1.360**
		(10.980)		(0.596)
Government expenditure (% GDP)		-2.292		1.463*
		(16.217)		(0.762)
Resources rents (% GDP)				0.162
				(0.342)
Population growth				2.571**
				(1.217)
Urban population (% total)		4.634		3.627**
		(57.759)		(1.519)
Inflation		0.845		-0.120
		(6.853)		(0.110)
Human capital index				6.519**
				(2.476)
Rule of law		13.300		0.992*
		(12.713)		(0.501)
Constant	23.297	7.009	-4.875	-17.018***
	(95.007)	(148.093)	(8.213)	(5.722)
Observations	158	148	240	235
R-squared	0.124	0.173	0.636	0.749
Number of countries	79	76	48	47
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	No	No	No
Marginal effect	3.721	2.453	0.241	0.120
Threshold GDP per capita (y*)	$4,763	$8,256	$13,283	$17,222

Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a greater share of spending on green recovery and stimulus (GRSS) or more stringent climate action and policies (CAP).
*** p<0.01, ** p<0.05, * p<0.1

Figure 7 plots the estimated marginal effects of cumulative democratic experience on green policy adoption at different levels of income per capita for the four regressions of Table 1. Two key findings are apparent. First, the marginal effect of a country's cumulative democratic experience on green policy adoption is increasing in GDP per capita. This again supports the hypothesis that, over 1990-2025, any influence of a country's cumulative democratic experience on green policy adoption is conditioned on its level of per capita income. Second, for countries above the threshold level of GDP

per capita, an increase in cumulative democratic experience led to a higher green spending share (GRSS) or more stringent climate action and policies (CAP) over 1995-2020. For GRSS, this occurs for countries with 2020 GDP per capita greater than that of the lower middle-income country Bolivia ($8,256), and for CAP, for countries with income per capita exceeding that of the upper middle-income country Dominican Republic ($17,222).

Figure 7. Marginal effect of cumulative democratic experience on green policy adoption at different levels of GDP per capita



Results for the regressions in Table 1 for green stimulus and recovery share (%) of total stimulus and recovery spending (GRSS) and the five-year average climate action and policy stringency score (CAP). For GRSS (Table 1 column 2), y* is $8,256, which is equivalent to 2020 GDP per capita of Bolivia. For CAP (Table 1 column 4), y* is $17,222, which is equivalent to 2020 GDP per capita of the Dominican Republic.

Table 2 contains the regression results for the five-year average green export share (%) of total exports (GEX) for 172 countries from 1995 to 2020. Regardless of whether time-period fixed-effects of controls are included, the coefficients on cumulative democratic experience and the interaction term are again significant, and the marginal effects are positive and increasing with income. It is therefore difficult to reject the hypothesis that the association of cumulative democratic experience with green export share over 1995-2020 is conditioned on the per capita income of an economy.

Table 2. Green export share, 1995-2020

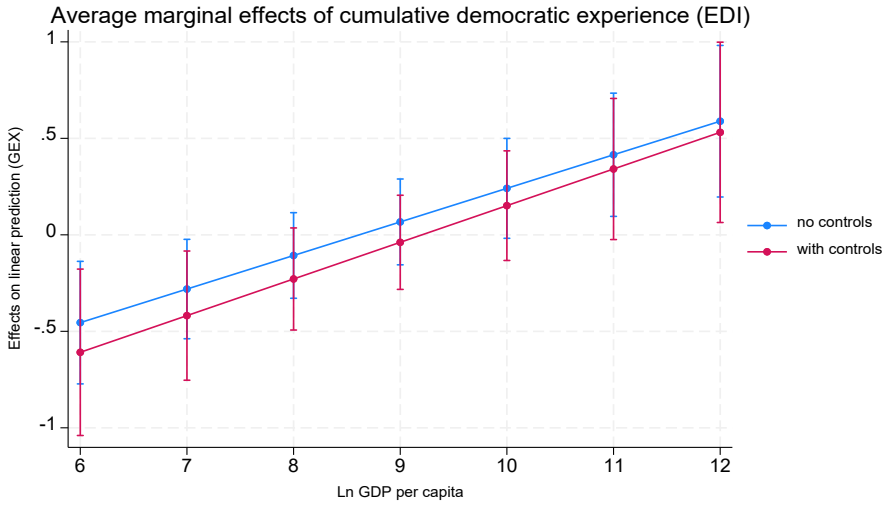
VARIABLES	(1) GEX	(2) GEX	(3) GEX	(4) GEX
Cumulative democratic experience (EDI)	-1.462***	-1.499***	-1.725***	-1.748***
	(0.419)	(0.418)	(0.594)	(0.580)
Ln GDP per capita	0.694*	0.588	0.323	0.358
	(0.396)	(0.426)	(0.684)	(0.688)
Interaction	0.175***	0.174***	0.188***	0.190***
	(0.047)	(0.048)	(0.064)	(0.064)
Trade (% GDP)			0.429	0.411
			(0.438)	(0.434)
Gross fixed capital formation (% GDP)			-0.045	-0.023
			(0.302)	(0.319)
Government expenditure (% GDP)			-0.069	-0.084
			(0.345)	(0.353)
Resources rents (% GDP)			-0.937***	-0.916***
			(0.229)	(0.244)
Population growth			-0.630	-0.631
			(0.403)	(0.430)
Urban population (% total)			0.798	0.823
			(1.446)	(1.466)
Inflation			-0.050	-0.038
			(0.134)	(0.138)
Human capital index			3.488*	3.625
			(1.964)	(2.532)
Rule of law			-0.711	-0.677
			(0.588)	(0.576)
Constant	-3.406	-2.331	-3.886	-4.368
	(3.261)	(3.748)	(5.742)	(6.426)
Observations	797	797	613	613
R-squared	0.169	0.182	0.271	0.290
Number of countries	160	160	134	134
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.114	0.071	-0.006	-0.010
Threshold GDP per capita (y*)	$4,321	$5,515	$9,694	$9,941

Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a higher green export share.

*** p<0.01, ** p<0.05, * p<0.1

Figure 8 plots the estimated marginal effects of cumulative democratic experience on green export share at different levels of income per capita for the two-way fixed effects regressions (2) and (4) of Table 2. The positive slopes of the two plots again support the hypothesis that, over 1990-2025, any influence of a country's cumulative democratic experience on green export share is conditioned on its level of per capita income. For regression (4), y* is $9,941, which is approximately the 2020 GDP per capita of upper middle-income Namibia. For countries above this threshold income level, an increase in cumulative democratic experience led to a higher green export share over 1995-2020.

Figure 8. Marginal effect of cumulative democratic experience on green export share at different levels of GDP per capita



Results for regressions (2) and (4) in Table 2 for green export share (%) of total exports (GEX). For regression (4), threshold GDP per capita y* is $9,941, which is approximately the 2020 GDP per capita of Namibia.

Table 3 depicts the regression results for the five-year average carbon intensity (CO2I) of 172 countries from 1995 to 2020. For all four regressions, the coefficients on cumulative democratic experience and the interaction term are significant, which lends support to the hypothesis that any impact of cumulative democratic experience on

carbon intensity is conditioned on income. As expected, the estimated marginal effect is negative, and it increases in absolute terms with income.

Table 3. Carbon intensity, 1995-2020

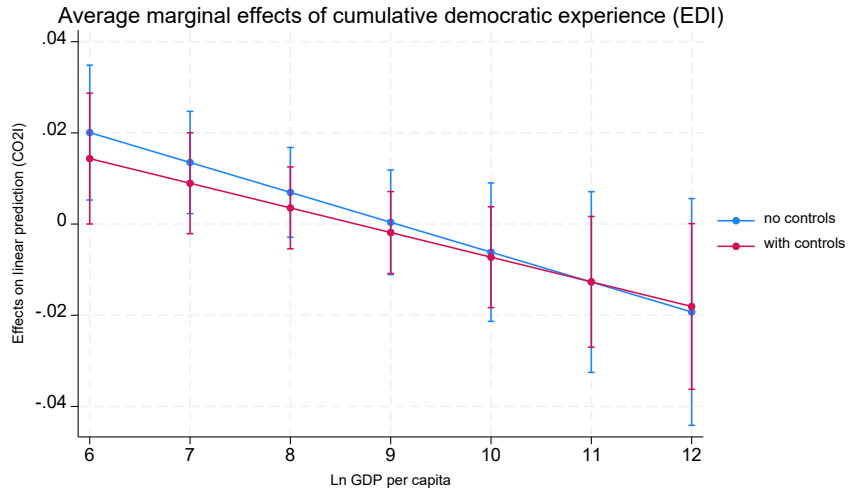
VARIABLES	(1) CO2I	(2) CO2I	(3) CO2I	(4) CO2I
Cumulative democratic experience (EDI)	0.056**	0.059**	0.069***	0.047**
	(0.024)	(0.023)	(0.019)	(0.020)
Ln GDP per capita	-0.084*	-0.064	-0.032	-0.022
	(0.044)	(0.041)	(0.038)	(0.039)
Interaction	-0.007**	-0.007**	-0.008***	-0.005**
	(0.003)	(0.003)	(0.002)	(0.002)
Trade (% GDP)			-0.029**	-0.030**
			(0.012)	(0.013)
Gross fixed capital formation (% GDP)			0.037**	0.044**
			(0.017)	(0.018)
Government expenditure (% GDP)			0.006	0.005
			(0.020)	(0.021)
Resources rents (% GDP)			-0.004	0.002
			(0.013)	(0.014)
Population growth			-0.043*	-0.053**
			(0.023)	(0.024)
Urban population (% total)			0.119**	0.168**
			(0.059)	(0.065)
Inflation			0.029***	0.029***
			(0.008)	(0.009)
Human capital index			-0.026	0.133
			(0.085)	(0.090)
Rule of law			-0.008	-0.013
			(0.018)	(0.018)
Constant	1.052***	0.855**	0.138	-0.273
	(0.375)	(0.348)	(0.358)	(0.412)
Observations	775	775	603	603
R-squared	0.192	0.206	0.499	0.526
Number of countries	156	156	131	131
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	-0.006	-0.000	-0.005	-0.003
Threshold GDP per capita (y*)	$3,600	$8,609	$4,827	$5,750

Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean

ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to lower CO_2 intensity of GDP.
*** p<0.01, ** p<0.05, * p<0.1

Figure 9 plots the estimated marginal effects of cumulative democratic experience on carbon intensity at different levels of income per capita for regressions (2) and (4) of Table 3. As the figure indicates for regression (4), for countries above the threshold income level $5,759, which is equivalent to the 2020 GDP per capita of lower middle-income Nicaragua, an increase in cumulative democratic experience led to lower carbon intensity over 1995-2020.

Figure 9. Marginal effect of cumulative democratic experience on carbon intensity at different levels of GDP per capita



Results for regressions (2) and (4) in Table 3 for CO_2 emissions (kg) per $ of GDP (CO2I). For regression (4), threshold GDP per capita y* is $5,750, which is approximately the 2020 GDP per capita of Nicaragua.

In sum, these four sets of regression results suggest that it is difficult to reject the hypothesis that the association of cumulative democratic experience with green policy

adoption and outcomes over 1995-2020 is conditioned on the per capita income of an economy. In addition, this marginal effect increases with income so that it has a larger impact in richer as opposed to poorer countries. However, the threshold level of per capita income at which a country's cumulative democratic experience begins to exert a positive effect varies with the type of green policy adoption and outcome. For example, over 1995-2020, carbon intensity tended to fall with cumulative democracy experience for countries that reached at least modest lower middle-income per capita levels of $5,750, whereas more stringent climate actions and policies were adopted at relatively high upper middle-income per capita income of $17,222.

6. Robustness

Appendix Tables 2A-7A show the results of the above regressions of (12) replicated with cumulative democratic experience x_{it} based on the liberal democracy index (v2x_libdem) from V-Dem v.13 or polity2 from the Polity 5 (2021) database. In all regressions, the null hypothesis that $b_1 = b_3 = 0$ is rejected. The exception is the two-way fixed effects regression of carbon intensity with no controls and using polity2 to measure cumulative democratic experience, as in this regression the coefficient b_3 on the interaction terms is not significant (see regression (2) in Table 7A). Overall, basing cumulative democratic experience on either the liberal democracy index or polity2 still makes it difficult to reject the hypothesis that the association of such experience with green policy adoption and outcomes over 1995 to 2020 is conditioned on income per capita.

Appendix Tables 8A-10A depict the regressions of (12) for 172 countries over 1995-2020 when the dependent variable $g_{i,t+T}$ is the share (%) of wind and solar energy in electricity generation (WSE) from EMBER's Global Electricity Review 2023. WSE can be considered an alternative dependent variable to global export share (GEX). The regressions of WSE reported in Tables 8A-10A base cumulative democracy experience x_{it} on the electoral democracy index, the liberal democracy index and polity2, respectively. All regressions reject the null hypothesis that $b_1 = b_3 = 0$ in (12). Note also that the

regressions for WSE produce similar results for marginal effects and the threshold level of income per capita y* as for the green export share (GEX) regressions (Tables 2, 3A and 6A).

An alternative indicator to carbon intensity is an economy's carbon dioxide emissions per capita. Appendix Tables 11A-13A display the regressions of (12) for 172 countries over 1995-2020 when the dependent variable $g_{i,t+T}$ is CO_2 emissions per capita from the World Development Indicators. Out of the 12 estimations displayed, only two fail to reject the null hypothesis that $b_1 = b_3 = 0$ in (12). The two exceptions are one and two-way fixed effects regressions using Polity2 for cumulative democratic experience but without any macroeconomic controls. However, as many of these controls are significant (see regressions (3) and (4) in Table 13A), their exclusion is likely to bias the results.[5] Once again, regardless of whether the measure of democracy is the electoral democracy index, the liberal democracy index or Polity2, it is difficult to reject the hypothesis that the association of cumulative democratic experience with green policy adoption and outcomes over 1995-2020 is conditioned on the per capita income of an economy.

Finally, it is worth noting that the threshold level of GDP per capita y^* where an increase in cumulative democracy will begin impacting carbon dioxide emissions is much higher for CO_2 emissions per capita as opposed to per $ GDP. Recall that for carbon intensity, the threshold income level is $5,759, which is equivalent to the 2020 GDP per capita of lower middle-income Nicaragua (see Table 3 and Figure 9). In comparison, as regression (4) in Table 11A indicates, for emissions per capita, y^* is $28,659, which is equivalent to GDP per capita in 2020 of high-income Panama.

[5] Specifically, by excluding these controls, the regressions (1) and (2) contain omitted variables that are non-constant over time, which would violate a key identifying assumption of fixed-effects panel analysis and thus introduce bias into the results of these regressions (Cunnigham 2021; Imai and Kim 2019)

7. Conclusion

This paper has explored the relationship between greenness, democracy and per capita income. This relationship is first examined in an electoral decision model, which demonstrates that democratic governments are more likely to adopt green policies if there is widespread public support for these policies and that this support is likely to increase with per capita income. A cross-country panel analysis over 1995-2020 indicates that it is difficult to reject the hypothesis that the association of cumulative democratic experience with various green policies and outcomes is conditioned on the per capita income of an economy. That is, more experience with democratic traditions was likely to lead to adoption of green policies and outcomes over 1995 to 2020 in richer rather than poorer countries. This finding appears to hold for a wide variety of measures of the "greenness' of economies, such as the green stimulus and recovery share of total stimulus and recovery spending in 2008-09 and 2020-2021, the stringency of climate action and policies, the share of green products in total exports, the wind and solar share of electricity generation, the carbon intensity of economies, and carbon dioxide emissions per capita. It also holds for different measures of democracy, including the electoral democracy index and liberal democracy index of V-DEM v.13 and polity2 of Polity5 (2021).

However, the threshold level of per capita income at which a country's cumulative democratic experience begins to exert a positive effect varies with the type of green policy adoption and outcome. For example, over 1995-2020, carbon intensity tended to fall with cumulative democracy experience for countries that reached at least modest lower middle-income per capita levels of $5,750, whereas more stringent climate actions and policies were adopted at relatively high upper middle-income per capita income of $17,222. And, only in high-income countries with income per capita of at least $28,659 was more democratic experience associated with declining carbon dioxide emissions per capita.

These findings have important policy implications.

If relatively richer democracies are most likely to pursue green transition policies and structural change, then there may be significant opportunities for international

collaboration and policy coordination to facilitate such transitions rather than engaging in a zero-sum "green competitive race" (Fankhauser et al. 2013). Such an approach might be consistent with a "bottom up" or "tiered" climate club approach (Barbier 2023; Iverson 2022; Parry et al. 2021). Already, there is some evidence of coordinated green policy adoption among the richest democratic economies, such as the Group of 7 (G7), which consists of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States plus the European Union. Based on estimates from the Global Recovery Observatory (O'Callaghan et al. 2020), COVID-19 green recovery spending over 2020-21 for 75 countries amounted to just over $1 trillion and over four-fifths of green spending ($893 billion) was by the G7.

Richer democratic countries should also consider providing greater financial and technical assistance to support democratic emerging economies to "go green". One promising initiative is the Just Energy Transition Partnership (JETP), which is a financing mechanism to reduce fossil fuel use and reliance on coal for a clean energy transition. JETPs are primarily funded by France, Germany, the United Kingdom, the United States, and the European Union, and are assisted by international development banks. Recipient countries are emerging economies with large coal industries and long-term economic growth potential. JETPs are currently in place for South Africa, Indonesia, Vietnam and Senegal, and they have shown considerable potential for achieving ambitious decarbonization targets (Ordonez et al. 2024). If expanded and adequately funded, JETPs could accelerate the clean energy transition in democratic emerging market economies and facilitate their participation in any G7-led "tiered" climate club (Barbier 2023).

References

Acemoglu, D., Naidu, S., Restrepo, P. and Robinson, J.A., 2019. Democracy does cause growth. *Journal of Political Economy*, *127*(1), pp.47-100.

Andreoni, J. and Levinson, A., 2001. The simple analytics of the environmental Kuznets curve. *Journal of Public Economics*, *80*(2), pp.269-286.

Andres, P., Mealy, P., Handler, N. and Fankhauser, S., 2023. Stranded nations? Transition risks and opportunities towards a clean economy. *Environmental Research Letters*, *18*(4), p.045004.

Barbier, E.B. 2010. *A Global Green New Deal: Rethinking the Economic Recovery*. Cambridge University Press, Cambridge.

Barbier, E.B. 2016. Building the green economy. *Canadian Public Policy* 42:S1-S9.

Barbier, E.B., 2020. Greening the post-pandemic recovery in the G20. *Environmental and Resource Economics*, *76*(4), pp.685-703.

Barbier, E.B., 2023. Greening the G7 economies. *Oxford Review of Economic Policy*, *39*(4), pp.731-751.

Clulow, Z., 2019. Democracy, electoral systems and emissions: explaining when and why democratization promotes mitigation. *Climate Policy*, *19*(2), pp.244-257.

Coppedge, M., Gerring, J., Knutsen, C.H., Lindberg, S.I., Teorell, J., Altman, D., Bernhard, M., Cornell, A., M. Fish, M.S., Gastaldi, L. et al. 2023. *V-Dem Dataset v13*. Varieties of Democracy (V-Dem) Project. University of Gothenberg, Sweden. https://www.v-dem.net/data/the-v-dem-dataset/country-year-v-dem-core-v13/.

Cunningham, S., 2021. *Causal Inference: The Mixtape*. Yale University Press; New Haven.

Dabla-Norris, M.E., Helbling, M.T., Khalid, S., Khan, H., Magistretti, G., Sollaci, A. and Srinivasan, M.K., 2023. Public perceptions of climate mitigation policies: Evidence from cross-country surveys. *IMF Staff Discussion Notes*. International Monetary Fund, Washington, D.C.

Economist Intelligence (EIU). 2024. *Democracy Index 2023: Age of conflict.* EIU, London.

Eskander, S.M. and Fankhauser, S., 2020. Reduction in greenhouse gas emissions from national climate legislation. *Nature Climate Change*, *10*(8), pp.750-756.

Eskander, S., Fankhauser, S. and Setzer, J., 2021. Global lessons from climate change legislation and litigation. *Environmental and Energy Policy and the Economy*, *2*(1), pp.44-82.

Fankhauser, S., Bowen, A., Calel, R., Dechezleprêtre, A., Grover, D., Rydge, J. and Sato, M., 2013. Who will win the green race? In search of environmental competitiveness and innovation. *Global Environmental Change*, *23*(5), pp.902-913.

Farzin, Y.H. and Bond, C.A., 2006. Democracy and environmental quality. *Journal of Development Economics*, *81*(1), pp.213-235.

Fredriksson, P.G. and Neumayer, E., 2013. Democracy and climate change policies: is history important? *Ecological Economics*, *95*, pp.11-19.

Gao, Y., Zang, L., Roth, A. and Wang, P., 2017. Does democracy cause innovation? An empirical test of the popper hypothesis. *Research Policy*, *46*(7), pp.1272-1283.

Glennerster, R. and Jayachandran, S., 2023. Think globally, act globally: opportunities to mitigate greenhouse gas emissions in low-and middle-income countries. *Journal of Economic Perspectives*, *37*(3), pp.111-135.

Gorokhovskaia, Y. and Grothe, C. 2024. *Freedom in the World 2024: The Mounting Damage of Flawed Elections and Armed Conflict.* Freedom House, Washington, D.C.

Hepburn, C., O'Callaghan, B., Stern, N., Stiglitz, J. and Zenghelis, D., 2020. Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?. *Oxford Review of Economic Policy*, *36*(Supplement_1), pp.S359-S381.

Imai, K. and Kim, I.S., 2019. When should we use unit fixed effects regression models for causal inference with longitudinal data?. *American Journal of Political Science*, *63*(2), pp.467-490.

Iverson, T.W. Advancing global carbon abatement with a two-tier climate club. *CESifo Working Paper* 9831. Center for Economic Studies and the ifo Institute, Munich, Germany. July 2022.

Mealy, P. and Teytelboym, A., 2022. Economic complexity and the green economy. *Research Policy*, *51*(8), p.103948.

Nachtigall, D., Lutz, L., Cárdenas Rodríguez, M., D'Arcangelo, F.M., Haščič, I., Kruse, T. and Pizarro, R., 2024. The Climate Actions and Policies Measurement Framework: A Database to Monitor and Assess Countries' Mitigation Action. *Environmental and Resource Economics*, *87*(1), pp.191-217.

Nord, M., Lundstedt, M., Altman, D., Angiolillo, F., Borella, C., Fernandes, T., Gastaldi, L., Good God, A., Natsika, N. and Lindberg, S.I. 2024. *Democracy Report 2024: Democracy Winning and Losing at the Ballot.* V-Dem Institute, University of Gothenburg:

O'Callaghan, B., Yau, N., Murdock, E., Tritsch, D., Janz, A., Blackwood, A., Purroy et al. 2021. *Global Recovery Observatory.* Oxford University Economic Recovery Project. https://recovery.smithschool.ox.ac.uk/tracking/

O'Callaghan, B., Yau, N. and Hepburn, C., 2022. How stimulating is a green stimulus? The economic attributes of green fiscal spending. *Annual Review of Environment and Resources*, *47*, pp.697-723.

Ordonez, J.A., Vandyck, T., Keramidas, K., Garaffa, R. and Weitzel, M., 2024. Just Energy Transition Partnerships and the future of coal. *Nature Climate Change*, *14*(10), pp.1026-1029.

Parry, I, Black, S. and Roaf, J. 2021. Proposal for an International Carbon Price Floor Among Large Emitters. *IMF Staff Climate Note 2021/001.* International Monetary Fund, Washington, D.C.

Persson, T. and Tabellini, G., 2009. Democratic capital: The nexus of political and economic change. *American Economic Journal: Macroeconomics*, *1*(2), pp.88-126.

Robins, N., Clover, R. and Saravanan, D. 2010. *Delivering the green stimulus*, 9 March 2010. HSBC Global Research, New York.

Setzer, J. and Higham, C. 2023. *Global Trends in Climate Change Litigation: 2023*

Snapshot. Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science, London.

Stef, N. and Ben Jabeur, S., 2023. Elections and environmental quality. *Environmental and Resource Economics*, *84*(2), pp.593-625.

Stokey, N.L., 1998. Are there limits to growth? *International Economic Review*, 39(1), pp.1-31.

Appendix

Table 1A. Summary Statistics

Variable	N	Mean	Med	Min	Max	St Dev
Dependent variables						
Green spending share (%) of total (GRSS)	158	10.13	0.00	0.00	100.0	19.5
Climate action and policy stringency score (CAP)	245	1.62	1.20	0.14	5.59	1.30
Green export share (%) of total (GEX)	858	3.88	2.34	0.01	27.04	4.05
Carbon intensity, kg CO_2 per $ GDP (CO2I)	812	0.24	0.19	0.00	1.95	0.20
Share (%) of wind and solar in electricity (WSE)	845	1.77	0.01	0.00	52.4	4.82
CO_2 emissions (metric t) per capita (CO2PC)	855	4.29	2.36	0.00	45.45	5.56
Variable of interest						
Cumulative democratic experience (EDI)	1027	6.67	5.97	0.21	14.09	3.94
Cumulative democratic experience (LDI)	1020	5.23	4.15	0.11	13.66	3.90
Cumulative democratic experience (Polity2)	961	26.24	36.73	-153.5	158.5	89.85
Conditioning variable						
GDP per capita (constant 2017 national prices)	960	16,775	9,890	383	115,884	18,899
Control variables						
Trade (% GDP)	947	83.57	72.53	1.28	422.1	52.33
Gross fixed capital formation (% GDP)	917	22.36	21.85	1.98	60.74	7.23
Government expenditure (% GDP)	925	16.41	15.66	1.34	133.26	8.57
Resources rent (% GDP)	1008	7.83	2.86	0.00	79.43	11.14
Population growth	1032	1.52	1.47	-5.05	14.05	1.48
Urban population (% total)	1032	55.21	55.69	6.83	100.0	23.02
Inflation	943	30.39	4.54	-4.07	6,517	247.4
Human capital index	840	2.41	2.46	1.04	4.07	0.70
Rule of law	1027	-0.14	-0.32	-2.44	2.06	1.00

Data sources for variables GRSS: Barbier (2010) and (2016); O'Callaghan et al. (2021); Robbins (2010); Global Recovery Observatory https://recovery.smithschool.ox.ac.uk/tracking/. CAP: Climate Actions and Policies Measurement Framework (CAPMF) https://oe.cd/dx/capmf. GEX: Green Transition Navigator (https://green-transition-navigator.org/). WSE: EMBER's Global Electricity Review 2023 https://ember-energy.org/latest-insights/global-electricity-review-2023/, CO2I and CO2PC: World Development Indicators https://databank.worldbank.org/source/world-development-indicators. EDI and LDI: electoral democracy index (V-Dem v.13 dataset https://www.v-dem.net/data/the-v-dem-dataset/country-year-v-dem-core-v13/. Polity2: Polity 5 (2021) https://www.systemicpeace.org/polityproject.html. Conditioning variable (real GDP per capita): Penn World Tables (PWT 10.01) https://www.rug.nl/ggdc/productivity/pwt/. Control variables: World Development Indicators except for human capital index, which is from PWT 10.01.

Table 2A. Green policy adoption, liberal democracy index, 1995-2020

VARIABLES	(1) GRSS	(2) GRSS	(3) CAP	(4) CAP
Cumulative democratic experience (LDI)	-29.157*	-48.014*	-3.905***	-3.686***
	(16.518)	(26.775)	(0.641)	(0.643)
Ln GDP per capita	-0.645	-1.105	0.820	-1.186
	(11.515)	(24.440)	(0.661)	(0.747)
Interaction	3.472*	5.155*	0.412***	0.379***
	(1.773)	(2.679)	(0.066)	(0.067)
Trade (% GDP)		8.366		0.742
		(11.424)		(0.450)
Gross fixed capital formation (% GDP)		-8.447		-1.195**
		(10.781)		(0.570)
Government expenditure (% GDP)		-2.909		1.547**
		(16.487)		(0.741)
Resources rents (% GDP)				0.204
				(0.333)
Population growth				2.265*
				(1.165)
Urban population (% total)		10.337		3.584**
		(58.845)		(1.521)
Inflation		0.374		-0.125
		(6.335)		(0.114)
Human capital index				6.648***
				(2.345)
Rule of law		12.254		0.944**
		(12.839)		(0.469)
Constant	-22.739	-51.201	-9.616	-19.520***
	(95.407)	(152.536)	(6.113)	(5.223)
Observations	158	148	240	235
R-squared	0.122	0.171	0.646	0.758
Number of countries	79	76	48	47
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	No	No	No
Marginal effect	3.995	1.244	0.248	0.142
Threshold GDP per capita (y*)	$4,435	$11,101	$13,101	$16,534

Cumulative democratic experience based on the liberal democracy index (v2x_libdem) from V-Dem v.13. Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a greater share of spending on green recovery and stimulus (GRSS) or more stringent climate action and policies (CAP).

Table 3A. Green export share, liberal democracy index, 1995-2020

VARIABLES	(1) GEX	(2) GEX	(3) GEX	(4) GEX
Cumulative democratic experience (LDI)	-1.381***	-1.405***	-1.685**	-1.758***
	(0.462)	(0.464)	(0.669)	(0.656)
Ln GDP per capita	0.891**	0.816**	0.586	0.636
	(0.351)	(0.400)	(0.629)	(0.632)
Interaction	0.169***	0.169***	0.187***	0.195***
	(0.051)	(0.051)	(0.071)	(0.071)
Trade (% GDP)			0.369	0.349
			(0.432)	(0.429)
Gross fixed capital formation (% GDP)			-0.088	-0.053
			(0.298)	(0.318)
Government expenditure (% GDP)			-0.026	-0.044
			(0.356)	(0.365)
Resources rents (% GDP)			-0.925***	-0.897***
			(0.231)	(0.247)
Population growth			-0.609	-0.618
			(0.419)	(0.448)
Urban population (% total)			0.524	0.617
			(1.406)	(1.443)
Inflation			-0.034	-0.026
			(0.133)	(0.136)
Human capital index			3.372*	3.788
			(1.946)	(2.596)
Rule of law			-0.730	-0.702
			(0.607)	(0.597)
Constant	-5.221*	-4.500	-5.201	-6.319
	(2.950)	(3.537)	(5.615)	(6.505)
Observations	792	792	608	608
R-squared	0.169	0.181	0.270	0.289
Number of countries	159	159	133	133
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.144	0.115	0.026	0.024
Threshold GDP per capita (y*)	$3,506	$4,146	$8,058	$8,215

Cumulative democratic experience based on the liberal democracy index (v2x_libdem) from V-Dem v.13. Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a higher green export share.

*** p<0.01, ** p<0.05, * p<0.1

Table 4A. Carbon intensity, liberal democracy index, 1995-2020

VARIABLES	(1) CO2I	(2) CO2I	(3) CO2I	(4) CO2I
Cumulative democratic experience (LDI)	0.058**	0.061**	0.073***	0.045*
	(0.026)	(0.026)	(0.021)	(0.023)
Ln GDP per capita	-0.097**	-0.073*	-0.045	-0.033
	(0.042)	(0.039)	(0.035)	(0.037)
Interaction	-0.007**	-0.007**	-0.008***	-0.005**
	(0.003)	(0.003)	(0.002)	(0.003)
Trade (% GDP)			-0.027**	-0.029**
			(0.012)	(0.013)
Gross fixed capital formation (% GDP)			0.038**	0.045**
			(0.017)	(0.018)
Government expenditure (% GDP)			0.004	0.005
			(0.020)	(0.021)
Resources rents (% GDP)			-0.004	0.002
			(0.013)	(0.014)
Population growth			-0.042*	-0.053**
			(0.023)	(0.024)
Urban population (% total)			0.128**	0.177***
			(0.059)	(0.067)
Inflation			0.031***	0.029***
			(0.009)	(0.009)
Human capital index			-0.036	0.126
			(0.088)	(0.093)
Rule of law			-0.007	-0.013
			(0.018)	(0.019)
Constant	1.157***	0.935***	0.211	-0.218
	(0.356)	(0.326)	(0.342)	(0.413)
Observations	770	770	598	598
R-squared	0.188	0.202	0.498	0.523
Number of countries	155	155	130	130
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	-0.004	0.002	-0.004	-0.002
Threshold GDP per capita (y*)	$4,600	$10,574	$6,016	$6,264

Cumulative democratic experience based on the liberal democracy index (v2x_libdem) from V-Dem v.13. Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to lower CO_2 intensity of GDP.

*** p<0.01, ** p<0.05, * p<0.1

Table 5A. Green policy adoption, polity2, 1995-2020

VARIABLES	(1) GRSS	(2) GRSS	(3) CAP	(4) CAP
Cumulative democratic experience (Polity2)	-1.034*	-1.641**	-0.121***	-0.100***
	(0.530)	(0.633)	(0.034)	(0.024)
Ln GDP per capita	18.865*	15.135	3.468***	1.575***
	(10.424)	(22.885)	(0.403)	(0.538)
Interaction	0.117**	0.180**	0.013***	0.010***
	(0.058)	(0.068)	(0.003)	(0.003)
Trade (% GDP)		17.729		1.623***
		(12.051)		(0.476)
Gross fixed capital formation (% GDP)		-6.809		-1.286**
		(10.362)		(0.580)
Government expenditure (% GDP)		0.857		1.862**
		(16.662)		(0.836)
Resources rents (% GDP)				0.072
				(0.372)
Population growth				2.775**
				(1.253)
Urban population (% total)		21.613		1.690
		(52.575)		(1.347)
Inflation		2.469		0.088
		(6.704)		(0.135)
Human capital index				6.720***
				(2.388)
Rule of law		24.371**		0.439
		(9.594)		(0.392)
Constant	-180.383*	-304.122**	-34.468***	-43.143***
	(96.646)	(136.864)	(3.881)	(5.187)
Observations	154	144	230	225
R-squared	0.115	0.209	0.603	0.743
Number of countries	77	74	46	45
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	No	No	No
Marginal effect	0.079	0.073	0.008	0.002
Threshold GDP per capita (y*)	$7,032	$9,341	$12,763	$19,065

Cumulative democratic experience based on polity2 from Polity 5 (2021). Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a greater share of spending on green recovery and stimulus (GRSS) or more stringent climate action and policies (CAP).

*** p<0.01, ** p<0.05, * p<0.1

Table 6A. Green export share, polity2, 1995-2020

VARIABLES	(1) GEX	(2) GEX	(3) GEX	(4) GEX
Cumulative democratic experience (Polity2)	-0.070***	-0.070***	-0.058***	-0.057***
	(0.017)	(0.017)	(0.021)	(0.021)
Ln GDP per capita	1.553***	1.290***	1.226**	1.201**
	(0.311)	(0.386)	(0.558)	(0.582)
Interaction	0.009***	0.008***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
Trade (% GDP)			0.207	0.193
			(0.456)	(0.448)
Gross fixed capital formation (% GDP)			-0.195	-0.194
			(0.310)	(0.324)
Government expenditure (% GDP)			-0.098	-0.085
			(0.368)	(0.382)
Resources rents (% GDP)			-0.934***	-0.941***
			(0.247)	(0.261)
Population growth			-0.593	-0.576
			(0.440)	(0.473)
Urban population (% total)			0.842	0.755
			(1.494)	(1.515)
Inflation			0.006	0.023
			(0.135)	(0.143)
Human capital index			3.307	3.090
			(2.117)	(2.570)
Rule of law			-0.760	-0.699
			(0.642)	(0.634)
Constant	-10.599***	-8.368**	-10.961*	-10.292
	(2.819)	(3.446)	(6.245)	(7.123)
Observations	747	747	584	584
R-squared	0.188	0.200	0.277	0.292
Number of countries	151	151	128	128
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.008	0.006	0.005	0.005
Threshold GDP per capita (y*)	$3,168	$3,820	$4,389	$4,533

Cumulative democratic experience based on polity2 from Polity 5 (2021). Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a higher green export share.

*** p<0.01, ** p<0.05, * p<0.1

Table 7A. Carbon intensity, polity2, 1995-2020

VARIABLES	(1) CO2I	(2) CO2I	(3) CO2I	(4) CO2I
Cumulative democratic experience (Polity2)	0.003***	0.003***	0.003***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Ln GDP per capita	-0.168***	-0.103***	-0.078**	-0.048
	(0.041)	(0.028)	(0.033)	(0.035)
Interaction	-0.000*	-0.000	-0.000***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Trade (% GDP)			-0.017*	-0.018*
			(0.009)	(0.011)
Gross fixed capital formation (% GDP)			0.037**	0.045**
			(0.016)	(0.017)
Government expenditure (% GDP)			0.006	0.003
			(0.019)	(0.020)
Resources rents (% GDP)			-0.002	0.006
			(0.013)	(0.013)
Population growth			-0.048*	-0.059**
			(0.025)	(0.025)
Urban population (% total)			0.109*	0.167**
			(0.057)	(0.064)
Inflation			0.031***	0.029***
			(0.009)	(0.009)
Human capital index			-0.044	0.147*
			(0.085)	(0.087)
Rule of law			-0.006	-0.008
			(0.016)	(0.017)
Constant	1.755***	1.205***	0.527	-0.099
	(0.358)	(0.246)	(0.328)	(0.410)
Observations	736	736	584	584
R-squared	0.214	0.267	0.473	0.514
Number of countries	149	149	127	127
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.000		0.000	0.000
Threshold GDP per capita (y*)	$72,897		$5,832	$8,519

Cumulative democratic experience based on polity2 from Polity 5 (2021). Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to lower CO_2 intensity of GDP.

*** p<0.01, ** p<0.05, * p<0.1

Table 8A. Wind and solar share of electricity, electoral democracy index, 1995-2020

VARIABLES	(1) WSE	(2) WSE	(3) WSE	(4) WSE
Cumulative democratic experience (EDI)	-6.769***	-6.176***	-10.548***	-7.681***
	(1.391)	(1.338)	(2.066)	(1.835)
Ln GDP per capita	-0.967	-4.469***	-4.559***	-6.274***
	(0.762)	(0.989)	(1.486)	(1.655)
Interaction	0.825***	0.695***	1.186***	0.840***
	(0.160)	(0.154)	(0.226)	(0.210)
Trade (% GDP)			1.466	2.104**
			(0.890)	(0.849)
Gross fixed capital formation (% GDP)			-0.927	-2.133**
			(0.901)	(0.874)
Government expenditure (% GDP)			-0.269	-0.817
			(1.078)	(1.037)
Resources rents (% GDP)			0.634	-0.242
			(0.716)	(0.750)
Population growth			-0.131	1.526
			(1.603)	(1.457)
Urban population (% total)			7.322**	1.476
			(3.034)	(2.936)
Inflation			0.279	0.017
			(0.204)	(0.221)
Human capital index			8.387*	-12.275**
			(5.020)	(5.100)
Rule of law			-0.105	-0.101
			(1.138)	(1.076)
Constant	4.005	38.159***	-1.553	55.616***
	(5.897)	(8.888)	(9.793)	(16.235)
Observations	794	794	610	610
R-squared	0.243	0.380	0.317	0.457
Number of countries	159	159	133	133
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.678	0.092	0.296	0.006
Threshold GDP per capita (y*)	$3,644	$7,259	$7,309	$9,316

Cumulative democratic experience based on electoral democracy index (v2x_polyarchy) from V-Dem v.13. Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a higher wind and solar share (%) of electricity generation.

*** p<0.01, ** p<0.05, * p<0.1

Table 9A. Wind and solar share of electricity, liberal democracy index, 1995-2020

VARIABLES	(1) WSE	(2) WSE	(3) WSE	(4) WSE
Cumulative democratic experience (LDI)	-7.697***	-6.893***	-12.435***	-9.004***
	(1.682)	(1.719)	(2.300)	(2.149)
Ln GDP per capita	-0.094	-3.851***	-3.590***	-5.678***
	(0.630)	(0.972)	(1.293)	(1.494)
Interaction	0.927***	0.789***	1.379***	0.988***
	(0.189)	(0.190)	(0.250)	(0.243)
Trade (% GDP)			1.057	1.835**
			(0.784)	(0.771)
Gross fixed capital formation (% GDP)			-0.858	-1.999**
			(0.888)	(0.842)
Government expenditure (% GDP)			-0.130	-0.817
			(1.057)	(1.019)
Resources rents (% GDP)			0.675	-0.184
			(0.680)	(0.726)
Population growth			-0.317	1.314
			(1.475)	(1.342)
Urban population (% total)			6.943**	1.420
			(2.792)	(2.892)
Inflation			0.213	0.015
			(0.200)	(0.229)
Human capital index			8.524*	-11.866**
			(4.816)	(4.979)
Rule of law			-0.143	-0.151
			(1.106)	(1.058)
Constant	-3.384	31.780***	-7.230	50.438***
	(4.817)	(8.784)	(8.767)	(15.929)
Observations	789	789	605	605
R-squared	0.260	0.394	0.338	0.471
Number of countries	158	158	132	132
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.658	0.218	0.162	0.017
Threshold GDP per capita (y*)	$4,028	$6,216	$8,229	$9,100

Cumulative democratic experience based on the liberal democracy index (v2x_libdem) from V-Dem v.13. Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a higher wind and solar share (%) of electricity generation.

*** p<0.01, ** p<0.05, * p<0.1

Table 10A. Wind and solar share of electricity, polity2, 1995-2020

VARIABLES	(1) WSE	(2) WSE	(3) WSE	(4) WSE
Cumulative democratic experience (Polity2)	-0.222***	-0.202***	-0.306***	-0.194***
	(0.051)	(0.049)	(0.072)	(0.065)
Ln GDP per capita	3.938***	-1.149	2.276	-1.992
	(0.773)	(1.065)	(1.418)	(1.602)
Interaction	0.029***	0.024***	0.036***	0.022***
	(0.006)	(0.006)	(0.008)	(0.008)
Trade (% GDP)			1.409	2.129
			(1.708)	(1.389)
Gross fixed capital formation (% GDP)			-1.530	-2.748***
			(0.938)	(0.899)
Government expenditure (% GDP)			-0.603	-0.952
			(1.225)	(1.141)
Resources rents (% GDP)			0.823	-0.269
			(0.824)	(0.816)
Population growth			0.239	2.084
			(1.520)	(1.368)
Urban population (% total)			5.187	-1.957
			(3.411)	(3.274)
Inflation			0.310	0.182
			(0.237)	(0.258)
Human capital index			9.583*	-14.670***
			(5.500)	(5.399)
Rule of law			1.461	1.046
			(1.336)	(1.192)
Constant	-35.797***	8.979	-52.023***	32.490*
	(7.148)	(9.435)	(12.957)	(17.792)
Observations	749	749	586	586
R-squared	0.212	0.361	0.272	0.439
Number of countries	151	151	128	128
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.036	0.011	0.025	0.008
Threshold GDP per capita (y*)	$2,309	$5,129	$4,625	$6,370

Cumulative democratic experience based on polity2 from Polity 5 (2021). Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to a higher wind and solar share (%) of electricity generation.

*** p<0.01, ** p<0.05, * p<0.1

Table 11A. Carbon dioxide emissions per capita, electoral democracy index, 1995-2020

VARIABLES	(1) CO2PC	(2) CO2PC	(3) CO2PC	(4) CO2PC
Cumulative democratic experience (EDI)	0.966***	0.851***	1.673***	0.840***
	(0.333)	(0.318)	(0.415)	(0.318)
Ln GDP per capita	1.110***	1.960***	1.887***	2.295***
	(0.296)	(0.393)	(0.478)	(0.464)
Interaction	-0.107***	-0.078**	-0.184***	-0.082***
	(0.037)	(0.035)	(0.044)	(0.035)
Trade (% GDP)			-0.520***	-0.614***
			(0.135)	(0.123)
Gross fixed capital formation (% GDP)			0.247	0.584
			(0.170)	(0.168)
Government expenditure (% GDP)			-0.252	-0.213
			(0.194)	(0.205)
Resources rents (% GDP)			0.288*	0.567
			(0.156)	(0.156)
Population growth			-0.386	-0.799**
			(0.338)	(0.316)
Urban population (% total)			0.245	2.029**
			(0.743)	(0.796)
Inflation			-0.126*	-0.107
			(0.073)	(0.071)
Human capital index			-1.764	4.168***
			(1.622)	(1.540)
Rule of law			-0.158	-0.307
			(0.194)	(0.195)
Constant	-5.262**	-13.555***	-8.922**	-24.916***
	(2.465)	(3.444)	(4.158)	(4.961)
Observations	794	794	610	610
R-squared	0.051	0.146	0.161	0.539
Number of countries	159	159	133	133
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.000	0.152	-0.006	0.092
Threshold GDP per capita (y*)	$8.198	$58,504	$9,002	$28,659

Cumulative democratic experience based on electoral democracy index (v2x_polyarchy) from V-Dem v.13. Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to lower CO_2 emissions per capita.

*** p<0.01, ** p<0.05, * p<0.1

Table 12A. Carbon dioxide emissions per capita, liberal democracy index, 1995-2020

VARIABLES	(1) CO2PC	(2) CO2PC	(3) CO2PC	(4) CO2PC
Cumulative democratic experience (LDI)	1.286***	1.117***	2.192***	1.156***
	(0.381)	(0.373)	(0.462)	(0.355)
Ln GDP per capita	1.075***	1.951***	1.775***	2.291***
	(0.259)	(0.391)	(0.434)	(0.431)
Interaction	-0.141***	-0.109***	-0.234***	-0.114***
	(0.041)	(0.039)	(0.048)	(0.038)
Trade (% GDP)			-0.449***	-0.577***
			(0.123)	(0.119)
Gross fixed capital formation (% GDP)			0.241	0.566***
			(0.171)	(0.164)
Government expenditure (% GDP)			-0.270	-0.188
			(0.198)	(0.208)
Resources rents (% GDP)			0.296*	0.575***
			(0.153)	(0.158)
Population growth			-0.361	-0.785**
			(0.331)	(0.314)
Urban population (% total)			0.223	1.985**
			(0.754)	(0.818)
Inflation			-0.093	-0.097
			(0.074)	(0.075)
Human capital index			-1.823	4.098***
			(1.593)	(1.514)
Rule of law			-0.139	-0.304
			(0.187)	(0.195)
Constant	-5.020**	-13.209***	-8.415**	-24.879***
	(2.180)	(3.439)	(3.973)	(4.810)
Observations	789	789	605	605
R-squared	0.063	0.146	0.186	0.370
Number of countries	158	158	132	132
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect	0.020	0.132	0.058	0.115
Threshold GDP per capita (y*)	$9,390	$27,260	$11,721	$25,030

Cumulative democratic experience based on the liberal democracy index (v2x_libdem) from V-Dem v.13. Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to lower CO_2 emissions per capita.

*** p<0.01, ** p<0.05, * p<0.1

Table 13A. Carbon dioxide emissions per capita, polity2, 1995-2020

VARIABLES	(1) CO2PC	(2) CO2PC	(3) CO2PC	(4) CO2PC
Cumulative democratic experience (Polity2)	0.016	0.012	0.043***	0.014
	(0.012)	(0.013)	(0.013)	(0.012)
Ln GDP per capita	0.497*	1.696***	0.849**	1.908***
	(0.258)	(0.398)	(0.372)	(0.405)
Interaction	-0.002	-0.001	-0.005***	-0.001
	(0.002)	(0.002)	(0.001)	(0.001)
Trade (% GDP)			-0.490**	-0.591***
			(0.215)	(0.136)
Gross fixed capital formation (% GDP)			0.284*	0.580***
			(0.168)	(0.165)
Government expenditure (% GDP)			-0.270	-0.303
			(0.187)	(0.199)
Resources rents (% GDP)			0.291*	0.590***
			(0.155)	(0.158)
Population growth			-0.654*	-1.051***
			(0.381)	(0.341)
Urban population (% total)			0.626	2.523***
			(0.758)	(0.846)
Inflation			-0.133*	-0.155**
			(0.073)	(0.076)
Human capital index			-1.591	4.697***
			(1.655)	(1.574)
Rule of law			-0.313	-0.327
			(0.212)	(0.202)
Constant	0.110	-10.420***	-0.948	-22.453***
	(2.287)	(3.490)	(3.781)	(4.524)
Observations	749	749	586	586
R-squared	0.024	0.129	0.125	0.353
Number of countries	151	151	128	128
Country FE	Yes	Yes	Yes	Yes
Time period FE	No	Yes	No	Yes
Marginal effect			-0.003	0.002
Threshold GDP per capita (y*)			$5,196	$28,991

Cumulative democratic experience based on polity2 from Polity 5 (2021). Robust standard errors in parentheses (clustered at country level). Marginal effect evaluated at the sample mean ln GDP per capita. Threshold GDP per capita y*: for any country at time t with y > y*, an increase in cumulative democratic experience will lead to lower CO_2 emissions per capita.

*** p<0.01, ** p<0.05, * p<0.1